The Representation of Coronal Segments

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Doctor of Philosophy

by

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ABSTRACT

In this thesis I am concerned with the way in which coronal segments should be represented. I argue that coronality is a phonetic rather than a phonological concept and that coronal segments are represented in the phonological component by the aperture particle A. In vowels, the aperture particle represents the central vowel of the language. In a language such as English therefore, A represents schwa. One consequence of this is that I am able to establish a connection between the most commonly unmarked vowel (i.e. a schwa-/a/ type vowel) and the unmarked oral place, namely coronal. In chapter 1, I set out the background to the study of the representation of coronal. In the general background I outline the representational issues which a thesis of this kind needs to consider. The specific introduction deals with two contemporary phonological debates in which coronals are central. The first concerns the extent to which consonants and vowels share the same place features and the second concerns their unmarked and special status.

In chapter 2, I discuss the classic problem of linking and intrusive r in English. I argue that r-sandhi is a process of Glide Formation. Once r-sandhi is viewed in this way two consequences ensue. First of all, I can provide a non-arbitrary account of this problem and secondly, a connection is suggested between schwa, represented by A, and /r/. In chapter 3, I consider the possibility that the use of A can be extended to other coronal segments. The principle data source is English. Specifically, synchronic dialectal phenomena and some diachronic phenomena are adduced as evidence for a A-coronal connection. Having established this, I consider the way in which coronal can be derived from A. Chapter 4 discusses the implications of the representation of consonantal place in a system where coronal is represented by A. Chapter 5 considers the implications of the link between schwa-A and coronal for the special status of coronals. Finally, in chapter 6, I return to the widely-held coronal-vowel connection introduced in chapter 1. I discuss an approach which groups coronal consonants with front vowels and evaluate some of the evidence put forward to support this class. I demonstrate that some of the main supporting evidence is more compatible with the coronal-A approach.
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CPC</td>
<td>Coronal Place Change</td>
</tr>
<tr>
<td>DP</td>
<td>Dependency Phonology</td>
</tr>
<tr>
<td>EDP</td>
<td>Extended Dependency Phonology</td>
</tr>
<tr>
<td>EModE</td>
<td>Early Modern English</td>
</tr>
<tr>
<td>ET</td>
<td>Element Theory</td>
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<tr>
<td>FG</td>
<td>Feature Geometry</td>
</tr>
<tr>
<td>GF</td>
<td>Glide Formation</td>
</tr>
<tr>
<td>GO</td>
<td>Gothic</td>
</tr>
<tr>
<td>KLV</td>
<td>Kaye, Lowenstamm and Vergnaud</td>
</tr>
<tr>
<td>ME</td>
<td>Middle English</td>
</tr>
<tr>
<td>OCP</td>
<td>Obligatory Contour Principle</td>
</tr>
<tr>
<td>OE</td>
<td>Old English</td>
</tr>
<tr>
<td>OHG</td>
<td>Old High German</td>
</tr>
<tr>
<td>OS</td>
<td>Old Saxon</td>
</tr>
<tr>
<td>OT</td>
<td>Optimality Theory</td>
</tr>
<tr>
<td>PP</td>
<td>Particle Phonology</td>
</tr>
<tr>
<td>RP</td>
<td>Received Pronunciation</td>
</tr>
<tr>
<td>SPE</td>
<td>Sound Pattern of English</td>
</tr>
<tr>
<td>SSE</td>
<td>Standard Southern English</td>
</tr>
<tr>
<td>WS</td>
<td>West Saxon</td>
</tr>
<tr>
<td>WY</td>
<td>West Yorkshire</td>
</tr>
<tr>
<td>Gen</td>
<td>Generator</td>
</tr>
<tr>
<td>DOR/RAD</td>
<td>Dorsal/Radical.</td>
</tr>
</tbody>
</table>
The Representation of Vowels Assumed in this Thesis

Below are the list of key words set out in Wells (1982: xviii-xix). For each word I have provided the vowel pronounced in that word for the two varieties which figure prominently in this thesis: my own Leeds, West Yorkshire, and RP. (NB This is meant as a guide rather than a detailed description of the vowel systems concerned.)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>RP</td>
<td>WY</td>
<td>Key word</td>
</tr>
<tr>
<td>i</td>
<td>i</td>
<td>kit</td>
</tr>
<tr>
<td>e</td>
<td>e</td>
<td>dress</td>
</tr>
<tr>
<td>æ</td>
<td>a</td>
<td>trap</td>
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<tr>
<td>ø</td>
<td>ø</td>
<td>lot</td>
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<td>ø</td>
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<td>strut</td>
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<td>ø</td>
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<td>foot</td>
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<td>ø</td>
<td>ø</td>
<td>bath</td>
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<td>ø</td>
<td>ø</td>
<td>cloth</td>
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<tr>
<td>ø</td>
<td>ø</td>
<td>nurse</td>
</tr>
<tr>
<td>i</td>
<td>i</td>
<td>fleece</td>
</tr>
<tr>
<td>ø</td>
<td>ø</td>
<td>face^1</td>
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<tr>
<td>ø</td>
<td>ø</td>
<td>palm</td>
</tr>
<tr>
<td>ø</td>
<td>ø</td>
<td>thought</td>
</tr>
<tr>
<td>ø</td>
<td>ø</td>
<td>goat^2</td>
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<tr>
<td>ø</td>
<td>ø</td>
<td>goose</td>
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<tr>
<td>ø</td>
<td>ø</td>
<td>price</td>
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<td>ø</td>
<td>ø</td>
<td>choice</td>
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<tr>
<td>ø</td>
<td>ø</td>
<td>mouth</td>
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<td>ø</td>
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<td>near</td>
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<td>ø</td>
<td>square</td>
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<td>ø</td>
<td>start</td>
</tr>
<tr>
<td>ø</td>
<td>ø</td>
<td>north</td>
</tr>
<tr>
<td>ø</td>
<td>ø</td>
<td>force</td>
</tr>
<tr>
<td>ø</td>
<td>ø</td>
<td>pure</td>
</tr>
</tbody>
</table>

^1 WY also has the diphthong /æu/ in some words that fall into this class.
^2 WY also has the diphthong /øu/ in some words from this class such as show, and also for words from the thought class such as jaw.
Acknowledgements

I would like to thank Dick Hayward for all his help and encouragement. Without his help, this thesis would never have been written. I'd like to thank a number of other people who discussed ideas or read parts of the thesis: Hussein Al-Ageli, Katrina Hayward, David Leslie, Gunnel Melchers, Keren Rice, Iggy Roca, Thais da Silva, and Janet Watson. I'm also very grateful to Robyn Carston, Marie Gibney and Val Williamson for their help and support.

The people who have acted as informants are too numerous to mention, but I am deeply grateful to everyone who has spared some of their time to answer my questions. I would however, like to mention one or two people: Renie Thompson (who sadly died shortly before this thesis was submitted), Molly Farrington, and my long suffering sister Gill Broadbent. I'd also like to thank two people who opportunely appeared with their 'interesting accents': Tina Bridges (Llanelli) and Andrew McCluskey (Durham).

I am very grateful to Gill, Justin Buckley, Ken Fletcher, Gerry Nelson and Jonathan White for giving up some of their spare time to proof read bits of my thesis, and to Sean Wallis for helping out with the formatting.

But the biggest debt of all is to my family, for their unfailing love and support. I dedicate this thesis to my parents, George and Lorna Broadbent.
1.1. General Introduction

The aim of phonology is to construct a theory which enables the phonologist to explain the processes and structures that occur in natural language; why some phenomena are observed with greater frequency than others and why some phenomena are never observed at all. Over the past 25 years, the approach to explanation in phonology has undergone a major shift in emphasis. In the early seventies, the approach was to study rules which were applied to a relatively impoverished representation. This representation was characterised in SPE as a 2D matrix of binary phonetic feature specifications, as in the partial representation of the word book in (1).

(1)

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>ü</th>
<th>k</th>
</tr>
</thead>
<tbody>
<tr>
<td>sonorant</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>syllabic</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>consonantal</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>voice</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>coronal</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>anterior</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

In the mid seventies, Kahn's work on syllable structure (Kahn 1976) and Goldsmith's work on tone (Goldsmith 1976), among others, lead to the development of nonlinear phonology which took features out of this bundle and placed them on independent tiers. The development of nonlinear phonology had a profound effect not only on the structure of the phonological representation, but also on its status, in that the representation
replaced the rule as the focus of study in the search for phonological explanation.\textsuperscript{1}

Contemporary phonologists assume that the representation is the best source of explanation because explanation which is tied to the representation should be non-arbitrary.\textsuperscript{2,3}

An additional consequence of the development of nonlinear phonology is that phonology is regarded as a set of interacting modules which can be studied in isolation, e.g. stress, syllable structure and subsegmental structure.\textsuperscript{4} Since the aim of this thesis is to find the best possible representation for coronal: one which will enable us to provide non-arbitrary explanation for the nature and behaviour of coronal segments in English, it is necessarily a study of the module of subsegmental structure.\textsuperscript{5} Any study of subsegmental representation has to address issues such as: What is the most appropriate phonological prime? Should primes be hierarchically organised and if so, to what degree? Are segmental representations fully specified in the lexicon and if not, what degree of underspecification is appropriate? Ultimately, in this thesis, the choice of prime, degree of organisation and underspecification will be selected according to which combination

\textsuperscript{1} As McCarthy (1988: 4) puts it "If the representations are right, then the rules will follow."

\textsuperscript{2} KLV (1990: 194) define non-arbitrariness as "There is a direct relationship between a phonological process and the context in which it occurs." See also Paradis and Prunet (1991: 22).

\textsuperscript{3} With the advent of Optimality Theory (OT), the focus has shifted once again. The aim is to find the correct constraint rankings. This does not undermine the approach being taken here, since any discussion of subsegmental structure contributes to the study of GEN - which produces the outputs only one of which will satisfy the constraint ranking. An illustration of the importance of such considerations is given in chapter 2 where McCarthy's (1993) OT account of r-sandhi is discussed.

\textsuperscript{4} See, for example, Archangeli and Pulleyblank (1994).

\textsuperscript{5} Aspects of representation such as syllable structure and stress will largely be ignored.
provides the best representation for coronal. With this in mind the following sections will provide an introduction to these three issues. In 1.1.1, I shall outline particle theories. 1.1.2, will review the main arguments for 'feature' organisation, and in the final section of this general introduction (1.1.3), I shall consider the proposal that predictable information should be underlyingly underspecified.

1.1.1. Particle Theories.

Although the claim that the basic phonological prime is smaller than the segment is uncontroversial, there is considerable disagreement about the exact nature of this unit. There are a number of different contenders such as 'feature' and 'particle', and it is an empirical question which type of prime is the most appropriate. In this thesis I shall restrict my consideration to two basic types: the mainstream feature and the particle. The background literature on coronals (see Section 2) is couched within mainstream feature theory. The question is, however, is the representation of coronal within this theory the best way to account for coronality or would a particle-type approach provide a more insightful representation, in line with the search for non-arbitrary explanation? As this question is explored during the course of the thesis, aspects of 3 particle-type

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6 I shall use the term 'particle' as a cover term for the class of approaches which assume that the phonological prime is a particle-like entity (i.e. KLV's 'element' and Dependency Phonology's 'component') as well as Schane's 'particle'.

7 Common to both types of prime is the issue of whether that prime should be articulatorily or acoustically based, or, for that matter, a mixture of the two. In this thesis, I shall assume a primarily articulatory based approach for convenience.

8 'Mainstream feature theory' is taken to be some version of the system first proposed in Chomsky and Halle (1968).
approaches will be further evaluated. In the following sections I shall introduce certain key notions of particle type approaches.

1.1.1.1. **I U A** \(^9\)

Common to all particle based accounts, such as Schane 1984; Anderson and Ewen 1987; KLV 1985; van der Hulst 1989; Smith 1988; and Harris 1994 are the three basic vowel particles: I, U and A. There is some variation in the interpretation of these particles and in the course of this and the following sections these interpretations will be explored. In all systems I, U, and A are single valued units which correspond to the extremes of the vowel triangle, i.e. to /i/, /u/ and /a/. According to Anderson and Ewen (1987: 210) these three vowels form the minimal vowel system; are acquired early during language acquisition cross-linguistically; and do not require as much articulatory precision as vowels such as /e/ and /o/.

Schane (1984a,b; 1987a,b; 1990; 1995) calls I and U 'tonality' particles: I represents 'palatality' and U represents 'labiality'.

---

\(^9\) Proponents of particle phonologies differ in their representation of I U A. Some, such as Schane (1984) and Anderson and Ewen (1987), use lower case i u a. Others such as KLV (1985), Harris (1994) use upper case. Roca's (1994) discussion of particle theories uses upper case except when making specific reference to the DP component which is represented using lower case and is encased in {I I}. Kaze (1991), using Schane's PP, uses bold lower case. However, I shall follow Hayes (1990) in that particles (other than those enclosed in {I I}) employed in the body of the text will be in bold upper case: **I U A**. Those used in numbered examples will be in regular upper case **I U A**.
The A particle, or 'aperture' particle serves to lower by degrees instances of I or U. In his 1990 paper Schane further equates A with laxness and RTR. Anderson and Ewen (1987: 28) assign the following articulatory/acoustic glosses to their components:

\[
\begin{align*}
\text{lil} & \quad \text{'frontness' (or 'acuteness' and 'sharpness')} \\
\text{lul} & \quad \text{'roundness' (or 'gravity' and 'flatness')} \\
\text{lal} & \quad \text{'lowness' (or 'compactness')} \\
\end{align*}
\]

I shall consider the interpretations given to these primes by KLV et c in section 1.1.1.4.

Using these three particles, proponents of this type of approach can represent three-vowel systems. Three-vowel systems generally have the form in (4a):

\[
\begin{align*}
\text{(4a)} & \quad \text{i} \quad \text{u} \quad \text{(b) I} \quad \text{U} \\
\text{a} & \quad \text{A} \\
\end{align*}
\]
Ignoring representational differences for the moment, (4b) sets out the way in which a particle approach can represent such a system. In order to capture vowel systems which require more than three vowels, particle theories combine vowel components. The particle accounts differ considerably in the precise details of particle combination used.

1.1.1.2. Stacking: Particle Phonology

As already pointed out above, Schane represents three-vowel systems using the 3 particles in isolation. However in order to derive a five-vowel system, for example, particles are combined as follows.

(5) /i/ I U /u/
/e/ I U /o/
 A A

Additional height distinctions are captured by the stacking of the aperture particle which thereby lowers the tonality particle. Schane assumes that up to 3 stacked aperture particles is sufficient to capture the full range of height distinctions.

---

10 This is a very simplified picture. In reality, certain particle theories cannot represent all three-vowel systems with such ease. See chapter 2 section 2.5.2 for a more detailed discussion.

11 A number of phonologists have expressed concern that all particle approaches have a particle which has a lowering effect, but there is nothing that corresponds to a height particle. Hayes (1990), Kaze (1991) and Hayward (pc) regard this as a serious omission from such theories.
The exact interpretation of the particles is system-dependent and this is particularly noticeable in the case of A. The exact interpretation of the single A is very different from that of ET or DP. Schane (1984:132) states that

"The central series of vowels requires special comment. A single occurrence of the aperture particle stands for [a] in those languages with only one central vowel. For languages with both [a] and [a] it is the former that is represented by one occurrence of the aperture particle, whereas the latter would have two. Hence the interpretation of particles (e.g. whether a represents [a] or [a]) is system-dependent."

Although schwa is not mentioned in Schane's early papers, we can conclude based on these comments that in a system with /a/ and /a/, schwa is represented by A and /a/ by AA (see Kaze 1991). In a system such as RP with /a/, /a/ and /a/, these vowels will have the following representations:

<table>
<thead>
<tr>
<th>(6)</th>
<th>/i/</th>
<th>I</th>
<th>/i/</th>
<th>I</th>
<th>/a/</th>
<th>U</th>
<th>/a/</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>/æ/</td>
<td>I</td>
<td>/æ/</td>
<td>I</td>
<td>/ɔ/</td>
<td>U</td>
<td>/ɔ/</td>
<td>U</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/æ/</td>
<td>I</td>
<td>/b</td>
<td>U</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>A</td>
<td>A</td>
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</tr>
</tbody>
</table>

It is only in his 1995 paper that Schane makes specific but contradictory reference to schwa. I shall discuss this point more fully in chapter 2, section 2.6.
Schane has been criticised for his stacking of the aperture particle and also for his system-dependent interpretation of particles, (see Anderson and Ewen 1987, den Dikken and van der Hulst 1988 and Roca 1994)\textsuperscript{13}. On the first count, the argument is that there is no principled way of ruling out $\text{AAAAAAA}$ or $\text{AAII}$ or $\text{AAAAAIIIIUUUU}$ and so on. There is however an empirically verifiable limit to the number of vowel heights and Schane's theory embodies the hypothesis that $A$ may not in principle be stacked more than three times. (In chapter 3 I shall also consider a possible justification for the single use of $I$ and $U$.)

As for system-dependency, the objection is that if one adopts such a position then it is impossible to give a precise definition for the individual particles, which in turn makes the theory less constrained. The point is well taken. However, in subsequent chapters we will see that such an approach has a number of desirable consequences. Further work may enable system-dependency to be tied down, so leading to a less wild appearance.\textsuperscript{14}

In contrast to Schane's extremely simple combinatorial system, the one employed by the Dependency Phonologists (DP) is relatively complex, with the Government Phonologists (GP) occupying the mid ground.

\textsuperscript{13} Although, as we shall see, there seems to be some degree of system-dependent interpretation in all particle approaches.

\textsuperscript{14} The arguments against system-dependency are reminiscent of arguments against the wild and unconstrained nature of underspecification theory in its earlier forms. As feature theory has developed, underspecification has been increasingly reined in. As far as system-dependency is concerned one potential avenue of research might be to consider the 'base of articulation'. Some phonologists assume that the base of articulation differs from one language to the next, for example, this is the position adopted by the Russian tradition.
1.1.1.3. **Complex Combinations: Dependency Phonology**

Dependency Phonologists, like Schane, represent the canonical three-vowel system using the three basic particles.\(^{15}\) To derive a five-vowel system they use simple combination (symbolised by ’, ’). The claim is that in simple combination each particle is equal, but not as strong as it would be if it were in isolation.\(^{16}\) So, the combination \{li,al\}, gives rise to “a segment that is perceptually 'front' but not as front as" ...\{li\}..."and 'low' but not as 'low' as \{lal\}, and it is not rounded: i.e. it is a frontish, mid, unrounded vowel” \(^{17}\)

(Anderson and Ewen (1987: 29).\(^{18}\))

\[\begin{align*}
/l\!/ & \quad \{\text{li}\} \quad \{\text{lu}\} \quad /u/ \\
/e\!/ & \quad \{\text{li,al}\} \quad \{\text{lu,al}\} \quad /o/ \\
/a\!/ & \quad \{\text{lal}\}
\end{align*}\]

The DP representation of a seven-vowel system illustrates another method of particle combination.

\(^{15}\) However, although Schane represents all three-vowel systems using these three primes, systems such as Gadsup’s /i, u, a/, Ojibwa and Quechua’s /i, a, o/ and Amuesha’s /e, a, o/ are not treated in this way by DP and ET. I shall return to this point in chapter 2.

\(^{16}\) Components can enter into simple combination when no other more complex combinatorial methods are necessary.

\(^{17}\) The notation \{11\} indicates that the segment being represented is phonologically characterised by the components contained within the verticals. We are concerned with the phonological representation of the locational gesture here (Anderson and Ewen 1987: 29).

\(^{18}\) Although Anderson and Ewen have been among those who have criticised Schane for his system-dependency, this quote suggests that their own position is a fairly flexible one.
'→' is used to represent 'preponderance', or 'dominance', in that in /e/, for example, I which stands at the tail of the arrows preponderates over, or dominates, A. (I is dominant and A is dependent.) This type of asymmetrical combination is said to be more costly than simple combination and therefore a vowel system which has 7 vowels is more marked/costly than one which has 5, which in turn is more marked than one which has only 3. A nine-vowel system is more marked than a seven-vowel system and in order to capture this fact, DP employs yet another type of combination.

The double headed arrow denotes mutual preponderance, i.e. it incorporates {li→al} and {la→il}, but is consequently more complicated than either. However Anderson and Ewen are at pains to point out that this is not the same as simple combination (see footnote 14). The inclusion of '↔' illustrates the complexity of the system. In other words a system which does not make use of this combinatorial relationship is preferred to one which does.
1.1.1.4. The mid-ground: Element Theory

In Element Theory the I, U, A elements are always independently pronounceable units corresponding to IPA's [i], [u] and [a] respectively. Within Element Theory, element combination is highly constrained. A compound composed of I and A, say, will give rise to [ɛ] or [æ] depending upon the status of each element in the formal operation of element combination or fusion. There are two possible roles which an element can hold during this process. First of all, an element may be the head of the operation which means that this element makes the greatest contribution to the outcome. Alternatively, an element may be the operator, in which case it transmits its salient property to the head. In the KLV formalism the fusion operation is represented by a dot symbol 

\[ (E1 . E2) \]

Thus when the element I fuses with the element A two outcomes are possible depending upon which element is the operator and which is the head. When I is the operator and fuses with A as the head, then I transmits its salient property of frontness to A. (I.A) is

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19 This thesis was written before Element Theory entered its current state of flux. There seems to be much discussion about the number of elements needed: five or seven. However, at the Fourth Phonology Meeting at Manchester University in May (1996), the references for Element Theory given by P. Harrison were KLV (1990) and Harris (1994). Consequently, in what follows, I shall use Harris (1994) as the main source on Element Theory.

20 In KLV (1985) I is said to correspond to IPA's [i], U to [u]. However, in more recent developments the ATR element I has been abandoned and now I corresponds to [i] and U to [u]. The lax vowels [ʊ] and [ɔ] have U and I respectively as operators with a distinct element called the cold vowel as the head (Harris 1994). We shall return to the role of a cold vowel in more detail in chapter 2.
accordingly taken to represent the intrinsic structure of the segment \([æ]\), i.e. \(I\) has fronted \(A\). \((A, I)\), on the other hand, is taken to represent the intrinsic structure of the segment \([e]\), because where \(A\) is the operator it transmits its salient property, non-highness, to \(I\) as head, i.e. \(A\) has lowered \(I\).

Harris (1994) represents a five-vowel system as in (12) below.\(^{21}\)

\[
\begin{array}{cccccc}
\text{x} & \text{x} & \text{x} & \text{x} & \text{x} \\
\text{I} & \text{I} & \text{@} & \text{U} & \text{U} \\
\text{@} & \text{A} & \text{A} & \text{A} & \text{@} \\
i & e & a & o & u
\end{array}
\]

No other method of combination is considered by KLV (1985, 1991) or Harris (1994) and additional vowel heights are captured using a fourth element called the cold vowel. KLV (1985, 1990) is a non-hierarchical model where the segment is represented by a 2D matrix composed of horizontal lines and columns. Each line bears the name of an element. If an element is not present then its absence is marked by what KLV 1985 call a 'cold vowel', the maximally unmarked element which KLV symbolise as 'v' and which is taken to represent a vowel of lax, high central quality. The cold vowel has no salient

\(^{21}\) The underlined element is the head of the combination; all other elements are operators. The symbol @ is used to represent the cold vowel by Harris (1994).
property and can only have an effect on the outcome of fusion if it is the head. Thus a seven-vowel system can be represented as:

(13)\[\begin{array}{cccccccc}
\text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} \\
\text{I} & \text{I} & \text{I} & \text{@} & \text{U} & \text{U} & \text{U} & \\
\text{@} & \text{A} & \text{A} & \text{A} & \text{A} & \text{A} & \text{A} & \text{@} \\
\text{@} & \text{@} & \text{@} & \text{@} & \text{@} & \text{@} & \text{@} & \text{@} \\
i & e & \varepsilon & a & o & o & u
\end{array}\]

And a nine-vowel system would be represented as:

---

22 The cold vowel is one of the elements currently under threat. (However, the Government Phonologist N. Ritter presented a paper at the Fourth Manchester Meeting which made full use of the cold vowel.) Government Phonologists now talk of 'empty headed' vowels which suggests that only the name 'cold vowel' has been abandoned. 'Empty headed' must surely contrast with 'headless' i.e. a segment where no element has overall control. Headless is equivalent to DP's simple combination.

23 In shorthand form, a vowel such as /i/ is represented by element theorists as:

\[\begin{array}{c}
\text{x} \\
\text{I} \\
\text{I}
\end{array}\]
In other words using one method of combination Element Theory is able to capture 3-9 vowel systems; it is not said to be system-dependent and it provides a precise interpretation for its elements. Therefore it is a more highly constrained theory than either DP or PP. However, it should be noticed that in order to derive the more complex vowel systems, Harris (1994) has to employ a fourth prime. I shall return to this point in chapter 2.

To summarise so far. Roca (1994) uses the analogy of colour in his discussion of particle combination. If we assume that the 3 basic primes correspond to the primary colours red, yellow and blue, then combinations of the particles, just like combinations of colours, result in different shades. Schane’s method of "colour" mixing appears the simplest of the three. The most highly constrained is the ET approach.

\[24\] There is arguably a degree of system-dependency in ET. Harris argues that the cold vowel (@) moves around in phonetic space. In one system it may be schwa whereas in others it is realised instead as [i]. It seems fair to say that system-dependency is present to some extent in all particle approaches.
Finally, before we leave our consideration of particle theories I should point out that the three differ on issues such as hierarchical organisation (KLV's theory is nonlinear, but does not recognise hierarchical organisation, DP on the other hand does)\textsuperscript{25} and underspecification (KLV do not recognise underspecification, DP does). Both have a full set of particles for consonantal properties but, as we shall see in chapter 3, there are fundamental differences as to the precise nature of these consonantal particles. In contrast, Schane's Particle Phonology was developed to account for certain recalcitrant vowel problems and he does not consider issues such as organisation\textsuperscript{26,27} and underspecification.\textsuperscript{28} Nor does he extend his particle theory beyond vowels. In chapter 4, the application of Schane's use of the basic vowel components will be extended to consonants.

\textsuperscript{25} Harris's 1994 model also recognises hierarchical structure of the type used in feature geometry. For the most part, however, Harris uses a shorthand form.

\textsuperscript{26} However, Hayes (1990) employs Schane's aperture particle in a Feature Geometry.

\textsuperscript{27} In his most recent paper, Schane (1995) includes a root node in his non-linear representation. His approach is therefore beginning to look much more like a hierarchically organised model:

\begin{center}
\begin{tikzpicture}
  \node (root) at (0,0) {$\emptyset$};
  \node (N) at (0,-1) {N};
  \node (R) at (-1,-2) {R};
  \node (a) at (-2,-3) {u};
  \node (i) at (-1,-3) {a};
  \node (p) at (0,-3) {i};
  \node (R) at (1,-2) {R};
  \node (R) at (2,-2) {R};
  \node (R) at (3,-2) {R};
  \node (R) at (4,-2) {R};
  \node (R) at (5,-2) {R};
  \node (R) at (6,-2) {R};
  \node (R) at (7,-2) {R};
\end{tikzpicture}
\end{center}

Schane (1995: 588)

\textsuperscript{28} Although Schane's original 1984 paper was linear, by 1987 he too had adopted a nonlinear approach.
1.1.2. Hierarchical structure

Although the development of hierarchical structure has only taken place during the past ten to fifteen years, recognition of feature groupings can be found in SPE, where Chomsky and Halle refer to 'Tongue body features' and 'Major Class Features', for example. Even so the unordered bundle of SPE, or the 'bottle brush' representation of early autosegmental phonology, give the misleading impression that features are 'independent' entities. In fact they are not. As Kenstowicz (1994: 146) states, there are at least two respects in which this is true. First of all, he gives the example of the feature [distributed]. In SPE velars and laryngeals, for example, were specified as [-distributed] which suggests that languages exist which have [+distributed] velars and/or laryngeals. With the development of Feature Geometry, this situation changed. From Sagey (1986) onwards [distributed] has been a dependent of the coronal node, thereby precluding the possibility of [+distributed] velars or laryngeals. Only coronal segments can be described as [+/-distributed].

Secondly, certain groups of features pattern together in phonological processes such as assimilations and deletions. For example, there is evidence that laryngeal features form a distinct group from supralaryngeal features. McCarthy (1988) gives the example of regressive laryngeal node assimilation in Greek. Consonant clusters in Greek regressively assimilate not only for voicing but also for aspiration. In other words it is

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29 A note on the representation of features.

Since some authors employ binary features, others use monovalent features, and still others a mixture of the two (e.g. Hume 1994), I shall follow the convention used by the particular author under discussion. This may give the appearance of inconsistency, but it is necessary to avoid confusion.
the laryngeal node and the features which it dominates that spread. A second example is
place assimilation, where the place features [labial], or [dorsal], spread onto a
neighbouring segment as in ten men [tɛm men] and ten kings [tɛŋ kɪŋz] in English.
Examples of feature groupings such as these can be placed alongside potential groupings
which are never observed. Kenstowicz (1994: 146) observes that [high], [low], and
[back] can spread from one vowel to another, but during assimilation the tonal feature
[hi tone] and the feature [nasal] will not simultaneously spread. In addition, he says that
it is extremely unlikely - if not impossible - that the [hi tone], [nasal] and [back], for
example, would spread during assimilation. This suggests that [high], [low] and [back]
belong to an organisational unit which excludes the tone feature [hi tone] and the feature
[nasal].

The aim of Feature Geometry has been in the first instance to produce a structure which
reflects all and only the known groupings of features. One consequence of this research
goal has been a proliferation of feature geometries. Consequently, in what follows I shall
focus on the most influential geometries: those of Clements (1985), Sagey (1986) and
the proposals of McCarthy (1988). I shall however also discuss the hierarchical
organisation of the particle approach in DP.30

30 Throughout the course of the thesis reference will also be made to numerous other geometries
specifically those of Avery and Rice (1989); Smith (1988); Clements and Hume (1995) and Hume
(1994).
With the kind of considerations outlined above in mind Clements articulated one of the first theories of the hierarchical organisation of features within mainstream feature theory.\[^{31}\]

\[^{15}\]

\[\begin{array}{c}
\text{ROOT} \\
\downarrow \\
\text{LARYNGEAL} \\
\quad \left[\text{spread}\right] \\
\quad \left[\text{voice}\right] \\
\quad \left[\text{constr}\right] \\
\downarrow \\
\text{SUPRALARYNGEAL} \\
\downarrow \\
\text{MANNER} \\
\quad \left[\text{nasal}\right] \\
\quad \left[\text{sonorant}\right] \\
\quad \left[\text{continuant}\right] \\
\quad \left[\text{consonantal}\right] \\
\quad \left[\text{lateral}\right] \\
\quad \left[\text{strident}\right] \\
\downarrow \\
\text{PLACE} \\
\quad \left[\text{coronal}\right] \\
\quad \left[\text{anterior}\right] \\
\quad \left[\text{distributed}\right] \\
\quad \left[\text{high}\right] \\
\quad \left[\text{low}\right] \\
\quad \left[\text{back}\right] \\
\quad \left[\text{round}\right] \\
\quad \left[\text{labial}\right]
\end{array}\]

\[\text{[Taken from Sagey 1986: 29]}\]

\[^{31}\text{It should be noted that Kenstowicz's comments on [distributed] were not reflected in the Clements' 1985 model.}\]
Within this hierarchical organisation Clements distinguishes two types of features: the organising nodes (or class nodes) and the terminal features. The organising/class nodes: laryngeal, supralaryngeal, manner and place serve to organise the terminal features which they dominate. So, for example, place groups the terminal features [coronal], [anterior], [high], [low], [back] etc. Class nodes have no independent interpretation, they are solely characterised by the set of terminal features which they dominate.

One consequence of this type of structure is that it imposes severe restrictions on phonological processes. A phonological process may affect the whole segment, part of the segment or one feature. In other words, phonological processes affect constituents. They do not affect non-constituents. As far as spreading is concerned, this means that if there is total assimilation, then the root node and everything which the root node dominates will spread; partial assimilation corresponds to class node spread and single feature spread refers to the spreading of a terminal feature such as [-back]. Non-attested combinations such as [-back] and [+nasal], for example, cannot pattern together during a spreading process because they do not form a constituent.

The Feature Geometry which in general forms the basis of any discussion referring to a feature geometric model is the one proposed by Sagey (1986). I have set out this feature geometry in (16) but the discussion will be confined to Sagey's reasons for developing the structure under the place node (which is perhaps Sagey's major contribution to Feature Geometry).
Sagey set out to account for segments which have multiple simultaneous articulations as in (17) for example.

(17)  
\[
\begin{align*}
\text{lab + cor} & \quad [\text{ptá}] & \quad \text{'an animal'} & \quad \text{Bura} \\
\text{vel + lab} & \quad [\text{akpá}] & \quad \text{'arm'} & \quad \text{Yoruba} \\
\text{cor + vel + lab} & \quad [\text{tkwana}] & \quad \text{'little children'} & \quad \text{Shona}
\end{align*}
\]

[Sagey 1986: 57]

Clements' model could not account for complex segments because place was characterised in the same way that it was in SPE i.e. using the features [coronal] and [anterior] as the basic consonant class dividers (see section 1.2.1. below for further discussion). Consider a segment which is simultaneously a velar and a labial segment as
in [akpá] arm. The Clements model could not represent this because in order to do so the place node would have to dominate [-ant] and [+ant] simultaneously, which is impossible. In order to account for such complex segments Sagey proposed that the place node should be more highly structured. She proposed that place should dominate a set of articulator nodes which should in turn dominate their own particular refining features:

(18)

```
place
  \_ labial
  \_ coronal
    \_ round
    \_ ant
    \_ distr
      \_ dorsal
        \_ high
        \_ low
        \_ back
```

[Sagey 1986: 61]

The presence of an articulator node indicates that the articulator is active. Since each articulator node dominates a set of terminal features, which refine its instruction, a terminal feature is only specified if its dominating node is present. On Sagey's approach, then, it makes no sense to talk of /p/ as [-coronal], [+ ant], since /p/ would be

32 Notice Sagey's mixture of binary and monovalent features. For example, [Dorsal] is unary, whereas [high], [low] and [back] are binary. However, Sagey attempts to overcome any problems which such a mixture might cause by redefining them. So, for example, in Chapter 4 she interprets [+ back] as "retracted tongue body" and [- back] as "fronted tongue body" (Sagey 1986: 278).
characterised for place solely by the presence of the labial node. In this respect, Sagey's proposal is significantly different from that of Clements (1985).

McCarthy (1988) set out to test the validity of each of the class nodes and suggested that any bona fide node should be observed to (a) spread, (b) delink and (c) exhibit the effects of OCP. Immediate casualties of these requirements were the manner node and the supralaryngeal node. In the latter case McCarthy argued that this was doing essentially the same job as place. In addition, McCarthy proposed that the features [sonorant] and [consonantal] should become part of the root node, because as terminal features they did not spread, delink or exhibit OCP effects, and so were not deemed suitable terminal features. Consequently McCarthy proposed the following geometry.

(McCarthy (1988: 20)
1.1.2.1. **Hierarchical structure and DP**

Recently a number of particle theorists have assumed a hierarchical particle organisation (Smith 1988 and Harris 1994, for example). However, the Dependency Phonologists were considering feature organisation long before this was considered by Clements etc. In the mid 70's, Lass (1976) and Lass and Anderson (1975) began to contemplate hierarchical structure within dependency phonology. Essentially DP assumes a segmental structure which divides into two **gestures**. Each gesture in turn divides into two **subgestures**. This is illustrated below, together with an indication of which segmental properties are located under which gesture.

(20)

In summary, hierarchical structure was developed to reflect feature groupings which are observed in phonological processes. The feature geometric models developed by

\[\text{[Anderson and Ewen 1987: 149-50]}^{33}\]

---

33 See also Anderson and Durand (1986: 22).
Clements, Sagey and others have served to constrain mainstream feature theory in two respects: first of all, feature groupings reduce the number of possible feature combinations and secondly they lead to restrictions on potential spreading processes.

1.1.3. Degree of Feature Underspecification

The central idea of underspecification theory is that only idiosyncratic information is stored in the lexical entry, all predictable information is underlyingly underspecified and supplied during the phonological derivation by redundancy rules. However, there are at least two definitions of 'predictable' in the literature and in this section I intend to consider two versions of underspecification theory which stem from these distinct interpretations: **Contrastive Underspecification** (Steriade 1987) and **Radical Underspecification** Archangeli (1984).

**Contrastive Underspecification.** Steriade (1987) takes the view that the only type of predictable value which can be underlyingly underspecified is a redundant (or non-contrastive) feature value. She illustrates this with the example of voicing specifications for sonorants and obstruents in English. The point is that [+voice] is predictable for sonorants in English: if the segment is [+sonorant], it is automatically [+voice]. So sonorants are underspecified for the non-contrastive feature [+voice]. Obstruents in

---

34 Although I shall discuss feature underspecification in this section, I follow Archangeli (1984, 1988) in assuming that underspecification theory applies to all modules of phonology and not just to features.

35 The standard assumption is that all redundancy rules apply during the phonological component and that when the phonological representation reaches the phonetic component it is fully specified. This is the position held by Archangeli (1984). More recently, however, researchers have began to argue that underspecification may continue into the phonetic component (Keating 1988).
English can be either [+voice] or [- voice], consequently [voice] is contrastive for obstruents in English and therefore Steriade assumes that English obstruents are underlingly specified for [voice].

**Radical Underspecification.** As the name suggests this approach to underspecification assumes a greater, or more radical, degree of underspecification than Steriade's approach. Archangeli (1988: 192) defines a value as predictable if "either a context-free, or a context-dependent rule can be formulated to insert the absent values..." Given this definition of predictability Archangeli's approach to the specification of [voice] in English sonorants and obstruents will be entirely different from Steriade's. Not only is [+voice] predictable for sonorants in English, but [-voice] is predictable for obstruents and so the only group of sounds in English which will be underlingly specified with a value for the feature [voice] will be the voiced obstruents. But why would the system underspecify [-voice] in obstruents, why not specify [- voice] and leave out [+ voice]? The point here is that all systems with voiced obstruents have a set of voiceless obstruents, but not all systems with voiceless obstruents have a set of voiced counterparts. In other words, [- voice] is predictable for obstruents whereas [+ voice] is not.

Although I have attempted to illustrate the difference between these two approaches to underspecification using only one minor example, this should be sufficient to demonstrate that contrastive underspecification only permits a restricted degree of underspecification whereas radical underspecification is more liberal. It remains to be seen which degree of underspecification is the most appropriate. What I propose to do
now is to consider radical underspecification a little further so as to give more of an idea of the application of underspecification and to illustrate the role of the redundancy rules referred to above. I shall, therefore, briefly consider Archangeli's account of the Spanish vowel system, and rounding harmony in Yawelmani.

The question arises, how is predictable information isolated and the underspecified system derived? Archangeli assumes that UG ensures that the language learner isolates feature oppositions, that is to say, isolates sounds distinguished by one feature. This information together with certain other information such as the default rules (see below) and language specific phonological information such as the nature of the epenthetic vowel form the input from which the underspecified representation is determined.

Archangeli summarises this as:

\[
\begin{align*}
\text{oppositions} & \quad \rightarrow \quad \text{alphabet formation} & \quad \rightarrow \quad \text{ALPHABET} \\
\text{phonological information} & \quad \rightarrow \quad \text{default rules} & \quad \rightarrow \quad \text{matrix component} \\
\text{default rules} & \quad \rightarrow \quad \text{complement rules}
\end{align*}
\]

(Archangeli 1984: 65)

Spanish has a five-vowel system /i, e, a, o, u/. Fully specified, the vowels are represented as follows.
Phonological information includes the fact that the epenthetic vowel in Spanish is /e/. On the basis of this the values of the features which characterise /e/ can be described as predictable and this results in the following representation in which the values [-high], [-low], [-back] and [-round] are unspecified.

(23)  

\[
\begin{array}{cccccc}
\text{i} & \text{e} & \text{a} & \text{o} & \text{u} \\
\text{H(igh)} & + & & & & + \\
\text{L(ow)} & & & & + & \\
\text{B(ack)} & - & & & + & + \\
\text{R(ound)} & - & & & & + \\
\end{array}
\]

[Archangeli 1984: 58]

However, both [+round] and [+back] are not required to distinguish /o/ and /u/. However, one of these features must be present in order to prevent [-back] being supplied to these vowels at the same time as it is supplied to /e/. Archangeli therefore elects to remove [back] giving:

(24)  

\[
\begin{array}{cccccc}
\text{i} & \text{e} & \text{a} & \text{o} & \text{u} \\
\text{H(igh)} & + & & & & + \\
\text{L(ow)} & & & & + & \\
\text{R(ound)} & & & & + & \\
\end{array}
\]

[Archangeli 1984: 59]
This is essentially the way in which the matrix is determined. We have already stated that predictable information is supplied by redundancy rules. There are different types of redundancy rule: default rules, complement and learned rules. The first two are cost-free. It is claimed that default rules play a role in the determination of the underspecified matrix and the full set of redundancy rules. The reason why they can function in this way is that they correspond roughly to a universal set of rules, although they may be overridden. Consider the following logical statements:

\[(25) \quad [\, ] \rightarrow [-\text{high}] / ____ +\text{low} \]

\[(26) \quad [\, ] \rightarrow [-\text{low}] / ____ +\text{high} \]

These two rules are absolute universal default rules in that the tongue body can never be simultaneously [+high] and [+low]. Default rules that are almost universals are designed to capture extremely common patterns. For example, high back round vowels are very common, as are back low unrounded vowels and front unrounded vowels. This second type of default rule is the preferred option but may be overruled by language specific considerations.

Once the matrix has been determined, complement rules are automatically created. Complement rules are cost free and their role is to supply those features which have been deemed predictable. In her treatment of the Spanish vowel system Archangeli (1984: 59) presents the following list of the complement and default rules.
But how are the rules ordered with respect to the phonological rules? Archangeli’s treatment of rounding harmony in Yawelmani provides a good illustration.

Yawelmani has a rule of vowel harmony where /i/ and /a/ round when they are preceded by a round vowel of the same height. The data below illustrates this process.

(27)  
\[ \begin{align*}
&\text{a. } [\ ] \rightarrow [-\text{high}] \quad \text{CR} \\
&\text{b. } [\ ] \rightarrow [-\text{low}] \quad \text{CR} \\
&\text{c. } [\ ] \rightarrow [+\text{back},-\text{round}]/[\ , , +\text{low}] \quad \text{DR} \\
&\text{d. } [\ ] \rightarrow [-\text{round}] \quad \text{CR} \\
&\text{e. } [\ ] \rightarrow [+\text{back}]/[\ , , -\text{low}, \alpha \text{round}] \quad \text{DR}
\end{align*} \]

Archangeli formulates the rounding harmony rule as follows:

\[ \text{(28) } i \rightarrow u/uC \quad \text{[Archangeli 1984: 78]} \]  
\[ \begin{array}{lcl}
\text{lihimhin} & < & \text{lihm} + \text{hn} \\
\text{śil'hin} & < & \text{śil'} + \text{hn} \\
\text{hōginhin} & < & \text{hogn} + \text{hn} \\
\text{bačinhin} & < & \text{bačn} + \text{hn} \\
\text{ʔugunhun} & < & \text{ʔugn} + \text{hn} \\
\text{duyduyhun} & < & \text{duy} + \text{dy} + \text{hn}
\end{array} \]

\[ \text{(29) } a \rightarrow o / o C \quad \text{[Archangeli 1984: 78]} \]  
\[ \begin{array}{lcl}
\text{diʔsəl} & < & \text{diʔs} + \text{al} \\
\text{xatal} & < & \text{xat} + \text{al} \\
\text{hoʔnol} & < & \text{hoʔn} + \text{al}
\end{array} \]

Archangeli has a five-vowel system: /i e a o u/. /o/ and /a/ are phonologically the same height. In particle terms /a/ and /o/ both contain a single occurrence of the A particle. Consequently since this vowel harmony language treats /a/ and /o/ the same, it conforms to predictions of Schane’s Particle Phonology.
The point is that in order for [+ round] to spread the redundancy rule inserting the values for [high] must have already applied so that the values for [high] are available to the rule. This suggests ordering of rules. In order to insure the correct ordering of fill-in rules, Archangeli (1984: 85) posits the Redundancy Rule Ordering Constraint (RROC).

(31) Redundancy Rule Ordering Constraint (RROC)

"A redundancy rule assigning "a" to F, where "a" is either "+" or "-" is automatically ordered prior to the first rule referring to [aF] in structural description."

This guarantees that the values for [high] are fully specified prior to vowel harmony in Yawelmani. Archangeli argues that the Elsewhere Condition (given in (32) below) guarantees that the particular rule (vowel harmony) is applied first and if it takes effect, then the general rule supplying [-round] is not applied.

(32) The Elsewhere Condition

Rules A, B in the same component apply disjointly if and only if

a. The input of A is a proper subset of the input of B.

b. The outputs of A and B are distinct.

In that case, A (the particular rule) is applied first, and if it takes effect, then B (the general rule) is not applied.

[Archangeli 1984: 27 citing Kiparsky 1984: 3]

So far, then, we have briefly considered the aspects of subsegmental structure which we will have to consider in the search for the best representation of coronal. With this in
mind, I now intend to consider the way in which coronal has been represented in the literature to date.

1.2. Specific Introduction.

There are two contemporary phonological debates in which coronal segments are central. First of all, there is the 'unified place features' debate which is concerned with the extent to which vowel and consonantal place can be represented by the same features. Secondly, there is the 'special status of coronals' debate which considers the asymmetrical behaviour of coronals with respect to other consonant types. Since the present study of coronal contributes to both debates, I shall present an overview of each issue in turn. In section 1.2.1, I shall set out some of the evidence which suggests that place in consonants and vowels should be characterised by the same set of features and in 1.2.2, I shall consider arguments for the special status of coronals.

1.2.1. Place Features for Consonants and Vowels.\(^{37}\)

Any feature system - regardless of the exact nature of the features concerned - must be able to meet certain basic requirements. For instance, it should be able to describe all and only attested phonological distinctions for both consonant and vowel inventories and further it should be able to describe all and only attested natural classes. In this section I shall focus upon the ability of a feature system to describe attested natural classes. As we shall see, there is abundant evidence that groups of vowels and consonants pattern

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\(^{37}\) In this section, discussion is restricted to the characterisation of place in mainstream feature theory. Particle approaches to place will be discussed at length in chapters 2, 3 and 4.
together in phonological processes and therefore form natural classes. The examples which I shall consider here were all put forward as examples of natural classes which the SPE feature system was unable to capture. I shall first of all outline the way in which place was characterised in SPE. I will then consider a number of arguments for individual C/V natural classes. In the final part of this section, I shall consider recent work which incorporates and develops some of these arguments and puts forward a unified set of place features for consonants and vowels: Clements (1989, 1991), Hume (1994) and Clements and Hume (1995).

First of all, then, the features which were used to determine place in SPE included the tongue body features: [high], [low] and [back] and the features [coronal] and [anterior]. The tongue body features were used primarily in the characterisation of vowels, whereas [coronal] and [anterior] were used to derive four basic divisions of consonantal place. [Coronal] and [anterior] are defined in SPE as follows:

(33)
"Coronal sounds are produced with the blade of the tongue raised from its neutral position; noncoronal sounds are produced with the blade of the tongue in the neutral position."

38 The tongue body features are defined on pages 304-305 of SPE as:
"High sounds are produced by raising the body of the tongue above the level that it occupies in the neutral position; nonhigh sounds are produced without such a raising of the tongue body."

"Low sounds are produced by lowering the body of the tongue below the level that it occupies in the neutral position; nonlow sounds are produced without such a lowering of the tongue body."

"Back sounds are produced by retracting the body of the tongue from the neutral position; nonback sounds are produced without such a retraction from the neutral position."

39 On p 300, Chomsky and Halle describe the neutral position as the vocal tract configuration for the English vowel [e]. They claim that studies of x-ray motion pictures of speech reveal that the vocal tract configuration for the vowel [e] is the configuration assumed immediately prior to speech.
"Anterior sounds are produced with an obstruction that is located in front of the palato-alveolar region of the mouth; nonanterior sounds are produced without such an obstruction. The palato-alveolar region is that where the ordinary English [s] is produced." (Chomsky and Halle 1968: 304.)

(34) illustrates the four way division created by the possible combinations of [coronal] and [anterior]:

<table>
<thead>
<tr>
<th>(+ANTERIOR)</th>
<th>(-ANTERIOR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[-coronal]</td>
<td>[+coronal]</td>
</tr>
<tr>
<td>Bilabial</td>
<td>dental</td>
</tr>
<tr>
<td>labiodental</td>
<td>alveolar</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Within the subgroup [+ ANTERIOR], the feature [distributed]\(^{40}\) was used to further divide the bilabials from the labiodentals and the dentals from the alveolars. However, [distributed] did not play a parallel role in the characterisation of nonanterior sounds. Instead the posterior sounds were further distinguished using the tongue body features. As in (35).

\(^{40}\) Chomsky and Halle (1968: 312) define distributed as:

"Distributed sound are produced with a constriction that extends for a considerable distance along the direction of the air flow; nondistributed sounds are produced with a constriction that extends only for a short distance in this direction."
The feature [back] was used to distinguish palatals ([back]) from velars, uvulars and pharyngeals ([back]). The [back] posterior noncoronals were further differentiated using [high] and [low] in that velars were described as [high], uvulars [-high, -low] and pharyngeals [+low]. This use of Tongue body features in both posterior noncoronals and vowels allowed Chomsky and Halle to capture a partial overlap between consonants and vowels in that they suggested a relationship between these two groups: palatals and high, front vowels; velars and high, back vowels; uvulars and mid, back vowels and pharyngeals and low back vowels.

Chomsky and Halle drew upon this connection in their characterisation of secondary articulation as the superimposition of vowel features onto a primary articulation. So, for example, if the features [+ high, -back] were added to

---

41 On page 305 of SPE, Chomsky and Halle comment that "The absence of nonhigh nonback consonants is a direct consequence of the fact that the body of the tongue can form a constriction only if it is high or back." This comment becomes particularly relevant in chapter two when the relationship between schwa and r is discussed and thereafter the relation between coronals and schwa.

42 See Hayward and Hayward (1989) for arguments that pharyngeals, laryngeals and sometimes uvulars pattern together as a natural class, which cannot be captured within traditional feature theories. They propose the feature 'guttural' to capture this particular natural class.
a consonant, then that consonant was described as palatalised; alternatively, if [+ high, + back] were added, then the consonant was said to be velarised.

Although SPE was able to suggest a connection between certain groups of consonants and vowels, phonololists argued that there were a number of C/V groups which the feature system failed to capture: labials and round vowels; labials, velars and round vowels; and coronals, palatals and front vowels. We can now consider some of the evidence put forward to support the claim that these groups form genuine natural classes. In attempts to capture these natural classes the proposals were in the main that features should be added to the SPE system. But as regards the coronal, front vowel and palatal natural class the most widely accepted proposal was that put forward by Clements in 1976, and subsequently developed in 1989, 1991, 1995, that this particular class can be captured simply by modifying an existing feature: [coronal].

1.2.1.1. Labials and round vowels

Campbell (1974) provides support for this natural class from processes of labial vocalisation, whereby labial consonants become round vowels; and labio-velar glides becoming labial consonants as in 36(a); and what he describes as "labial attraction rules", whereby vowels and consonants assimilate to labial consonants/round vowels as in 36 (b).

36(a)
Mono m → w/V___
Papago w → p in reduplicated forms
Swahili w → b/nasal___
Cakchiquel w → f/___#
w > v (historically) in Latin, Sanskrit, German, Finnish, Latvian and Skandinavian
languages; and in dialects of Cakchiquel, Aztec, Tzeltal and Tzotzil.
Spanish b > u/___C (e.g. ausencia > ausencia 'absence')
Rumanian b > u/liquid
[Taken from Campbell 1974: 53.]

36(b)
Finnish 0 > v/# oo

Finnish  k → v / { u  u  } C { C  }  
    { ü  ü  }  #

Nupe  Ø → { i/C  C  }  
                { a/C  h  }  
                { u/C  labialC  }  

Cakchiquel  o→ o/labial C
Cakchiquel  i > u/labial C + V

(Taken from Campbell 1974: 52)

One of the most frequently cited examples in support of this natural class is vowel
rounding before round vowels and labial consonants in Tulu. In (37) I have set out a
sample of the Tulu vowel rounding data.

(37)

näːji  country
kätti  bond
kanni  eye
pudari  name
ugari  brackish
ari-n-i  rice (acc)
obolpu  whitener
kappu  blackness
ponnu  girl
uccu  kind of snake
morodu  empty
uru-n-u  country village (acc)

(T Clements 1991: 7-8)
In Tulu, the high, central/back vowel [i] is rounded if the preceding consonant is labial or the vowel in the preceding syllable is round. An SPE-type characterisation of this process is unable to establish any connection whatsoever between the rounding process and labial consonants. SPE characterised labial as [+anterior, -coronal], but there is no principled reason why this particular feature specification should produce a rounding effect on a following vowel. As Campbell (1974) points out, given SPE assumptions this should not be a natural process.

Campbell considered the possibility of introducing the feature [labial] into the feature system, but he ultimately rejected this as a viable possibility because he felt that to have two features (i.e. [round] and [labial]) referring to roughly the same property built unnecessary redundancy into the system. In spite of Campbell’s concerns, [labial] was later adopted by mainstream feature theory.

Sagey (1986) incorporated labial into her feature geometry. Sagey (1986: 138) analyses the Tulu data as the spread of the articulator node labial. Consider the following feature geometric representations of a labial consonant and a round vowel.

(38)  

```
  V               C
 /                |
|                 |
PLACE            PLACE
|                 |
LABIAL           LABIAL
|                 |
[+round]         [+]round
```
It cannot be [+ round] that is spreading from the consonant/vowel to give rise to vowel-rounding, since Tulu consonants are not round. Furthermore, it cannot be place which is spreading, because any intervening consonant which was itself specified for place would block the process. The only property which both labial consonants and round vowels share in common is labial. Therefore, Sagey (1986) (see also Clements 1991) argues that Tulu vowel rounding is the spread of the articulator node labial. This is illustrated in (39) below.

(39) PLACE PLACE
    \       /    \ DORSAL
   /     \ [+high]
LABIAL

(Sagey 1986: 138)

[+round] would then be supplied to the labial node of the vowel by redundancy rule.

The natural class labial, which includes labial consonants and round vowels, together with the proposal that the feature labial, a place feature, should be introduced into the mainstream feature system has gained widespread acceptance in the literature. This natural class is arguably a subset of the natural class of labials, velars and round vowels. A number of phonologists, including Hyman (1973), Vago (1976) and Odden (1978) argued that the SPE system failed to capture the natural class of labials, velars and round vowels, on the one hand, and coronals, palatals and front vowels on the other. They
proposed that the re-introduction of one feature into the SPE system would be sufficient to capture both groups. I shall consider the arguments for these two natural classes below.

1.2.1.2. Labials, Velars and Round Vowels and Coronals, Palatals and front Vowels

There are numerous instances of labials alternating with velars and I have given a sample of such cases in (40).

(40)

\[
\begin{align*}
\text{x} & \rightarrow \text{f} & \text{middle English} & \quad \text{e.g. laugh, cough, rough} & \quad \text{(Nieuwint 1981)} \\
\text{y} & \rightarrow \text{u} & " & " & \quad \text{e.g. plough, bough} & \quad \text{(Jones 1931)} \\
\text{ft} & \rightarrow \text{xt} & \text{Celtic} & \quad \text{e.g. secht (seven)} & \\
\text{Dutch} & & \text{after} & \rightarrow \text{achter} & \\
\text{x} & \rightarrow \text{f} & \text{Slovenian} & \quad \text{e.g. kozuch} & \rightarrow \text{kozuf,} & \quad \text{krxka} & \rightarrow \text{krfka} \\
\text{f} & \rightarrow \text{x} & \text{Russian} & \quad \text{e.g. x cerkox vcerkov} & \\
\text{p} & \rightarrow \text{k} & \text{Indonesian} & \quad \text{piso (kiso) knife} & \quad \text{(Jakobson and Waugh 1979)}
\end{align*}
\]

Velars, like labials, vocalise to [u]. In a number of varieties of English, for example, velarised-1 vocalises to [u], as in bell [bɛl] and milk [mɪlk] for example. Austrian German provides an example of velarised-1 causing vowel rounding whereby the front vowels /i/ and /e/ were rounded to [y] and [ø] when they immediately preceded a velarised-1 (Lass 1984: 176).

SPE was unable to adequately capture this natural class. Labials, velars and round vowels were members of the set [-coronal]. However, [-coronal] characterises an
unattested class which includes not only labials, velars and round vowels, but also nonround vowels, uvulars and pharyngeals.

Hyman (1973) argued that not only did SPE fail to characterise this class, it also was unable to capture the class, coronal, palatal and front vowels. The following example of reduplication in Fe?fe? Bamileke was put forward to demonstrate the existence of this natural class.

(41) za → zuza to eat
to → tuto to punch
sóh → susóh to wash

(Hyman 1973: 333)

In Fe?fe? reduplication the stem-initial consonant is reduplicated and there is in addition a reduplicated vowel. On the basis of the data in (41) the reduplicated vowel is said to be [u], which is, under certain circumstances, realised as [i]. If the stem vowel is [i], then the reduplicated vowel is [i] regardless of the nature of the intervening consonant, hence the data in (42).

(42) sii → sisii to spoil
pii → pipii to profit

(Hyman 1973: 333)

The data in (43) show that when the stem vowel is front the reduplicated vowel will be [i] just so long as the intervening consonant is a coronal, or a palatal.

(43) pée → purpée to hate
tée → titee to remove
Hyman assumed the following derivation:

\[(44) \quad \text{sii} \rightarrow \text{susii} \rightarrow \text{sisii} \]
\[\text{pii} \rightarrow \text{pupii} \rightarrow \text{pipii} \]

Hyman assumed the following derivation:

\[
\begin{align*}
yee & \rightarrow \text{yiyee} & \text{to see} \\
k\ddot{e}\text{e} & \rightarrow \text{k\ddot{u}k\ddot{e}e} & \text{to refuse} \\
\text{p}e\text{n} & \rightarrow \text{pup\ddot{e}n} & \text{to accept} \\
\text{t}e\text{n} & \rightarrow \text{tit\ddot{e}n} & \text{to stand up} \\
\check{c}\text{en} & \rightarrow \check{c}\ddot{i}\check{c}\text{en} & \text{to moan} \\
\check{y}\text{en} & \rightarrow \check{y}\ddot{u}\check{y}\text{en} & \text{to go} \\
\text{pa}? & \rightarrow \text{pup\ddot{a}?} & \text{to commit suicide} \\
\text{ta}? & \rightarrow \text{tit\ddot{a}?} & \text{to bargain} \\
\check{c}\text{a}? & \rightarrow \check{c}\ddot{i}\check{c}\text{a}? & \text{to trample} \\
\text{ka}? & \rightarrow \text{k\ddot{u}k\ddot{a}?} & \text{to grill}
\end{align*}
\]

(Hyman 1973: 333, 334)

He proposed that in order to capture both natural classes, the Jakobsonian feature [grave] should be reintroduced into the feature system. Hyman (1973: 329) defines grave/acute as "acoustically-concentration of energy in the lower (vs. upper) frequencies of the spectrum." So labials, velars and round vowels belong to the natural class [+grave] and coronals, palatals and front vowels belong to the natural class [-grave]. Hyman did not propose that [grave] should replace [coronal], but rather that both should be available within the system. With [grave] available in an SPE-type feature system, Hyman argued, the Fe?fe? example could be accounted for as a case of "acoustic assimilation." The alternation of the high back vowel to the high front vowel was therefore the change from [+ grave] to [- grave] under the influence of a [- grave] trigger. Hyman formulates this proposal as:

48
Although Hyman's proposals won support from Vago (1976) and Odden (1978), [grave] was not reintroduced into the feature system and arguments for +labials, velars and round vowels did not attain universal acceptance.

But of the early papers challenging the shortcomings of SPE it was the proposal in Clements (1976) that gained widest acceptance. In essence this proposal was that coronals, palatals and front vowels formed the natural class [+coronal]. Clements' starting point was with the process which Hume (1994) describes as "perhaps the best known of all processes involving the interaction of front vowels and coronal consonants" i.e. palatalisation. Clements set up his view of the natural class [+coronal] by taking issue with Chomsky and Halle's account of velar fronting whereby velars are palatalised to palato-alveolars. In Slavic, for example, the velars /k, g, x/ are fronted to [ť, čť, ș] respectively when they are followed by a front vowel or palatal glide. Chomsky and Halle characterised palatalisation in Slavic as:
In their discussion of Slavic First Palatalisation, Chomsky and Halle assumed that the first stage of velar fronting was a highly marked palatal plosive [c] (represented in SPE as /kl/). They proposed that a set of linking rules completed the process by changing the highly marked palatal stop [c] into the unmarked articulation for the palatal zone: a palato-alveolar [ç].

Clements suggested that rather than using linking rules, if velar fronting was assumed to be assimilatory in nature then a far simpler account of velar fronting could be put forward which did not require the linking rule machinery. His point was that if it is assumed that the velar is assimilating to some property of the front vowel then given that the result is a palato-alveolar affricate, front vowels and palato-alveolars must have something in common. And that something Clements suggested was [+coronal].

Within the SPE system vowels were by definition [-coronal]. Clements proposed that if the SPE definition of [coronal] was modified so that front vowels were [+coronal] then a more explanatory account of velar fronting would be available. Clements argued that it was Chomsky and Halle's neutral position that was the source of the problem and

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43 This is a very appealing proposal, but in chapter 6 when we consider the way in which Clements' model has been developed in order to implement this, we find that it runs into a number of problems. We shall also see that if we adopt a different coronal-vowel relation, these problems cease to exist.
suggested that this was better thought of as [ə] rather than [ɛ]. The point being that if schwa was the neutral position, then at the very least /i/ and /e/ would be [+coronal] vowels.\textsuperscript{44}

The arguments which we have considered so far have been concerned with establishing that certain C/V natural classes exist. The natural classes which have been almost universally accepted are those natural classes which have been successfully characterised by place features. In one case (i.e. labials, and round vowels) a place feature was added to the system, whereas in the second case (i.e. coronals, palatals and front vowels) an existing place feature was modified. In recent work by Clements (1989, 1991), Hume (1994) and Clements and Hume (1995), a unified set of place features for consonants and vowels has been proposed and developed within a feature geometric model. In this section I shall restrict the discussion to the proposals of Clements (1989, 1991) and Clements and Hume (1995). Chapter 6 will consider Hume (1994) which is concerned specifically with the coronal-front vowel connection.

\textsuperscript{44}There is a second controversial aspect of the definition of [coronal] and this concerns the definition of the ‘blade’ of the tongue. The question is how far does the blade extend before it is classified as the front of the dorsum. (For a useful discussion of the precise definition of blade see Keating 1991.) Catford (1988) and Ladefoged (1982) both hold the position that the blade extends 1-1.5 cm back from the apex, i.e. that portion of the tongue which is at rest under the alveolar ridge. Keating contrasts this position, the British position, with the American position which is that the British position is actually just the tip, with the blade extending further back.
1.2.1.3. **Feature Geometry and the Unified Set of Place Features**

In the early stages of the development of Feature Geometry, the primary consideration was (and still is) to determine which features should be grouped together and more specific debates such as the extent to which consonants and vowels should share place features were not addressed.

Sagey's model had profound consequences for the role of [coronal] in feature theory. Even in Clements' (1985) model, as in SPE, [coronal] had been one of the primary place determiners in consonants. However, in Sagey's model it lost this function and instead was placed on an equal footing with the other articulator nodes labial and dorsal.

Objections were raised to Sagey's organisation of place, in the first instance, because this model predicted an unattested class: velars and the class of vowels as a whole (see Steriade 1987a). On the basis of arguments such as those for labials and round vowels and coronals, palatals and front vowels, for example, Clements (1989, 1991) proposed a unified set of features to account for place in both consonants and vowels. More recently, this has been developed in Clements and Hume (1995). A partial representation of Clements and Hume's model of place for both a consonant and a vowel is given below (from Clements and Hume 1995: 292).
The idea is that [labial], [coronal], and [dorsal] are used in the characterisation of both consonants and vowels and that by using these features for both groups, the features [-back], [round] are made redundant. The claim is that if [coronal] is present under the C-place node the result is a [+coronal] consonant, whereas if it is present under the V-place node the result is a front vowel. Clements (1989, 1991) and Clements and Hume (1995) draw support for the segregation of the features under the C-place or V-place nodes from the observation that vowel features, e.g. in vowel harmony and umlaut, often spread without being blocked by intervening consonants. They argue that because V-place is lower in the tree than C-place, features under V-place can spread freely.

45 Clements and Hume (1995: 277) defines the features as follows:
- labial - involving a constriction formed by the lower lip.
- coronal - involving a constriction formed by the front of the tongue.
- dorsal - involving a constriction formed by the back of the tongue.
There is one other respect in which consonants and vowels share the same set of features. In this model the refining features [anterior] and [distributed] are present under V-place [coronal] as well as C-place [coronal]. (I shall return to consider the use of [anterior] in V-place in detail in chapter 6, where I shall consider the way in which Hume's (1994) variant of this model accounts for velar fronting. This will form part of a more general evaluation of the coronal-front vowel position advocated by Clements and Hume.)

In summary, the primary purpose of this section has been to consider why phonologists argue for a unified set of place features for consonants and vowels. I have set out a number of arguments which suggest that certain groups of consonants and vowels form natural classes and we have seen that the cases which have gained widespread acceptance are those which can be captured by a single phonetic place feature. I have also briefly considered recent work by Clements (1989, 1991) and Clements and Hume (1995), which is an attempt to draw together these generally accepted arguments into contemporary feature theory. However, this discussion has also served to highlight the changes which have affected the feature [coronal]. Over the past twenty-five years, not only has the definition of [coronal] changed, largely due to its connection with front vowels, but also with regard to its role in the feature system. Whereas [coronal] was a primary place determiner in consonants in the SPE system, in contemporary feature

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46 The arguments for a unified set of place features for consonants and vowels is accepted in this thesis although my position differs from that of Clements and Hume as to which vowels and consonants share which features. I shall put forward a challenge to the existence of the natural class, coronal, palatal and front vowels. I shall set out arguments which align coronal with a different set of vowels and which suggest that the coronal-front vowel connection has been a red herring.
theory, [coronal] simply indicates that the tongue front is involved. What I propose to do now is to consider a second, distinct, issue which concerns coronal: the 'special status of coronals' debate.

1.2.2. The Special Status of Coronals

It has been generally accepted that [coronal] is the universally unmarked oral place feature and also that coronals have special status. But prior to the work of Avery and Rice (1989) and Paradis and Prunet (1989, 1991), among others, these assumptions had simply been 'accepted'. No one had studied these claims in any depth and furthermore the representation did not reflect this unmarked and special status in any illuminating way.

Since this thesis will contribute to the special status of coronals debate, in that arguments will be put forward which suggest that the representation of coronal should be changed in such a way that it leads to a greater degree of understanding of the unmarked/special status of coronals, this section will consider the special status arguments. In section 1.2.2.1, I shall list a number of frequency facts which have been cited as evidence for the universally unmarked status of coronal. I will then consider two examples put forward to support the claim that coronals have special status. In 1.2.2.2, I will present the example of Catalan coronal assimilation and consider an account which adopts modified contrastive underspecification. In section 1.2.2.4, I will consider Tahltan Coronal Harmony and the radical underspecification account of this data.
1.2.2.1. **Frequency facts**

One of the interpretations of 'marked' is that the unmarked option is the one which occurs most frequently (Hyman 1975: 145). There is abundant evidence in the literature to suggest that coronals occur more frequently than other place types. For example, based on a sample of 317 languages, Maddieson (1984) found that almost all languages have /n/ (316); if a language has an affricate the preference is palato-alveolar; if a language has a fricative, then in 84% of those languages the fricative will be /s/; and furthermore only one language in the sample lacked a coronal stop: Hawaiian.

Paradis and Prunet (1991) took a computerised data base of 22,945 French words which consisted of a lexicon with phonetic transcriptions of lexical entries from a number of different sources and found that the 10 most frequent consonants in French are /r, t, s, l, k, p, m, d, n, y/ (in order of frequency). A similar examination of English (Fry 1947, cited by Paradis and Prunet 1990) found that the 5 most frequent consonants in English were /n, t, d, s, l/.

According to Keating (1991: 29) consonants described as coronal cover approximately half of the primary places of articulation: dental, alveolar, palato-alveolar, palatals, and retroflex versus bilabial, labiodental, velar, uvular and pharyngeal. Keating (1991) summarizes the implications of the frequency of coronals as follows:

"Thus, there are more coronal consonant types, and languages use them more. Put simply, coronals are special phonologically because there are so many of them. Presumably, this sheer preponderance of coronal consonants is a factor in the status of coronals as the usual unmarked or underspecified place of articulation. If half of the consonants in a language are coronal, then any given consonant is more likely to be coronal than any other place class." (Keating 1991:30)
Although these frequency facts suggest that coronals are the universally unmarked place, coronals are not assumed to be special simply because of their greater frequency. In many languages coronals behave as the 'odd-man-out' in phonological processes such as assimilation, deletion and harmony processes. In the following section I shall set out the first examples that illustrates coronal’s asymmetrical behaviour.\(^{47}\)

12.2.2. Catalan.

One example of the type of phonological processes used to support the claim that coronals behave asymmetrically with respect to other place-types is place assimilation. Avery and Rice (1989:87-8), drawing upon Kiparsky 1985 and Mascaro 1979, provide the following example of asymmetrical coronal behaviour in Catalan.

\begin{verbatim}
48(a)

so[n] amics  'they are friends'
so[m] pocs   'they are few'
so[m] feliços 'they are happy'
so[n] dos    'they are two'
so[n] sincers 'they are sincere'
so[ŋ] rics   'they are rich'
so[n, ʒ]ermans 'they are brothers'
sou[n, ʎ]atures 'they are free'
sou[ŋ] grans  'they are big'

(b)

so[m] amics  'we are friends'
sou[n] pocs   'we are few'
sou[n] feliços 'we are happy'
sou[m] dos    'we are two'
ti[n] pa      'I have bread'
als[ŋ] feliç  'happy year'
\end{verbatim}

\(^{47}\) In Chapter 5, I shall present a number of examples of asymmetrical behaviour of coronals in English.
The data in 48(a) shows that the coronal nasal readily assimilates to the place of the following consonant. The data in 48(b) demonstrates that the only other nasal to undergo any assimilation at all is /m/. /m/ undergoes a limited kind of assimilation in that it only assimilates to a following labial. Thus if /m/ is followed by /f/, as in so[m] felicos 'we are happy', then the /m/ becomes a labiodental [m]. However, it is not just the coronal nasal that undergoes assimilation, Avery and Rice provide examples which illustrate that the coronal lateral [l] assimilates in much the same way.

(49) l-assimilation

\[
\begin{align*}
\text{e[l]} & \quad \text{the} \\
\text{e[l] pa} & \quad \text{the bread} \\
\text{e[l] foc} & \quad \text{the fire} \\
\text{e[l] dia} & \quad \text{the day} \\
\text{e[l] sol} & \quad \text{the sun} \\
\text{e[l, ] ric} & \quad \text{the rich} \\
\text{e[l, ñ]ermá} & \quad \text{the brother} \\
\text{e[l, ]ibre} & \quad \text{the book} \\
\text{e[ç] gos} & \quad \text{the dog}^{48}\end{align*}
\]

(Mascaro 1976: 46 cited by Avery and Rice 1989: 189)

---

48 There is an additional assimilatory process in Catalan which affects the coronal /t/ to a much greater degree than any other stop. However, Avery and Rice (1989) do not provided any account for it. I have included data for this process here because it provides additional support for the claim that coronals behave asymmetrically with respect to other place types.

\[
\begin{align*}
\text{t-assimilation} \\
\text{se[t]} & \quad \text{seven} \\
\text{se[m]} & \quad \text{seven hands} \\
\text{se[p, ] focs} & \quad \text{seven fires} \\
\text{se[l] ñ} & \quad \text{seven lines} \\
\text{se[t, ñ]ais} & \quad \text{seven lambs} \\
\text{se[ß, ]ibre} & \quad \text{seven books} \\
\text{se[k] cases} & \quad \text{seven houses} \\
\text{se[d]} & \quad \text{seven women} \\
\text{se[b] beus} & \quad \text{seven voices}
\end{align*}
\]

\[
\begin{align*}
\text{ca[p]} & \quad \text{no} \\
\text{ca[m]} & \quad \text{no hand} \\
\text{ca[p, ] foc} & \quad \text{no fire} \\
\text{ca[p] signe} & \quad \text{no signs}
\end{align*}
\]

\[
\begin{align*}
\text{po[k]} & \quad \text{few} \\
\text{po[k] pa} & \quad \text{few bread} \\
\text{po[k] sol} & \quad \text{few sun} \\
\text{po[k, ñ]ai} & \quad \text{few lamb}
\end{align*}
\]
Before we consider Avery and Rice's account of place assimilation in Catalan, I will briefly overview the main points of their approach to the special status of coronals.

Avery and Rice (1989a, b)\textsuperscript{49} assume that coronal is the universally unmarked place feature and is therefore underspecified and this, they claim, lies at the heart of the special status of coronals. In some languages, coronals behave no differently from other places and in order to capture both types of language they claim that in languages where coronal is not special considerations of universal markedness are overridden by the Node Activation Condition (NAC):

\begin{equation}
\text{"If a secondary content node is the sole distinguishing feature between two segments, then the primary feature is activated for the segments distinguished. Active nodes must be present in underlying representation."}
\end{equation}

\textsuperscript{(Avery and Rice 1989: 183)}

\textsuperscript{49} Avery and Rice assume a modified version of Sagey's (1986) model of feature geometry:

\begin{tikzpicture}
  \node {Root} child {node {continuant} child {node {Laryngeal} edge from parent node [above] {Supralaryngeal}} child {node {Place} edge from parent node {soft-pal} child {node {Dorsal} edge from parent node [below] {Labial}} child {node {Coronal} edge from parent node [above] {[voice] [nasal]} child {node {[round] [distributed]} edge from parent node}}}}
\end{tikzpicture}

\textsuperscript{(Avery and Rice 1989: 180)}
In order to see how this affects the representation of coronals, consider the examples
given by Avery and Rice (1989 a,b) of Ponapean obstruents and Sanskrit coronals:

(51) Ponapean Obstruents
\[
\begin{array}{cccccc}
\text{p} & \text{d} & \text{k} \\
\text{p}^w & \text{t} \\
\text{s}
\end{array}
\]

Avery and Rice (1989: 185, citing Rehg and Sohl 1981: 34)

(52) Sanskrit coronal inventory
\[
\begin{array}{cccccccccc}
\text{retroflex [-distributed]} & \text{t} & \text{th} & \text{d} & \text{dh} & \text{n} & \text{r} & \text{s} \\
\text{dental [+distributed]} & \text{t} & \text{th} & \text{d} & \text{dh} & \text{n} & \text{l} & \text{s} \\
\text{palato-alveolar} & \text{č} & \text{čh} & \text{j} & \text{ţh} & \text{n} & \text{š}
\end{array}
\]

First of all in the case of the Ponapean inventory, their point is that /t/ is not
distinguished from /p/ and /k/ by having any dependants of the coronal node therefore
universal markedness considerations are not overruled by the NAC. In contrast, Sanskrit
coronals are minimally distinguished by a dependant of the coronal node:
[+/- distributed] and so the NAC overrides universal markedness conditions and the
coronal node is present underlingly. Hence Avery and Rice are able to account for the
fact that coronals exhibit asymmetrical behaviour in Ponapean but not in Sanskrit (Avery
and Rice 1989a and b).

The type of underspecification assumed by Avery and Rice falls somewhere between
radical and contrastive underspecification. They adopt the radical underspecification
assumption that only marked values are underlingly present (although this may be
overridden). In line with contrastive underspecification, they assume that one should be
able to set up contrasts. They therefore call their approach ‘modified contrastive
underspecification'. This approach is not nearly as restrictive as contrastive underspecification. To illustrate the difference consider, /p, t, k/ and /s/ and /ʃ/ in English. On a contrastive underspecification approach the argument would be that since /t/ must be distinguished from /p/, and also from /k/, and /s/ must be distinguished from /ʃ/, the coronal node would be contrastive and therefore all three coronal segments would be specified for coronal underlyingly. On the assumptions of modified contrastive underspecification, only /s/ and /ʃ/ would be specified for coronal, since they are minimally distinguished by dependents of the coronal node and consequently coronal is underlyingly present in both. /t/ in English, like /t/ in Ponapean, would be underspecified for [coronal], since it is not distinguished from /p/ and /k/ by dependants of the coronal node. For segments which are underspecified for coronal, coronal is supplied by a default rule in the phonetic component (Avery and Rice 1989: 184).

On the basis of their theoretical assumptions vis-à-vis underspecification and feature geometry, Avery and Rice propose the following account of the Catalan data. n/l assimilation is said to be the result of a primary content node spreading to fill an empty position.

(53)

\[
\begin{array}{l}
\text{Root} \\
\text{S-L} \\
\text{Place} \\
\text{Primary C.} \\
\end{array}
\]

(Avery and Rice 1989: 188)
Furthermore, Avery and Rice's account of n/l place assimilation in Catalan and their account of why coronals are special, results in an explanation of why other places do not undergo place assimilation with the same frequency that coronals do. As an example of non-coronal place assimilation consider the change from Latin to Italian.

(54)  

<table>
<thead>
<tr>
<th>Latin</th>
<th>Italian</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>factum</td>
<td>fatto</td>
<td>no gloss given</td>
</tr>
<tr>
<td>septem</td>
<td>sette</td>
<td>'seven'</td>
</tr>
<tr>
<td>somnum</td>
<td>sonno</td>
<td>'sleep'</td>
</tr>
</tbody>
</table>

(Jeffers and Lehiste 1982: 4)

The greater frequency of coronal as opposed to other place assimilation falls out from the autosegmental view of assimilation as spreading. There are two types of spreading: one is a feature filling operation as in (55a) and the other is a feature changing operation as in (55b).

(55a)

\[ \begin{array}{c}
  x \rightarrow x \\
  \cdot \\
  \cdot \\
  A \\
\end{array} \]

(55b)

\[ \begin{array}{c}
  x \rightarrow x \\
  \cdot \\
  \cdot \\
  B \rightarrow A \\
\end{array} \]
In (55a), the idea is that when A spreads it spreads into an empty position supplying that position with a value, hence it is feature filling. This is the type of spreading process involved in coronal place assimilation as in Catalan. Alternatively, A may spread to a position which is already occupied by a feature B and, as a direct consequence of A spreading, B is delinked, hence this form of assimilation is feature changing and it is the type of assimilation illustrated by the change from Latin to Italian. As Goldsmith (1989) points out, a process which involves spreading only is preferable to one that involves spreading followed by delinking. So, if you adopt these assumptions then it follows that the assimilation of the latter type will be more highly marked than the former case and so the theory has a built-in frequency predictor.⁵⁰

To summarise Avery and Rice's position, we have seen that Avery and Rice adopt a form of underspecification (modified contrastive underspecification) which dictates that in languages where coronals are not minimally distinguished by dependents of the coronal node, those coronals will be able to manifest their universally unmarked status and will be underlyingly underspecified. Languages in which coronals are minimally distinguished by dependents of the coronal node will not be underspecified and will not exhibit special behaviour.

Before I look at the Tahltan data, I shall consider the radical underspecification approach to the special status of coronals.

⁵⁰ A contrastive underspecification approach would be unable to capture the difference between coronal and non-coronal place assimilation. Catalan place assimilation would be the same type of process as the change from Latin to Italian: spreading followed by delinking.
I.2.2.3. **The Radical Underspecification Approach**

Those who adopt a radical underspecification approach to the special status of coronals (such as Paradis and Prunet (1989) and Shaw (1991), like Avery and Rice, assume that coronal is the universally unmarked oral place. But they differ from Avery and Rice in that they claim that not only do unmarked coronals lack [coronal], they also lack a place node. Coronal is filled in by the following rule:

(56) Coronal Specification Rule (CSR)

[0 Place] →[coronal]

Paradis and Prunet (1989: 319)

Paradis and Prunet (1989) also assume the Node Generation Constraint NGC (citing Archangeli and Pulleyblank 1994) which guarantees that once [coronal] is supplied it is dominated by a place node. The NGC is defined on page 320 as:

(57) The Node Generation Constraint (NGC)

A rule or convention assigning some feature or node x to some node b creates a path from x to b.

In cases where [coronal] dominates marked terminal features such as [-anterior] not only will the marked terminal feature be present but so will [coronal]. So, /J/ for example will be specified for [coronal] and [anterior]. Unmarked terminal features are not specified and so /s/ which is [+anterior], the unmarked value of [anterior], is specified neither for [anterior], nor for [coronal].\(^{51}\)\(^{52}\) Paradis and Prunet account for languages in which

---

\(^{51}\) This means that Paradis and Prunet's radical underspecification approach makes different predictions to the modified contrastive approach of Avery and Rice. For Paradis and Prunet /s/ is predicted to be special, whereas for Avery and Rice /s/ should be a non-special coronal.

64
coronals do not appear to be special by claiming that the CSR applies early in the lexicon.\textsuperscript{53}

1.2.2.4. Tahltan Coronal Harmony

Tahltan is an Athapaskan language spoken in British Columbia.\textsuperscript{54} It has the following consonant inventory.

\begin{table}[h]
\centering
\begin{tabular}{cccccccc}
(58) & b & d & dl & d\textsuperscript{o} & dz & d\textsuperscript{ž} & g & g\textsuperscript{w} & G \\
& t & t\textsuperscript{t} & t\textsuperscript{θ} & ts & t\textsuperscript{s} & k & k\textsuperscript{w} & q \\
& t\textsuperscript{’} & t\textsuperscript{t\textprime} & t\textsuperscript{θ\textprime} & ts\textsuperscript{’} & t\textsuperscript{s\textprime} & k\textprime & k\textsuperscript{w\textprime} & q\textprime & ? \\
& l & ò & s & ñ & x & x\textsuperscript{w} & \chi & h \\
& m & n & y & w \\
& n\textprime
\end{tabular}
\end{table}

What is of interest to us here is the presence of 5 contrastive coronal series which Shaw refers to as the d-series, dl series etc. Coronal harmony affects three of these groups: the d\textsuperscript{o}, d\textsuperscript{ž} and dz series. For example, coronal harmony affects the first person subject

\textsuperscript{52} Paradis and Prunet (1990) state

"The physiological rationale behind the phonological claim that [+ anterior] coronal is the unmarked place of articulation for consonants is that the position involved in [+ anterior] coronals is the basic position of the tongue, neither front nor back."

\textsuperscript{53} In this respect they make a very different claim from that of Avery and Rice (1989). Recall that for Avery and Rice, it is the node activation constraint which guarantees the appearance of the coronal node in languages in which coronal is not special. Otherwise coronal is filled in by phonetic default rule in the phonetic component. This makes very precise predictions: that a language in which coronals are not special shows a minimal contrast between say /t/ and /t\textprime/, for example. If languages exist in which /t/ alone occurs, but yet coronal is not special then this supports Paradis and Prunet.

\textsuperscript{54} According to Shaw (1991) this language is spoken by less than 40 people.
marker /s/ (a member of the dz series) when it is followed by any member of the dô, dź or dz series. This is illustrated by the data in (59).

(59)

(a)

<table>
<thead>
<tr>
<th>Token</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>080Ô</td>
<td>'I'm hot'</td>
</tr>
<tr>
<td>de80 k“80</td>
<td>'I cough'</td>
</tr>
<tr>
<td>ê80du:80</td>
<td>'I whipped him'</td>
</tr>
<tr>
<td>me808080808080</td>
<td>'I'm wearing (on feet)'</td>
</tr>
<tr>
<td>na80t80t80</td>
<td>'I fell off (horse)'</td>
</tr>
</tbody>
</table>

(b)

<table>
<thead>
<tr>
<th>Token</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>hudištša</td>
<td>'I love them'</td>
</tr>
<tr>
<td>ê80dž80ni</td>
<td>'I'm singing'</td>
</tr>
<tr>
<td>ţeneštšu:š</td>
<td>'I'm folding it'</td>
</tr>
<tr>
<td>ne8y80t</td>
<td>'I'm growing'</td>
</tr>
</tbody>
</table>

(c)

<table>
<thead>
<tr>
<th>Token</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>ê80k’80</td>
<td>'I'm gutting fish'</td>
</tr>
<tr>
<td>nade80de80sba:t80</td>
<td>'I hung myself'</td>
</tr>
<tr>
<td>ê80dan</td>
<td>'I'm drinking'</td>
</tr>
<tr>
<td>sê8x80t</td>
<td>'I'm going to kill it'</td>
</tr>
<tr>
<td>nê80t80t</td>
<td>'I'm sleepy'</td>
</tr>
</tbody>
</table>

(Shaw 1991: 144)

In (a) the first person singular subject marker /s/ surfaces as /θ/ just in case a member of the dô series is present. In (b) it surfaces as /s/ and in this data the trigger is a member of the dź series. The data in (c) contains no instances of the triggering series and /s/ surfaces as [s].

Shaw argues that it is only place that spreads, manner features etc are not affected. The direction of spread is from right to left. Furthermore she provides data which demonstrates that if a member of the d or dl series are present between a trigger and
target, they are transparent to the harmony process. That is they neither block nor trigger coroidal harmony. This is illustrated by the data in (60).

(60)

(a)  
\[
\begin{align*}
\varepsilon \partial \varepsilon \partial \partial \partial & : \partial & \text{I whipped myself} \\
\text{to}^{\partial} \partial \partial \partial \partial & : \partial & \text{I'm dying'} \\
\chi \partial \eta \varepsilon \partial \partial & : \partial & \text{'I'm cutting the hair off'} \\
\varepsilon \delta \partial \delta \partial \partial & \partial \partial & \text{'we are walking'} \\
\text{n}\partial \partial \partial \partial \partial & : \partial & \text{'we got up'} \\
\delta \varepsilon \gamma \varepsilon \partial & \partial \partial & \text{'we are breast feeding'}
\end{align*}
\]

(b)  
\[
\begin{align*}
\text{no}^{\partial} \varepsilon \partial \delta \partial \partial \partial & \partial \partial & \text{'I melted it over and over'} \\
\text{y} \partial \partial \partial \partial \partial & \partial \partial & \text{'I splashed it'}
\end{align*}
\]

(Shaw 1991: 145)

Shaw assumes, in line with radical underspecification, that for the feature [+/-continuant], [+continuant] is the underspecified feature. Only [-continuant] can be lexically present. Given this she assumes that stops and affricates are represented by [-continuant]. These segments are distinguished underlingly by the presence of [+lateral] for the dl series, [+distributed] for the d\o\ series, [+strident] for the dz series and [-anterior] for the dz series. The d series are only represented by [-continuant] and this reflects their unmarked status. Coronal place is later filled in by the redundancy rule given above (repeated below for convenience).

(61)  
\[
\begin{align*}
[0 \text{ Place}] & \rightarrow \text{Coronal}
\end{align*}
\]

So Shaw assumes the following representations for the five coronal series.
The three series of consonants that participate in harmony have one thing in common the coronal node is present and dominates terminal features. Given this it must be the coronal node which is spreading from the trigger to the target since this is the organising node that dominates [-dist], [+str] and [-ant]. Shaw therefore formulates coronal harmony as follows.
In other words, [coronal] spreads from right to left targeting the coronal node which is adjacent on the coronal tier and causing it to delink.

With this in mind we can now say why it is that the d series and dl series are transparent to coronal harmony. First of all, Shaw uses Tahltan as evidence that lateral is a dependent of the root node rather than the coronal node (as in Levin 1988 for example). If lateral were a dependent of coronal then we would expect the dl series to participate in harmony. If the d and dl series are underspecified for coronal and for place, then we can explain the reason why they do not participate in harmony. Shaw argues that coronal harmony targets an existing coronal node which is adjacent on the coronal tier. She goes on to argue that members of the d and dl series do not undergo harmony because they are not specified for coronal. However, in the light of the discussion of spreading in the preceding section, we can also add that if the place node was present it would be difficult to explain why a spreading coronal node would not attach to that empty place node. However, if we assume that there is no place node, then Shaw can explain why these two series are transparent to coronal spread.

In this section we have considered three pieces of evidence put forward in support of the claim that coronal is the unmarked place and that coronals are special. We have considered evidence for the claim that there are two approaches to the special status debate. Although both approaches argue that coronals are special because they are universally unmarked and in some cases underspecified and that this accounts for the special behaviour, they differ chiefly in the degree of underspecification assumed.
In this chapter we have seen that Coronal segments are aligned with front vowels and are assigned special status. In mainstream feature theory these two properties are represented by (1) a feature [coronal] which is currently defined as tongue tip, blade and/or front raising and (2) [coronal] underspecification. In chapter 2 I shall consider a classical problem of English phonology: r-sandhi. I shall present an account of this process which suggests a link between coronal consonants and the vowel schwa.
CHAPTER 2

The study of /r/ in English is generally concerned with two main problems. First of all, there is the change from rhotic to non-rhotic status which is roughly characterised as the loss of pre-consonantal and pre-pausal /r/. Secondly there is the problem of r-sandhi in certain varieties of non-rhotic English. In this chapter I shall only consider the latter problem, and aspects of the change from rhotic to non-rhotic status will be discussed in chapter 3. The reason why this chapter will be restricted to the r-sandhi problem is that one consequence of the analysis of r-sandhi proposed in Broadbent 1991 is that it establishes a connection between a coronal: /r/ and a vowel not traditionally linked with [coronal], namely schwa. This new link poses a challenge to the front vowel-coronal position and in addition has a number of consequences for the way in which coronals should be represented.

In section 2.1 I will set out the r-sandhi problem. 2.2 will overview some contemporary accounts of r-sandhi available in the literature. Section 2.3 will introduce the Glide Formation (GF) account of r-sandhi developed in Broadbent 1991, together with an attempt to implement GF in Element Theory. Although Element Theory is unable to implement GF, there are indications as to what the most appropriate representation should look like. Section 2.4 will then consider a possible implementation of GF in Feature Geometry. Feature Geometry succeeds in implementing GF, but not as elegantly as we might expect given the restrictions imposed on spreading in this framework. Section 2.5 will focus on the way in which schwa is represented in ET and DP. Problems encountered by both representational approaches suggests a requirement which
the selected theory of representation should provide. In section 2.6, I will consider an approach which meets this requirement: Particle Phonology. All of this work is necessary before we can begin to address one of the meatier problems which arises out of Broadbent 1991: if schwa in an onset gives rise to /r/, where does the coronality come from? Therefore Chapter two not only provides a new and explanatory account of the classical r-sandhi problem, but it also provides the necessary spadework for a new approach to coronality, which will be developed throughout the rest of the thesis.

2.1. Linking and Intrusive r in English.

In certain varieties of non-rhotic English, /r/ can only occur prevocally, as in *red*, *rope*, *arrive*, etc. and never before a consonant or pause. But such non-rhotic systems typically show a certain alternation of zero with /r/; thus while /r/ does not appear pre-pausally in an item like *fear* [fiə], it does show up, apparently in the same item, before a vowel, as in *fear* of [fiə v]. Whenever such an occurrence of /r/ is recognized as 'etymologically justified' the /r/ is termed 'Linking' (as in *fear* of above); otherwise it is termed 'Intrusive' (as in, for example, *drawing* [dɹəʊ] or *law and order* [lɔː r ʌндəðɔːdə]). More precisely, the labels 'Linking r' and 'Intrusive r' are used in the description of non-rhotic English to describe certain instances of pre-vocalic /r/. The term 'linking r' is used to refer to the occurrence of /r/ after certain vowels, namely, [ɑː], [ɔː] and [ə], when the following morpheme begins with a vowel. In (1a) and (1b) below I have set out some examples which illustrate linking r in RP:

(1)(a)
fear of [fiəv]
door open [dɔəpən]
far away [fəˈəwe]
The term 'intrusive r', like the term 'linking r', refers to the appearance of /r/ between final [aː], [eː], and [ɔ] and a following vowel initial morpheme. As mentioned above, two distinct terms have been employed because linking r has traditionally been regarded as the historical /r/ 're-emerging', whereas intrusive r has no such etymological justification. (2) below presents some classical examples of intrusive r, once again from RP (Gimson 1980, Wells 1982):

(2) idea of [aidiai av]
Shah of [ʃaː av]
law and [laː end]

The use of both linking and intrusive r is optional in the examples given above. So, for example, fear of may be pronounced [fiə av], [fiəʔ av] or [fiər av]. Wells (1982) claims that r-sandhi is the most common of the three alternatives.

A second case of what must be strictly classified as intrusive r comes from English speakers of foreign languages. Wells (1982: 226) observes:

---

1 Brown (1988) makes a very interesting point with respect to an instance of intrusive r. Consider a word such as banana. The word has no 'r' in the spelling and so given the definition of intrusive r any occurrence of /r/ should be intrusive as in: bananary taste [bənanər tiːst]. But as Brown points out why is it that the occurrence of /r/ in this case, where the r is as 'intrusive' as that in drawing [drəˈmɪŋ], appears in the spelling?
"...I have often heard instances such as j'etais déjà/ɪ/ ici, ich bin ja/ɪ/ auch fertig, tio estas interesario/ɪ/ ideo, fe wela/ɪ/ i rywbeth. Choirmasters have to admonish against alpha/ɪ/ es et O, gloria/ɪ/ in excelsis, and viva/ɪ/ Espania."

Wells observes that intrusive r can also occur when foreign words are incorporated into sentences. He provides the following examples from his own observations.

Degas/deɪɡə:/r/ and Sickert.
Dada/ɪ/ism
the social milieu /miːlɪ/ of Alexander Pope.
the junta /ˈʃʊntə:/ in Chile. (Wells 1982: 226)

Several accounts of linking and intrusive r have been proposed, notably those of Mohanan 1986, Wells 1982, Nespor and Vogel 1986, McCarthy 1993 and Harris 1994. The accounts provide an adequate description of their data in each case, but they remain, from a theoretical point of view, arbitrary and non-explanatory.  

Most accounts focus on linking and intrusive r in so-called 'Received Pronunciation' (RP) only, and until recently, little or nothing has been said about other non-rhotic accents.  Arguably, one reason why these accounts fail to convincingly account for r-  

---

2 In chapter 1 we have already seen that a 'non-arbitrary' account is judged to be one which establishes a direct and principled relationship between a phonological process and the context in which it occurs.

3 It is not clear that Received Pronunciation in the strictest sense of the term exists as a living system. John Harris has suggested that 'Received Pronunciation' might better be considered to have the status of an 'ideal form'. Similar ideals exist in Arabic and in Mongolian (Charrette, pc). Should RP exist as a living system, it will be a form of Standard Southern English; so, although I shall use the term 'RP' throughout, this should be understood as RP and Standard Southern English more generally.

4 McCarthy (1993) provides an Optimality account of r-sandhi in Boston English (see section 2.2.3 below). Harris (1990, 1994) describes four systems. System A is fully rhotic. System D stands at the opposite pole in that it is non-rhotic and lacks both linking and intrusive r. System C is non-rhotic with linking and intrusive r and System B is non-rhotic and has linking r without intrusive r. However, in a footnote Harris gives an example of system B as RP and acknowledges that more usually speakers of this accent in fact fall into system C.
sandhi is that RP in isolation is a poor data base. It is a poor data source because RP speakers variably suppress intrusive r and this suppression has often been interpreted in the literature as the phonological absence of intrusive r. Broadbent 1991 considers not only RP data but also data from a different non-rhotic system: West Yorkshire (WY). WY as opposed to RP shows no suppression of so-called intrusive r and so Broadbent claims that WY and RP do not differ as regards the grammar of /r/, but that amongst RP speakers intrusive r is subject to (variable) socially motivated suppression. However, such suppression should not be reflected in a grammatical analysis, and grammatical generalization is only possible once we have abstracted away from such 'sociolinguistic' suppression. In Broadbent 1991, no distinction is made between linking and intrusive r from the point of view of grammatical theory.

Having established what the r-sandhi problem entails, I shall now consider a number of contemporary accounts of r-sandhi.

5 One example of an analysis which assumes the phonological absence of intrusive r in RP is Mohanan (1986). Nespor and Vogel (1986) assume that RP has both linking and intrusive r. Note, however, that although Mohanan and Nespor and Vogel disagree as to the facts, the data source cited in both cases is the same, namely Gimson (1980). When we consult Gimson, we find that RP does have intrusive r, but that intrusive r is subject to sociolinguistic suppression. Gimson writes that

"...By analogy, this /r/ linking usage is extended to all /ai/, /ɔi/, /ɔ/ endings, even when there is no historical (spelling) justification. Such intrusive /r/ is to be heard particularly in the case of /ai/ endings, e.g. Russia and China /rəˈʒərm ʃaːma/...idea of /aʊdəˈzərəl/...Less frequently analogous links unjustified by the spelling, are made with final /aː/ e.g. Shah of Persia /ʃæhəˈnɒːpəzːə/; law and order /lɔːˈrəʊndərə/...I saw it /aʊsəˈvɔː/; drawing /ˈdrɔːrə/ are generally disapproved of, though it is likely that many RP speakers have to make a conscious effort to avoid the use of such forms".

(See also Wells (1982 Vol 1 Section 3.2.3) Walmsley 1973 and Windsor Lewis (1975) in this regard.)

6 In Boston English, there may be evidence that sociolinguistic suppression of so-called intrusive r occurs in certain cases (see 2.2.3 below).
2.2. Contemporary Accounts of r-sandhi

2.2.1. Mohanan (1986)

Mohanan (1986: 36) claims to be dealing with a non-rhotic accent which does not exhibit intrusive r, and cites RP. Mohanan's account attempts to handle alternations such as those in (5), below.\(^7\)

(5)

\[
\begin{array}{llll}
\text{soar} & \text{soaring} & \text{saw} & \text{sawing} \\
\text{bear} & \text{bearest} & \text{idea} & \text{ideology} \\
\text{star} & \text{star is} & \text{spa} & \text{spa is} \\
\end{array}
\]

(Mohanan 1986: 36.)

Mohanan proposes the following analysis. Following syllabification in lexical stratum 1, /r/ is syllabified in the rhyme:

(6)

\[
\begin{array}{ccc}
O & R \\
C & C & V & C \\
s & t & a & r \\
\end{array}
\]

Mohanan claims that /r/ is not allowed to remain in the rhyme and he posits a rule of r-resyllabification which applies post-lexically (Mohanan 1986: 36):

(7)

\[
\begin{array}{c}
R \\
x \\
r \\
\end{array} \rightarrow \begin{array}{c}
R \\
x \\
r \\
\end{array}
\]

Resyllabification is possible in, for example, *star is*, which I have illustrated in (8) below.

---

\(^7\) In Mohanan's symbolism [o] corresponds to [o], [o] to [o], [e] to [e] and [i] to [i].
In (6) the /r/ in *star* cannot resyllabify (for there is no immediately adjacent rhyme), and since the output does not contain /r/ it must have been deleted. Mohanan accordingly posits a rule of r-deletion. r-deletion (as in (9) below) is another post-lexical rule and is ordered after r re-syllabification (Mohanan 1986: 36).

(9) 
\[
\begin{array}{c}
R \\
\downarrow \\
r \rightarrow \emptyset \\
\end{array}
\]

And so an item like *star* in isolation will show the following derivation.
As an analysis of linking r only, this account is descriptively adequate but highly arbitrary. Mohanan's account is arbitrary in that it does not establish a direct and principled relationship between the phonological processes which he posits and the contexts in which they are claimed to occur. Given the arbitrariness of Mohanan's account, we should ask how much is really explained by that account. We might ask why it is that /r/ cannot remain in the rhyme. Are there any other consonants which cannot remain in the rhyme, and if not, why not?

In a footnote Mohanan comments on the existence of intrusive r and comments that intrusive r is the result of r-insertion. Any system which has linking and intrusive r, on Mohanan's account, requires two post-lexical rules: one of r-deletion and another of r-insertion. Again, the analysis is arbitrary and non-explanatory. Why do we find 'r-insertion' at all? And what is the connection, if any between r-insertion and the 'r-

---

8 See Mohanan (1986: 61, footnote 19).
resyllabification' and 'r-deletion' rules already posited? These questions go unanswered in Mohanan's account.

2.2.2. r-insertion accounts

The accounts proposed in Nespor and Vogel (1986) and Wells (1982) have much in common. Although Nespor and Vogel, unlike Wells, deal exclusively with RP, they all assume that RP has both linking and intrusive r and that post-vocalic /r/ is not present underlyingly in RP. In order to account for /r/ in, for example, star is [staː iz] and fear of [fiaə əv] etc. Nespor and Vogel propose an utterance domain rule of r-insertion (Nespor and Vogel 1986: 229).

(11) \[ \emptyset \rightarrow r / [\ldots a \odot \varepsilon \ldots] u \]

Although Wells' r-sandhi account is largely concerned with RP, he does make comments about other accents. Wells (1982: 227) cites Trudgill's (1974) example of Norwich English where [æ] precedes r-sandhi e.g. he have often said [heːə ofən sed]. From his own observations of cockney how/r/ are you and now/r/ 'e's done it! [hauə ər/ ə ˈɛs ˈdən ɪt!] where the quality of the vowel preceding the /r/ is given as [æː]. Examples such as these lead Wells to posit a more general rule of r-insertion:

(12) \[ \emptyset \rightarrow r / [-highV] \#. V \]

(Wells 1982: 226).
Notice that both Nespor and Vogel, and Wells treat linking and intrusive r as one phenomenon. In classical generative terms, such accounts are simpler than that presented by Mohanan in that they require fewer rules. Both analyses provide a descriptively adequate accounts of the data. However, there is nothing principled in the theory within which these accounts are formulated that rules out the possibility of a system having r-sandhi after [+ high] vowels (a system in which, for instance, *seeing* might be pronounced [siːiŋ]). Such systems are unattested and we shall see shortly that they can be excluded in a theoretically principled way. There is, I believe, a good reason why r-sandhi cannot appear after a high vowel, but no such reason figures in the accounts of either Nespor and Vogel or that of Wells. Like Mohanan's account, the analyses offered by Nespor and Vogel and by Wells are subject to the charge that they are, in the technical sense, arbitrary.

2.2.3. An Optimality Account of r-sandhi.

McCarthy (1993) provides an Optimality Theoretic account of the non-rhotic variety of English spoken in Boston (Eastern Massachusetts). Linking and intrusive r occur after [a, ɔ, ə] and before a vowel initial word. McCarthy illustrates this with the following data.

(13)

<table>
<thead>
<tr>
<th>r loss</th>
<th>r Linking</th>
</tr>
</thead>
<tbody>
<tr>
<td>The spa seems to be broken</td>
<td>The spar is broken.</td>
</tr>
<tr>
<td>He put the tuna down</td>
<td>He put the tuner away.</td>
</tr>
<tr>
<td>You’re somewhat older.</td>
<td>You’re a little older.</td>
</tr>
</tbody>
</table>

(McCarthy 1993:170)

---

9 See Wells (1982: 223) who claims that *seeing* *[siːiŋ]* is not a possible form.
McCarthy assumes that /r/ is underlying in forms such as spar, tuner and are and that this underlying r is deleted when it is not followed by a vowel initial morpheme.

Intrusive r cases on, the other hand, lack underlying r and are subject to r-insertion. The picture is according to McCarthy far from straightforward however.

(14) r linking after function words
They're eating. Tom and I are eating.
Tom and I were eating. One answer was...
Their answer was... He didn't give her any trouble
...for any reason... ...either apples or oranges...
After all... Under any circumstances.

(McCarthy 1993:175)

Although linking r can occur after function words as in (14) above, the pattern of r intrusion is more complex.

(15) Lack of r Intrusion after Function Words
a. Modal + reduced have
   should have (shoulda), could have (coulda),
   might have (mightha),
   He shoulda eaten. [ʃudə(*r) iʔən]

b. Verb + reduced to
go ing to (gonna), want(s) to (wanna, wantsta),
o ught to (oughta), have/has to (hafta, hasta),
got to (gotta), used to (useta), supposed to (supposta)
I'm gonna ask Adrian [ajə ɡənə(*r) æsk ædriˈən]
We're supposed to eat now. [wiˈjə səpəwəs tə(*r) iʔ ˈnɔw]

c. Auxiliary + reduced you
did you, should you, would you, could you
Did you answer him [dɪdə(*r) ænˈsər ɪm
Would you ask for me? [wədə(*r) æsk fə miˈj]

b. reduced to, so, by
To add to his troubles [tə(*r) æd ta(*r)ɪz trəblz]
to Ed [tə(*r)ɪd]

e. Reduced do
Why do Albert and you [wəj do (*r) əlˈbɛt ən juˈw]
In the above examples there is no r intrusion after these function words unless they occur phrase finally.

(16) r Intrusion After Phrase-Final Function Words:
I said I was gonnar and I did.
Did you or didn't you? [dɪdʊə dɪdən jə]
We oughtar if we're asked.
We shouldar, I guess, gotten more charcoal.
If you haftar, I'll help.

So what is it about phrase internal function words that prohibits intrusive r? Before we consider this question we should consider the theory in which this question is being addressed. McCarthy takes an Optimality approach to this problem. In essence Optimality Theory assumes that a number of candidates are produced by GEN. The selected candidate which is then the output is the one that violates least constraints. The goal of Optimality Theory is to determine the rankings for these constraints.\textsuperscript{10}

McCarthy argues that one of the constraints involved in the account of r-sandhi is the constraint FINAL-C.

(17) FINAL-C
\*V)PrWd

This constraint states that a prosodic word cannot end in a vowel. r-intrusion occurs to prevent violations of this constraint. But why is r intrusion impossible unless the function word is phrase final? McCarthy argues that forms such as to are recognised as proclitics. If to in to Ed has been procliticised onto Ed then it is no longer at the end of a prosodic word and so no violation arises. According to McCarthy (1993: 177), Selkirk argues that there is one condition under which procliticisation fails to take place and that is phrase finally. She argues that procliticisation in phrase final position would violate the proper bracketing required by the prosodic hierarchy.

McCarthy posits that a second constraint is required to account for the data:

(18) CODA-COND

*VrX]σ

(McCarthy 1993: 172)

This constraint states that r cannot occur in a coda. But notice that these constraints make conflicting demands. FINAL C reflects the fact that words apparently like to end in consonants or glides and CODA-COND that r is banned from coda position. One of the tenets of Optimality theory is that conflicts such as this "lie at the heart of phonological description" (McCarthy (1993: 182). To resolve such a conflict one has to work out the ranking of the constraints within the system concerned.

(19)

<table>
<thead>
<tr>
<th></th>
<th>FINAL-C</th>
<th>CODA-COND</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>wanda left</td>
<td>*!</td>
</tr>
<tr>
<td>2.</td>
<td>→ wandar left</td>
<td>*</td>
</tr>
<tr>
<td>3.</td>
<td>Homer left</td>
<td>*!</td>
</tr>
<tr>
<td>4.</td>
<td>→ Homer left</td>
<td>*</td>
</tr>
</tbody>
</table>

The tableau in (19) gives one possible ranking of the two constraints. The solid vertical line dividing the two constraints means that FINAL-C is crucially ranked above CODA-
COND which means that any violation of FINAL-C is fatal. The ranking given in the tableau above gives rise to the selection of incorrect outputs, therefore the correct ranking of the constraints must be CODA-COND >>FINAL-C. The tableau in (20) gives this ranking and shows that the correct outputs are selected.

<table>
<thead>
<tr>
<th></th>
<th>CODA-COND</th>
<th>FINAL-C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>wanda left</td>
<td>*</td>
</tr>
<tr>
<td>2.</td>
<td>wandar left</td>
<td>*!</td>
</tr>
<tr>
<td>3.</td>
<td>Homer left</td>
<td>*!</td>
</tr>
<tr>
<td>4.</td>
<td>Homef left</td>
<td>*</td>
</tr>
</tbody>
</table>

Finally, in an appendix, McCarthy discusses the issue of why it is /r/ that surfaces rather than any other consonant. He considers the possibility that GEN produces so one of the candidates for Wanda would be [wanda] and that this empty position is spelled out phonetically. But although this would work if /r/ was the default consonant in English, McCarthy acknowledges that it is not and that a rule is required to epenthise the /r/.

This in essence is the Optimality account of r-sandhi. There are a number of points to make about this account. First of all, although McCarthy appears to have tied intrusive r to the vowel set in that it appears after 'true vowel final words only', Intrusive r is treated as a different phenomenon from linking r and yet both occurrences of r are tied to the same restricted vowel set. McCarthy (1993) comments that the linking and intrusive r are

---

11 Constraint violation is represented by * and a fatal violation is represented by !.

12 McCarthy (1993: 190) defines 'rule' as 
..."a phonologically arbitrary stipulation, one that is outside the system of Optimality."
phonetically distinct from the r in *red* for example, and to account for this he assumes that this is a consequence of their junctural ambisyllabicity. But why should this guarantee that an inserted r would be identical to one type but not the other type of underlying r? We might rather expect the linking r to be identical to the prevocalic underlying r in *red*. The fact that, even in the case described by him, linking and intrusive r are phonetically the same actually suggests that they have more in common than McCarthy's account suggests. In addition, there is the point which McCarthy acknowledges himself: why should it be an r that is inserted in the r intrusion cases?  

On the matter of the peculiar distribution of r intrusion, we may compare Boston English with Durham English for example. Durham English exhibits mid phrasal r intrusion

(21) I'm going to have a go [am gowin?ə av o:] 
He was sensible enough to have something to eat. 
[ə: wəz sensəbl məf?əv suməm?ə i:t]
driving into England [dri:vən in?ə inɡlænd]

This suggests that in British English function words are encliticised. In fact there is abundant evidence in British English to support encliticisation of forms such as *to*. Compare *going to* [gowin?ə] and to go [tə go] The initial t of *to* cannot glottal, however in *going to* it can. Leslie (1983) claims that the reason /t/ can glottal in the latter case is that the *to* has encliticised onto the preceding word. If such forms do exhibit encliticisation then the *to*, for example, is prosodic word-final. In British English at least, function words such as *to* are enclitics. Although British English varieties may differ from American varieties in terms of cliticisation, notice that in a phrase such as *He was*...
sensible enough to have something to eat [tː wɒz ˈsɛnsəbl ɪŋəv ˈsʌmθən ˈtiː], the occurrences of r intrusion are very noticeable. Could it be this salience which is the true cause of their absence in Boston English? That is, is r intrusion in such forms subject to sociolinguistic suppression in Boston English?

2.2.4. An Element Theoretic Account

Although Harris (1994) distinguishes three systems of non-rhotic English, I shall only be concerned with two of those varieties: system B and C (see FN 4 above). Harris represents the alveolar median approximant in element terms as cold vowel headed by the coronal element (R) as an operator.\textsuperscript{15} This is illustrated below.

\begin{equation}
\text{(23)}
\begin{array}{c}
\text{x} \\
\text{@} \\
\text{R}
\end{array}
\end{equation}

Harris (1990, 1994) claims that /r/ is underlyingly present as a floating segment.

According to Harris, the lexical entry of fear, for example, in both systems B and C has the following form:

\begin{equation}
\text{(22)}
\begin{array}{c}
\text{O} \\
\text{N} \\
\text{x} \\
\text{X} \\
\text{X} \\
\text{f} \\
\text{I} \\
\text{@} \\
\text{R}
\end{array}
\end{equation}

\textit{fear}

\textsuperscript{15} On its own R is realised as a tap. In combination its salient property is coronality.
However, there is a difference between the two systems as regards the lexical entries for words such as *shah*.

System B allegedly lacks intrusive r and this is captured by the absence of a floating r, as in 23(b). This is the representation that Harris assumes for the lexical entries in system B (cf. 23(b)). In system C on the other hand, *shah* contains a floating r (cf. 23(a)).

Lexical incidence of floating r is the sole difference between the two systems and in this way Harris proposes to account for the absence of intrusive r in RP.

Harris (1994:248) proposes that these non-rhotic systems are constrained by the following licensing requirement:

(24) only an onset position licences R.

The idea is that the ultimate realization of the floating segment depends upon the surrounding structures. To take the example of *fear* first of all, Harris claims that when the cold vowel head of the floating r is absorbed into the nucleus this is interpreted to mean that @ and R are linked to the nucleus portion but that only @ is licensed and therefore realised. So we do not need to talk of delinking. If, however, an empty onset\(^\text{16}\)

\(^{16}\) Many phonologists from different theoretical backgrounds accept the notion of a degenerate syllable having an empty onset position or an empty nucleus position. See for example, Selkirk 1981;
is available, then the element R in some way triggers creation of a skeletal slot linked to that onset, and anchors to that skeletal slot. This is illustrated in (25) below, which I reproduce from Harris (1994: 262).

\[(25)\]

Notice that on this account, both the surface schwa and the r in, for example, fearing, when realized as [fiσrɪŋ], derive from underlying floating r, the element structure of which has been linearized in the derivation. Harris states that this is possible because the r contains both a vocalic component and the coronal element.\(^\text{17}\)

---

\(^\text{17}\) Harris (1991), at which the criticisms in Broadbent (1991) were originally aimed, took the stipulation to affect the segment r rather than just the coronal component. Broadbent criticised this as being ad hoc. Arguing that the licensing stipulation needed to be tied to some deeper principle in order to avoid being ad hoc, it was pointed out that the segment r is, after all, the most vowel-like of consonants, and so, one might think, the least likely to be barred from membership in the rhyme.
Perhaps the main objection to Harris' account is the fact that it is tied to lexical incidence. To account for RP (system B), Harris claims that there is no floating r in the lexical entries of words such as shah. However, as he acknowledges, system B is really a variant of system C, i.e. that those speakers can and do have intrusive r.

Harris (1994) does not establish a non-arbitrary relationship between the vowels that occur before r and the appearance of the r. Since a floating r can potentially occur in the lexical entry of any word, there is no principled way to rule out seeing *[si:In]* for example. Consider in this regard bar a and see a:

(26)  

\[ \begin{array}{cccc}
 O & N & O & N \\
 x & x & x & x \\
 [b & a] & @] & [a] \\
 \text{bar a} & R \\
\end{array} \]  

\[ \begin{array}{cccc}
 O & N & O & N \\
 x & x & x & x \\
 [s & i] & @] & [a] \]  
\text{see a} & R \\
\end{array} \]

In (26a), the cold vowel is absorbed into the low A-headed vowel. Consequently we must assume that, in this case, @ has lost its headedness and has simply been absorbed.
into the cold vowel present in the segmental make-up of [a]. But the same account must surely apply in the case of [i], which likewise contains @ in its representation.

We might ask, how does Harris account for Wells' examples of English speakers of foreign languages and of foreign words incorporated into otherwise English sentences. I have repeated the examples in (28) for convenience.


Presumably the account would be that in the lexical entry for Degas, for example, there would be a floating r. In other words it is the highly productive nature of this process which Harris singularly fails to account for.

A distinct set of problematic data are the vowel reduction cases, where vowels which have reduced to schwa exhibit intrusive r, non-reduced versions do not.


Presumably the account here would be that yellow, for example, has two lexical entries, one with [o] and the other with schwa and r (or perhaps just the r).
In addition there are reported cases where children who have not fully mastered the a/an distinction produce an intrusive r after the indefinite article.

(30) oh look it's a horse [əˌβ]:s]

Finally, to return to the licensing requirement that R can only be licensed in an onset.

This stipulation runs into difficulty if an instance of R can be found which is not in an onset. Just such an instance occurs in nt sequences for example. Consider Harris' representation of dainty (Harris 1994: 69).

(31) O N A X X R O R N

In (31) the nasal in the rhyme is a coronal nasal. However, the claim is that R is licensed by the onset and that the rhymal nasal takes its licensed coronality from the onset. However, R is still being read in the rhyme i.e. in a position which is not supposed to be able to tolerate it. Consequently we have to assume that in a partial geminate structure of this kind the rhymal R is sufficiently licensed.
Counter evidence comes from varieties of English in which a coronal nasal precedes a glottal stop as in *dainty* [da:n?i] and *bent* [ben?] for example. These examples suggest that Harris' licensing stipulation is wrong. Harris (1994) tries to pre-empt this problem when, earlier in his book, he suggests that in terms of glottalling English is rather like the system described by Kahn (1976) for American English. Kahn argued that the left environment for glottalling was [-consonantal]. The point is that in a case such as *bent*, /t/ can only glottal if the nasal is incorporated into the nucleus forming a nasalised vowel. The work of Leslie (1983) and Broadbent (1985), however, shows that [+sonorant] segments form the left environment in many British glottalling varieties. Consequently a full [n] before a glottal stop is not only possible in e.g. *dainty*, it is also very common. Furthermore, instances such as *elk, elf, alp* etc. cannot form a partial geminate structure, therefore we must assume that the coronal element is not licensed in such items.

In contrast to the above accounts, Broadbent (1991) presents a naturalization of the r-sandhi problem. One in which the above data are in no way exceptional.

2.3. The Glide Formation Hypothesis.

The main proposal in Broadbent (1991) is that occurrences of so-called linking and intrusive r are manifestations of the same Glide Formation process which gives rise to the [j] in, for example, *see a* [si:ja] and also to the [w] in, for example, *do it* [du:wit] in
WY phonology. In WY phonology, when a vowel-final stem is followed by a vowel-initial morpheme a glide may optionally appear. For example:

(32)

| See a | [si:jo] | Be on | [bi:jon] |
| Sue on | [su:won] | Do it | [du:wit] |
| No I'm not | [no:wam not] | Do it | [du:wit] |
| With him | [wi:jim] | With my | [wi mi] |
| With him (wi' im) | [wi:jim] | With my (wi mi) |

The question arises, why does the glide appear only when the following morpheme begins with a vowel? (Contrast *with my* and *with him* above.) The assumption, in line with much recent theory, is that all vowel-initial words are preceded by an empty onset.

(33)

\[
\begin{array}{c}
\text{O} \\
\text{N} \\
\text{x} \\
\text{a}
\end{array}
\]

Notice firstly, that on this view of syllabification, there is no such thing as a syllable of the form N. ON is the basic irreducible syllable structure. If an empty onset position is present it provides a means of breaking up a sequence of vowels. Consider the WY examples *see him* [si:jim] vs *see my* [si: mi] in (34) and (35) below.

(34)

\[
\begin{array}{c}
\text{O} \\
\text{N} \\
\text{x} \\
\text{x} \\
\text{x} \\
\text{[s i m]}
\end{array}
\]

Following bracket erasure, we have:
Following bracket erasure, we have:

So the glide only appears when the following morpheme begins with a vowel; i.e. the glide only appears when there is a position for it to occupy. Arguably, then, the appearance of [j] and [w] provides evidence for the existence of empty onsets. On this view, the [j] glide fills an empty onset when the immediately preceding vowel is [i] and the [w] glide fills an empty onset when the immediately preceding vowel is [u]. It has been quite standard within contemporary phonology to consider [j] to be a glide.\(^{18}\) Given that a [j] glide appears after [i] and a [w] glide appears after [u], it seems strange that the appearance of the post-alveolar median approximant after the vowels [α: ɔ: ə] should be treated as a phenomenon wholly distinct from [j] and [w] glide formation. The natural assumption is that [j] appears after high vowels, [w] after high back vowels and [∫] after non-high vowels.

\(^{18}\) See Kahn (1976) for example.
Consider, once again, that linking and intrusive r in RP is recorded after the [- high] vowels [æː, ɔː, ə]. But what happens after other non-high vowels such as [e, ə, æ, a, ʌ, o], for example? RP does not help here, because in that system vowels such as [e, æ, a, ʌ, o] never occur in final position and [e] and [o] form diphthongs ([-eɪ]) and [oʊ] respectively). What Broadbent (1991) did was to show that when the WY vowels are considered, not all non-high vowels can precede the r-glide.

When we consider the vowels closest to RP's [æː, ɔː, ə]: [æː, ɔː, ə], we find that schwa, first of all, behaves as it does in RP. Examples such as fear of [fɪərə] and idea of, [aɪdə] and so on are found in both accents. [aː] is not a vowel in the WY system. The equivalent WY vowel is [aː], which is another non-high vowel.¹⁹ This vowel behaves in exactly the way that [aː] behaves in RP; so, for example far away is pronounced [faːrə] in WY and Shah of Persia is pronounced [ʃaːhəfərə]. [ɔː] is very interesting in WY phonology where it is often characterised as a lowered half-open vowel [ɔː].²⁰ Consider the classical examples of intrusive r such as law and order. Items such as law and raw in WY belong to two lexical sets. They can be pronounced with either [ɔ] or [ʊ]. The [ʊ] set is the older Northern set which is now merging with the [ɔ] set. If they are produced with long [ɔ], as in [lɔ] and [rɔ], then Glide Formation produces [ɹ]; but if, on the other hand, these items are pronounced [lʊ] and [rʊ], it is the labio-velar glide which is

---

¹⁹ Recall Wells' (1982) cockney examples how/ɹ are you and now/ɹ's done it! where the quality of the vowel preceding the /ɹ/ is given as [æː]. Such forms are also found in WY, however the vowel is [æː].

²⁰ In fact, the most accurate phonetic characterisation of this vowel may well turn out to be [ɔːː].
produced as a result of glide formation.\textsuperscript{21} It is also possible to find instances of intrusive r in WY following a short [o] as in:

(36) for a [fo:1a] was it [w3u:t] was my [w3mt]

WY differs from RP in that it has a number of non-high vowels which can occur in positions where they might trigger glide formation. There is one isolated instance of the vowel [e] giving rise to [j] in yes it is [je:t itz].\textsuperscript{22} But of greater importance is the occurrence of the vowels [e:] and [o:] in r-forming positions.\textsuperscript{23} If Wells (1982) is correct and the class of non-high vowels are indeed r-forming vowels, then we should expect [e] and [o] to give rise to [j]. Broadbent (1991), however, found that these vowels do not give rise to [j], and instead we find the following:

(37) pay me [pe: mi] pay as [pe:jaz]
go to [go: ta] going [go:win]
no time [no: taum] no I'm not [nowam not]

[o:] in the following examples may reduce to [a]. If [o:] remains and gliding occurs, then the result will be [w]. If, on the other hand, [o] reduces to [a], the result is [j]:

\textsuperscript{21} However, some members of this class, draw and saw, for example, have not yet become members of both sets they are only members of the older set: the [to] set and therefore they are found with the [w] glide rather than exhibiting both possibilities.

\textsuperscript{22} However, recall Wells' Norwich example in which intrusive r occurred after [e:] (see page 80 above).

\textsuperscript{23} West Yorkshire also has diphthongs [ei] and [ou]. Some of the words being used as [e:] and [o:] examples may belong to either set. However, the crucial point is that when the words are pronounced with the pure vowels the glides are [j] and [w]. Furthermore many words belong to one set only such as the yellow, piano cases.
As a result of data such as this we can no longer claim that [j] occurs after high front vowels, [w] after high back vowels and Wells' [- high] requirement for r-sandhi is not restrictive enough. Instead what we must say is that [j] and [w] occur after non-low tense vowels, and [i] occurs after a non-high lax trigger. Why then does [j] occur only after non-low tense front vowels, [w] only after non-low back tense vowels and [i] only after non-high lax vowels? Presumably, some aspect of the final vowel optionally spreads into the following empty onset position forming a glide. The question is what is spreading from the final vowel into the following empty onset? Before we consider this question notice that the proposal put forward in Broadbent (1991) makes a number of precise predictions about which glide can occur after which vowel. Clearly [i] can be ruled out in an example such as *seeing in a theoretically principled way. The properties of [i:] can only spread to form [j] as [i:] does not contain the properties necessary to give rise to [i] or [w]. Therefore *[si:riŋ] and *[si:wiŋ] are ruled out. In relation to linking and intrusive r, more particularly, such a characterisation of r-sandhi predicts that systems can have linking and intrusive r, but linking without intrusive r is not possible.

In order to consider the question of what spreads to form each of the three glides, we can begin with Broadbent's (1991) attempt to implement GF within Element Theory. First of all, consider the formation of [j] and [w] in WY phonology.

---

*Wells (1982) also notes that vowel reduction gives rise to r-sandhi.*

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2.3.1. **i-formation.**

[j] may optionally appear in examples such as *see a* [si:jə], *be a* [bi:jə] and *pay as* [pe:jəz]. In classical feature theory the features [-low, +tense, -back] would be the features spreading into the following empty onset. If we consider the elemental composition of the vowels [i] and [e] (given in (39) below), we find that they share a common head, namely the element I.

(39)  

```
  I   I
  A   @
  [e]  [i]
```

So we can say that when the element I spreads into a following empty onset the result is [j] as in (40).

(40)  

```
  O  N  O  N  O  N
  X  X  X  X  X  X  X  X  X  X  pay as
  p  I  >>>>>>  e  z
  A
```

2.3.2. **w-formation.**

[w] may optionally appear in examples such as *do it* [du:wɪt], *Sue on* [su:wən] and *going* [gəʊɪŋ]. In classical feature theory it would be the features [-low, +back, +tense] that are spreading to produce the labio-velar glide. What account is possible in
Element Theory? The elemental composition of the vowels which occur before the labiovelar glide reveal that the element \( U \) is the head of all vowels which occur before [w].

\[
\begin{array}{cc}
\text{(41)} & U & U \\
\text{@} & A \\
[u] & [o]
\end{array}
\]

So when the element \( U \) spreads into an empty onset the result is [w]. This process is illustrated in (42).

\[
\begin{array}{cccccccc}
\text{(42)} & O & N & O & N & O & N \\
\text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} \\
\text{n} & U \gggggg & a & m \\
\text{A}
\end{array}
\]

So far then, ET has successfully accounted for GF.

2.3.3. r-formation

r-formation considered in classical feature theory is the spreading of the features [- high, -tense]. In element theoretic terms, which element spreads to give rise to \( r \)? The elemental composition of the r-forming vowels considered above are displayed in (43).
On the basis of these representations there are two possibilities. First of all it could be the cold vowel which is spreading to form [i]. However, if we assume that it is indeed @ which spreads, then we have to be able to explain why it does not spread in examples like *going and *see it, since they also contain the cold vowel. The second possibility is that it might be A that is spreading to form [i]. All the examples of r-forming vowels contain the element A. However, in (43) above, A is an operator in some vowels and a head in others. Could it be that I and U spread when they are not in combination with A? This would mean that whenever A is present it would take precedence over I and U. However, the problem with this is cases such as *going and *pay as. Once again these examples turn out to be crucial determiners. We have already seen that in WY *pay as and *going give rise to [j] and [w] respectively. Clearly if A took precedence it would do so in examples such as these and we would obtain *[pərəz] pay as and *[ɡoːɪŋ] going, which are not possible forms in WY.

Broadbent (1991) concluded that the simplest assumption to make was that r-formation occurs when A is the head of the relevant segment. On this assumption r-formation is
like j- and w-formation in that the element which is the head of the segment may spread into a following empty onset. As in (44), for example:

(44) ONONONN

But notice that ET's attempt to implement GF has now come unstuck. Not only does the vowel representation fail to carve the vowels into the three divisions required by GF, but a problem arises when we consider A-spread.

When I, U and A spread from their positions as heads into a following empty onset, the question arises as to whether they remain heads or become operators. Since the claim is that an empty position contains cold vowels this is not a trivial question. It is particularly pertinent in the case of A. If the A-head spreads and remains a head then the outcome is [a]. However, if it becomes an operator, then the outcome is schwa.

(45)

It has often been assumed that in English there is a relationship between r and schwa (Firth 1948, Dobson 1957, Jones 1969, for example). Broadbent (1991) assumed that

\[25\] In some languages however, there is a connection between /r/ and /a/. I shall return to this point below.
I, U and A must therefore spread from head position into operator position. In the remainder of the thesis I shall consider a number of examples which illustrate the relationship between schwa and r. For now, we can demonstrate this relationship between schwa and r using a simple experiment suggested by Catford (1988). In a discussion on the relationship between glides and their cognate vowels, Catford (1988) describes 3 stages of vowel production:

1. the on-glide phase, during which the articulators move into position. 2. the hold phase, during which the position is maintained and 3. the off-glide phase, when the articulators move away from that position. Catford argues that the difference between /j/ and /i/, and /w/ and /u/ is that /j/ is an 'ultra-short /I/' and /w/ an 'ultra-short /u/'. In other words, /j/ and /w/ lack a hold phase. If /j/ is prolonged, which effectively inserts the hold phase, then it reverts to its cognate vowel [i]. Similarly if /w/ is prolonged it reverts to [u].

Therefore, if the hold phase is inserted into the r-glide, we should be able to determine which vowel is the cognate of r: schwa or [a]. If we apply this to [j], we find that the result is an r-coloured schwa. Lower the blade whilst maintaining the tongue body position and the result is very definitely a schwa. (I shall consider the relationship between glides and vowels in more detail in chapter 3.)

The point so far is that if linking and intrusive r are characterised as GF, then arguably we have a non-arbitrary, explanatory account. It is non-arbitrary because the appearance of r is directly related to the context in which it occurs. On the view that it is some aspect of the final vowel which spreads into an empty onset we can demonstrate a relationship between the structural change and the conditioning context. Furthermore, this
explanation is established for a range of phenomena and not just [1], so the explanation is established at an appropriate level of generality.

Broadbent (1991), noted that further work needed to be carried out on the representation and then adopted the view that schwa and r are related. Broadbent (1991) concluded that A spreads when it is the head of a vowel structure. But this requires that all mid-low and low vowels are A headed. In this way the r-glide can be tied in a non-arbitrary way to the mid-low vowels.

Given that the ET approach cannot implement GF, I shall consider some alternatives in an attempt to find one which will facilitate the expression of this simple account of r-sandhi in an equally simple fashion. Having determined which representation best accounts for GF, I shall begin consideration of another issue raised by Broadbent (1991): if schwa in an onset gives rise to [1], where does the coronality comes from?

2.4. Glide Formation and Feature Geometry

The claim that r-sandhi is a form of Glide Formation, whereby some aspect of the final vowel spreads into a following empty onset, is a simple proposal. It is so simple that it should be easily expressible in Feature Geometry and in this section I shall consider a feature geometric account of Glide Formation (GF). In Broadbent (1991) the question was which elements spread to form the glides [j], [w] and [1]. In Feature Geometry, the question is not quite so straightforward.
Clements (1985) argued that the point of the hierarchical organization of features is to build into the representation a means of explaining why certain features never pattern with other features. The way in which features are hierarchically organised predicts three types of spreading: root node spread (giving rise to total assimilation), class node spread resulting in partial assimilation (as in Place assimilation, for example) and single feature spread. Although partial constituent spread is not completely ruled out, it is to be avoided, since it would severely weaken the theory precisely because it undermines the basic insight of hierarchical organisation. Furthermore, because the three forms of spreading fall out from the representation they should correspond to unmarked processes, whereas partial constituent spread, being highly marked, should be rare and preferably non-existent. (See Clements 1985 and Hayes 1990.) On the basis of this we would expect the simple process of Glide Formation to correspond to an unmarked spreading type. The most likely possibilities being single feature, articulator or place node spread. When we consider these possibilities we find that, although GF is expressible as single feature spread, this does not turn out to be as straightforward as we might expect.

2.4.1. **Place Node, Articulator Node or Single Feature Spread?**

To begin our exploration of what aspect of the final vowel spreads, consider the possibility that it is the Place Node that spreads. If the place node spreads into the following empty onset, then all the features which it dominates will spread with it. On the assumption that the features [high], [low], [back], [round] and [ATR] have all been filled in prior to GF, consider what would happen if the place node spread from the vowels [i] and [e] (the representations for [i] and [e] are given in (46) below). When we
consider the representation, following Sagey (1986), for these two vowels, both of which give rise to [j], it becomes clear that it cannot be the place node which is spreading during GF.

(46)

```
PLACE
  /   
[i]  [e]
  /   
DOR  RAD
  /   
[-high] [-low] [-back] [+ATR]
```

The point is that, in one case, we have a high front vowel spreading and in the other case we have a non-high front vowel spreading and yet in both cases the result is a high segment. In other words, it would appear that only part of the information is relevant and that that part must be a property which both vowels share in common.

If we assume that the vowels are not fully specified at the point at which GF applies, we may ask whether this will enable GF to be expressed as a form of place node spread? In order to answer this question, consider the feature breakdown of the WY vowels that give rise to the r-glide⁶:

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⁶ There are other vowels which give rise to the r-glide in WY but they are all derivatives of these four vowels. So [ɜ:] = [a] and the various diphthongs end in schwa.
This group of vowels share two properties: [-high] and [-ATR]. (I shall consider and reject the possibility that ATR plays a part in GF below.) For the moment, we can assume that the feature which spreads to give rise to the r-glide is [-high]. On the assumption that schwa is the unmarked, underspecified vowel in English and, furthermore, given that schwa is one of the vowels which gives rise to the r-glide, the property which is spreading from the schwa must have been filled in prior to GF. If [-high] has been filled in for [e] and if [+high] was already present in vowels such as [i], then GF cannot be achieved by place node spread because the problem of why a high and a nonhigh vowel should both give rise to a high glide remains unresolved. Notice that GF cannot be expressed as articulator node spread, for exactly the same reason: if DORSAL spreads from [i] or [e] it would still take with it [+high] in one case and [-high] in the other.

This leaves the option, single feature spread, as the sole means of expressing GF within feature geometry. The question is, though, which feature spreads from which group of vowels? First of all, notice that it cannot be the feature ATR which is responsible for GF not least because ATR only gives us a two way divide between the vowels. It divides the mid-high and high vowels from the mid-low and low vowels, but notice that it cannot be this feature that spreads because two glides are possible and in order to derive the split between the front and back high glides we would have to say that GF was a form of non-
constituent spread in that we would be spreading RAD and [-back] to get [j], and RAD to get [w], or, RAD to get [j] and RAD with [+round] (or RAD with [+back]) in order to get [w]. So, there are good grounds to rule out ATR as the source of glide formation.

If ATR is not a possibility then the r-forming vowels only share the feature [-high] in common and so it must be this feature that spreads.

(49) \[
\begin{array}{c}
\text{PLACE} \\
\text{DOR} \\
\text{[+low]} \quad \text{[-high]} \\
\end{array} \quad \begin{array}{c}
\text{PLACE} \\
\text{(DOR)} \\
\end{array}
\]

[-high] spread has to be conditional on [-ATR] since if [-high] can spread whenever it is present in a vowel this predicts r after [e] and [o].

As for w-formation, there are two possibilities, [+back] or [+round]. Although both would do equally well, I shall assume that it is [+round] that spreads. This would derive [w] from [u] and [o]. But notice that we need to stipulate spread [+round] if [+ATR]. So GF is not straightforward constituent spread due to the condition imposed upon feature spread.\footnote{An interesting question arises here because, although GF can be made to work in FG, in order to work, crucial reference is made to two constituents. The question is, if non-constituent spread is undesirable in a spreading process in FG, is it undesirable to refer to non-constituents?}

\[108\]
If we turn now to the vowels [i] and [e], we could argue that [-back] spreads from the j-forming vowels, but once again we have to stipulate that, in order for [-back] to spread, the vowel must be [+ATR], as in (51). So, once again spreading relies on information from two different constituents, in that the presence of one constituent is a necessary condition for the spread of another.

One consequence of this stipulation is that the vowels [i] and [u] would be excluded as possible high glide formers, which is not a desirable result. Arguably, this stipulation masks the true nature of the property which spreads. The feature geometry account relies on the feature ATR because there is no built-in mechanism which explains why it is that [-back] spreads from certain vowels, [-high] spreads from a distinct set of vowels and [+round] from a third set. If feature geometry made use of the notion of head-operator

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28 Indeed this is also true of ET where I and U are no longer considered to be the heads of [I] and [U] respectively. [I] and [U] are considered @ headed. See Harris (1994).

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relations (or dominance and dependence) then GF would fall out from the representation, since it is precisely this property which is lacking from the feature geometric representation. Mester (1986) considers dependency relations between features, but he is concerned with one tier being dependent on a distinct tier. He argues that [anterior], for example, is universally dependent on the coronal tier. This kind of dependency is quite different from that employed in ET and DP, as Mester himself notes in a footnote. In fact it makes no sense to talk of asymmetrical relations between individual features.

We have considered a traditional feature geometric account in the first instance, to determine if this provides the best representation which will allow us to express the simple process of GF. We have seen that FG can account for GF, but not in the straightforward way predicted by restrictions on spreading. And the Feature Geometry considered did not provide a better representation of the mid-low and low vowels than ET did. Our main concern is to find a segmental representation which groups mid-low and low vowels in such a way that the one property shared by the r-forming group of vowels can form a schwa in an onset. Perhaps the best way to pursue this search is to consider the way in which schwa itself should be represented. In the following section I propose to look in more detail at the way in which schwa is represented in Element Theory, first of all, and then in Dependency Phonology.
2.5. The structure of Schwa in Element Theory and Dependency Phonology

2.5.1. Element Theory

There is a difference of opinion amongst Element Theorists regarding the representation of schwa. Kaye, for example, assumes that there is no such thing and that the segment described as schwa is in fact [i]. Harris, on the other hand, assumes that the cold vowel moves around in phonetic space, and that, in British English, the cold vowel corresponds to [a]. The representation in (52) below, in which the cold vowel is the head and the A element is the operator, is frequently used to denote schwa (Broadbent 1991, for example).

\[(52) \quad \begin{array}{c}
\circ \\
\end{array}
\]

A

Glide Formation suggests that this structure is incorrect. In addition, this structure seems an unlikely candidate for schwa because it is a complex structure and schwa is the reduction vowel in a number of languages including English\(^{29}\). It seems far more likely that a vowel will reduce to a single particle such as the cold vowel rather than to a complex structure such as this.

However, the equation of schwa with the cold vowel does not fare any better. First of all, if one adopts the GF account of r-sandhi, then one cannot accept the equation of schwa with the cold vowel, because the only element which schwa would have in common with

\(^{29}\) Indeed, examples of vowel reduction feeding r-sandhi have been considered above.
the other mid-low and low vowels, would be the cold vowel and I have already argued that it cannot be the cold vowel which is spreading to give rise to [a], because the cold vowel is present in all vowel representations. Secondly, if schwa is the cold vowel, then there appears to be a mis-match between the interpretation of the cold vowel in vowels as opposed to consonants, i.e. the cold vowel functions as a low-mid vowel, and yet in consonants it functions as the velar instruction and hence could have no possible connection with [ə]. If we pursue the role of the cold vowel in consonantal representation we find that the existence of the cold vowel can be called into question. The presence of the cold vowel in an empty onset makes a number of predictions as to the nature of onset fillers. These predictions turn out to be false. First of all, there are a number of phenomena concerning velar and velarized segments which are not accounted for in an insightful way if the cold vowel is assumed to be the velar element.

In section (2.3.3), I stated that within ET the creation of a skeletal point guarantees the presence of the cold vowel. In Element Theory, the cold vowel represents the absence of any salient property. But the cold vowel does have a phonetic interpretation. Suppose that an empty onset is spelled out, what will the resulting consonant be? Since the cold vowel is interpreted as velarity and given that we might expect the cold vowel to be the only element in an empty onset, we should expect a velar glide, or, at the very least, some other kind of velar consonant. But this is not borne out. In language after language the onset filling consonant is either [ʔ], [h] or [t]. English and German, for example, both have [ʔ] as the onset filler. One of the basic aims of contemporary phonological theory is

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30 There is a very simple way around this mismatch, which is to assume that the cold vowel is not the velar element.
to extract the explanation for a particular phenomenon from the representation itself wherever possible. KLV-ET claims that things do not simply appear, they must be present in the context. Given this, where has the [?] come from? One possibility is that glottal stop could be the 'cold consonant'. On closer inspection, however, this turns out to be impossible. An element can be described as ‘cold’ iff it has no salient property. If the glottal element was ‘cold’, then, it would only have an effect on the outcome of a fusion operation if it was the head of the fusing pair. Consider in this regard the implications of a cold consonant for velar stops. Velarity is represented by a cold vowel head. It would be impossible to have a velar stop if one adopted a cold consonant together with a cold vowel since both the glottal element and the cold vowel could not simultaneously be the head of a velar stop. But notice that it is the existence of the cold vowel that blocks the possibility of a cold consonant. So the prediction made by the putative presence of the cold vowel in the empty onset is not borne out and this could well call the existence of the cold vowel itself into question.

A second problem arises when we consider the relationship between labials and velars and between velars and round vowels. In Chapter 1, we considered a number of arguments claiming that labials and velars are related. For example, velar and labial fricatives regularly interchange as in Middle English laugh [x] changing to [f] and so on (I have repeated the example from chapter 1 in (53) below for convenience).

(53)
\[
\begin{align*}
x & \rightarrow f & \text{middle English} & \text{e.g. laugh, cough, rough (Nieuwint 1981)} \\
\gamma & \rightarrow u & \text{" "} & \text{e.g. plough, bough (Jones 1990)} \\
f & \rightarrow x & \text{Celtic} & \text{e.g. secht (seven)} \\
x & \rightarrow f & \text{Dutch} & \text{after} \rightarrow \text{achter} \\
x & \rightarrow f & \text{Slovenian} & \text{e.g. kozuch } \rightarrow \text{ kozuf,}
\end{align*}
\]
Consider the element representations of labial and velar voiceless obstruents.

(54)  

\[ \begin{array}{cccc} 
\text{\textit{f}} & \text{\textit{x}} & \text{\textit{k}} & \text{\textit{x}} \\
\text{?} & \text{?} & \text@@ & \text{?} \\
\text{U} & \text{U} & \text@@ & \text@@ \\
\text{h} & \text{h} & \text{h} & \text{h} \\
\end{array} \]

If we assume the representations in (54), then the change from \([x]\) to \([f]\) in Middle English, for example, involves two stages. First of all, the head of the segment has changed from \(\text{\textit{x}}\) to \(\text{\textit{h}}\) and secondly a \(\text{U}\) element has been added to the representation. So, element theory is able to describe the change, but has very little to offer by way of an explanation. Arguably, the source of the failure to connect velars with labials is a direct consequence of the choice of the cold vowel as the velar element. Other particle theorists assume that the \(\text{U}\) element is common to both labials and velars. (Anderson and Ewen (1987: 237), for example).

In chapter 1 we noted that certain varieties of English, Standard Southern English and London English for example, /l/ has two realizations depending upon its position in the
word. Prevocally /I/ has a clear articulation as in (55), for example. Whereas postvocally, /I/ is velarised, as in (56), for example.\(^1\)

\[
\begin{align*}
\text{(55)} & \\
\text{leaf} & [\text{li:f}] \\
\text{yellow} & [\text{jelau}] \\
\text{(56)} & \\
\text{mill} & [\text{mil}] \\
\text{belt} & [\text{belt}] \\
\text{table} & [\text{teibi}]
\end{align*}
\]

ET assumes the structure given in (57) for /I/.

\[
\begin{array}{c}
\text{(57)} \\
R \\
? \\
\end{array}
\]

This structure supposes the existence of cold vowels (which for reasons of simplicity have been left out) on tiers where other elements are absent. Element theorists could argue that I-velarisation simply involves a change in headship. So, instead of a glottal-head a velarised-I will have the @ as its head.\(^2\) However, on the assumption that I-velarisation involves a change from the structure in (58a) to that in (58b), how can we

\(^1\) I have not addressed the environment in which I velarises/vocalises in detail since this is not directly relevant to the present discussion. However, in order to provide a full account of these two processes the representation of /I/ should be studied in the conditioning environments.

\(^2\) Harris describes @ as a 'dark' median approximant, and he contrasts it with I a clear median approximant.

This suggests that [I] would have a @ head.
account for the fact that velarised-l regularly vocalises to a round vowel in London and Southeastern accents?

Wells (1982) claims that the result of l-vocalization is usually a [ʊ] although it may also be a [o]. He notes that on occasion l-vocalises to a nonround vowel: [y], but that this third realisation is extremely rare. Where has this rounding come from? If /l/ has lenited leaving only a cold vowel, we might expect the result to be [i]? If the cold vowel is the velar element, then we would expect [ut] to be the usual result of vocalisation not [ʊ].

If we assume that the element which is responsible for velar place and which results in the velarization of segments is U, then we can account not only for the labial and velar connection, but also for vocalisation of velarised l to [ʊ].

---

33 There is a potential line of defence which an element theorist might take here: the cold vowel is the head of a velarized l and when velarized l vocalises the result is a [i], which receives rounding by phonetic default, because high, back vowels are round in the unmarked case. This argument is easily countered, however. There are a number of examples where velarised-l has a rounding effect on a neighbouring vowel. One example is given in Lass (1984). Lass gives an example from Austrian German in which the front vowels [i] and [ɛ] rounded to [y] and [ʊ] respectively when they occur immediately before velarized l. This is very interesting from the point of view of the current discussion. If the cold vowel spread into a preceding /i/ or /ɛ/, it would have no effect on the outcome whatsoever. If it was possible to add [round] by phonetic default, then we would expect it to apply to all vowels, since all vowels contain the cold vowel.
So the whole concept of the cold vowel looks highly dubious not only because it appears to be the root cause of the inability to implement the GF account in an insightful way using ET, but also because its use in consonantal representation results in a failure to establish a non-arbitrary explanation for a number of consonantal phenomena. Additional support for the claim that the representation which we shall ultimately choose should forgo a central component such as the cold vowel comes from Dependency Phonology.

2.5.2. The Representation of Schwa in Dependency Phonology

The Dependency Phonologists, Anderson and Ewen (1987), propose two structures for schwa. First of all, they propose a component lal which has the articulatory gloss ‘centrality’ and which has the same status as the three basic vowel components lil, lul and lal. This centrality component is used to represent schwa in systems which do not reduce vowels to schwa. An alternative DP representation is proposed for systems which do reduce vowels. In such systems, schwa is represented not by lal, but by the categorial component lVI. Since English is a vowel reduction system, the claim would be that schwa is represented by lVI. This component belongs to the phonatory sub-gesture. The phonatory sub-gesture (see chapter 1) makes use of two components: {lVI} or ‘relatively periodic’ and {lCl} or ‘periodic energy reduction.’ (Anderson and Ewen 1987: 151). The idea is that V and C stand at opposite poles of the sonorancy scale and that as V is increasingly affected by C so the segment becomes increasingly obstruent. For example, when V dominates C {lV→Cl}, the result is a vowel like consonant i.e. a sonorant. Since there are degrees of sonorance among consonants, {lV→V:Cl} indicates that there is a
greater degree of V-ness then C-ness. Therefore, this is the representation for a liquid.\textsuperscript{34}

The representation \{IV:Cl\}, symbolises a voiceless fricative, \{|C→VI|\} a voiced stop and \{|Cl|\} the most consonantal of consonants: a voiceless stop.

If we adopt the IV\{I\} representation of schwa, we lose the account of r-sandhi as glide formation, because we are faced with one of the objections that caused us to abandon the idea that the cold vowel might be spreading to give rise to [a], namely that it is present in all vowels. One could try to argue that, despite being a vowel-reducing language, English also represents schwa with the centrality component, but this does not work because the only segment that would contain schwa would be schwa itself (or schwa and [\textipa{a}] in SSE, for example). So DP does not provide a more insightful representation of the low-mid vowel /æ/.

Notice that not only does the l\{a\} component fail to provide an adequate representation for schwa, but if we focus more closely on the implications of adopting a fourth basic prime for our ability to account for vowel systems more generally, then we find that the introduction of a fourth basic component, carries with it a number of undesirable consequences. The three basic vowel components, common to all varieties of element theory (van der Hulst 1988; 1989, KLV 1985, Schane 1984, Anderson and Ewen 1987) do not constitute a random selection. They correspond directly to the vowels which

\textsuperscript{34} Notice that there is a sense in which we have a stacking of components i.e. V dominates another structure which is composed of V and C.
children acquire first and to the canonical three vowel system. If $lai$ is a prime as basic as $I, U,$ and $A,$ then we might expect this fact to be reflected in vowel systems.

The simplest type of vowel system is one in which there are three vowels which correspond more or less directly to $/i/, /u/ \text{ and } /a/,$ for example:

\begin{align*}
\text{(59) Moroccan Arabic } & \quad \text{Cree } \\
\begin{array}{cc}
& \\
\text{i} & \text{u} \\
\text{a} & \text{ä} \\
\end{array}
\end{align*}

Anderson and Ewen (1987) provide two interesting examples of three vowel systems in which the third vowel is a central vowel, rather than the usual low vowel. The Gadsup system is of particular interest.

\begin{align*}
\text{(60) Gadsup } & \quad \text{Quechua } \\
\begin{array}{ccc}
& & \\
\text{i} & \text{u} & \\
\text{3} & \text{u} & \text{v} \\
\end{array}
\end{align*}

Anderson and Ewen's discussion suggests that there are two ways of representing the Gadsup system. First of all, one can assume that the central vowel $[3]$ is a form of $/a/.$ (An approach taken by Crothers 1978 and Schane 1984, for example.) If one adopts this suggestion, then the Gadsup and Quechua systems are completely regular in that they only employs the three basic vowel components, but the precise specification of the vowel component is system-specific. In Gadsup and Quechua, therefore, $\{lil\}$ stands for $/i/ \text{ and } /u/,$ $\{lul\}$ for $[u] \text{ and } [ου]$ and $\{lal\}$ for $[3] \text{ and } [v]$ respectively.
The alternative approach, discussed by Anderson and Ewen, is to assume that systems such as Gadsup and Quechua have opted to use three of the four basic vowel components: lil, lul and lal. Although this would allow all the systems mentioned above to be accounted for, it is not as straightforward as an approach which only recognises three components. Anderson and Ewen have to stipulate that three vowel systems may be represented by one of two combinations of three of the four basic primes: lil, lul, lal or, lil, lul and lal. But this appears to be nothing other than an ad hoc stipulation and indeed the question arises, do we ever find three vowel systems which exhibit other combinations? For example, /i/, /o/ and /a/, or /u/, /a/ and /a/.

A number of languages do occur which have a four vowel system of the form given in (61). For example, Margi, Pashto and Kwakiutl (Crothers 1978).

(61)  
\begin{align*}
\text{i} & \quad \text{u} \\
\text{a} & \quad \text{a}
\end{align*}

We could argue that this supports Anderson and Ewen's claim that there are four basic vowel components. However, if we do so then we have to explain the problem, which I have outlined above. Usually, four vowel systems are regarded as being more complex than three vowel systems, not simpler. They include basic components and complexes of two components as in (62) for example.

(62) Campa  
\begin{align*}
\text{i} & \quad \text{e} \quad \text{a} \quad \text{o} \\
\{i\} & \quad \{i,a\} \quad \{a\} \quad \{u,a\} \text{ or } \{u\}
\end{align*}

Moxo  
\begin{align*}
\text{i} & \quad \text{e} \quad \text{a} \quad \text{u} \\
\{i\} & \quad \{i,a\} \quad \{a\} \quad \{u\}
\end{align*}
It seems, then, that if one adopts four basic primes, the account of three vowel systems becomes unnecessarily complicated. Furthermore, it is not only DP which complicates the approach to three vowel systems such as Gadsup, ET does so too. If the representation for [3] in a ET account of Gadsup was the cold vowel, then ET would be subject to the same criticism levelled at DP. Alternatively, KLV-ET could represent [3] as (A.V), i.e. the representation given in (52) above for schwa in English. But given this representation, Gadsup becomes a highly marked system. In other words, the Gadsup system is a problematic system for both DP and ET.

On the basis of the problems encountered by particle theories which posit a central particle, it would appear that the solution to our representational difficulties does not lie in a theory which posits a 'central' particle. It is arguably the case that it is the presence of this element that lies at the heart of our inability to find an appropriate representation of schwa i.e. one that relates it to the mid-low and low vowels more generally. Schane's particle phonology unlike ET and DP does not make use of a centrality component.

2.6. Particle Phonology

PP differs from ET and DP in a number of respects. But of primary interest to us is the potential way in which schwa, and the mid low and low vowels can be represented. In

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35 The cold vowel of ET is equivalent to neither the centrality component nor the categorial gesture. It does however have properties in common with both. @ like {lal} is regarded as a basic prime (a point I shall return to below) and both are concerned with central vowels. @ has the pervasiveness of the categorial gesture, but there is a sense in which @ is more pervasive than {IVI} in that {IVI} is present in all segments except voiceless stops, whereas @ is present in all segments.
We saw in Chapter 1 that the exact interpretation of the particles is system-dependent. Recall from Chapter 1 (Section 1.1.1.2) that Schane (1984:132) states that

"The central series of vowels requires special comment. A single occurrence of the aperture particle stands for [a] in those languages with only one central vowel. For languages with both [a] and [a] it is the former that is represented by one occurrence of the aperture particle, whereas the latter would have two. Hence the interpretation of particles (e.g., whether a represents [a] or [a]) is system-dependent."

This strongly suggests that in a system with /a/ and /a/, schwa is represented by A and /a/ by AA (this is the interpretation assumed by Kaze 1991). Following this line of reasoning, in a system such as RP with /o/, /a/ and /a/, these vowels will have the following representations:

\[
\begin{array}{c|c|c|c|c|c}
/a/ & A & /a/ & A & /a/ & A \\
\hline
A & A & A & A
\end{array}
\]

Additional support for this interpretation comes from the division of the vowels according to which glides they give rise to. If schwa in English is characterised in line with Schane's comments on central vowels, then we can achieve a straightforward pairing of schwa with A.\(^{36,37}\)

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\(^{36}\) Since Kaze (1991) and Broadbent (1992, 1994a, b) Schane has published his 1995 paper in which he comments, for the first time, on schwa. In footnote 1, Schane comments that in "Languages with [a] and no [i] have the schwa vowel as the null-particle set." (Schane 1995:605). However in Footnote 19 (page 607) he comments "For languages with [a a] (but without [i]) the schwa vowel will generally be without any aperture particle." The use of the word "generally" suggests that Schwa may be represented by A. The evidence discussed in this chapter suggests that English is such a system.

\(^{37}\) At first glance Schane's reference to the null-particle set suggests that PP also has four basic primes and is therefore subject to the same criticisms levelled against DP and ET. However, this so-called null set does not have the same role in the system. On Schane's approach it represents high central vowels.
In the light of Schane's representation of central vowels, consider the Gadsup and Quechua systems once again.

(64) Gadsup

\[
\begin{array}{cccc}
/i/ & I & U & /u/ \\
/æ/ & A
\end{array}
\]

Quechua

\[
\begin{array}{cccc}
/i/ & I & U & /u/ \\
/æ/ & A
\end{array}
\]

Given Schane's proposals for central vowels, Gadsup's central vowel [æ] and Quechua's [u] will both be represented by a single occurrence of A. On this system-dependent approach, then, the problem encountered using Dependency phonology and ET of selecting from the four basic vowel components a three vowel system has become a non-issue. Furthermore, four vowel systems such as Margi, Pashto and Kwakiutl, which have two central vowels, can be accounted for without assuming a fourth prime.

(65) 

\[
\begin{array}{cccc}
/i/ & I & U \\
æ & A \\
æ & A \\
\end{array}
\]

The two central vowels will be accounted for with A [æ] and AA for [æ]. If we consider WY, which has one central vowel: schwa, the WY vowel system will be represented in PP as follows:

---

only; it has no combinatorial role with A I U and it is described as highly marked. This latter point makes his comments on schwa all the more bizarre since schwa is a highly unmarked vowel.
If schwa were to be taken as null, then this system would permit the tonality particles I and U to occur in combination or in isolation, whereas A would only occur in combination. This goes against the idea that vowel systems employ the three basic primes and that any combinations build in markedness.

In his (1995) paper Schane comments on the nature of particle combinations in footnote 1 (page 605). He states

"Within a set there is no ordering of particles. Hence {ia} and {ai} both represent [e]. In dependency phonology..., which also makes use of unary vowel components, hierarchic ordering plays a role: iil dominating ial representing a higher mid vowel; ial dominating iil, a lower mid. In particle phonology, vowels of lower height have additional occurrences of the iil particle."

Although Schane insists that particles do not enter into "hierarchic ordering" when his system is compared with DP, or ET for that matter, it becomes clear that in a seven vowel system with [e] and [ɛ] {ia} indicates a dominance of I and {iaa} a dominance of A. In other words these two representations can be shown to be equivalent to (li→al) and (la→il) respectively. In chapter 4, I shall return to the question of expressing asymmetry in Particle Phonology in more detail. For now, we can assume that when two or more particles combine, A will be the dominant force in that combination provided it is

38 Note that /ɛ/ and /u/ have the same particle representation. Schane (1984b) argues that support for this representation comes from historical lengthening processes where /u/ lengthened to /ɛ/.
represented more than once in the segment. Given this assumption, we have a representation which captures the fact that the low-mid and low vowels are A-headed. Furthermore, schwa can be equated with A and so, when the head of the mid-low or low vowels spreads into a following empty onset the result will be a schwa. A spreading is now compatible to I spreading and U spreading. So, PP can implement GF in a straightforward way and it does so because it provides a better vowel representation than that assumed in Broadbent (1991).  

2.7. Summary

In this chapter we have considered a new account of linking and intrusive r in English, and this was first proposed in Broadbent (1991). The main idea is that r-sandhi is a manifestation of Glide Formation, a process which occurs as a hiatus breaker. We have considered the implementation of GF in three theories: ET, FG and PP. GF provides a naturalization of the r-sandhi problem. It is an extremely simple proposal and this should be reflected in any adequate theory of segmental representation. ET fails to implement GF because the representation of vowels is such that the vowels can not be correctly divided into the three glide-forming classes. Furthermore, ET was unable to establish a relationship between /r/ and what is widely assumed to be its cognate vowel schwa. FG fared much better. In section 2.4 I argued that it was possible to implement GF in FG. However, the process was not as simple as FG restrictions on spreading would lead us to expect. Since the feature approach did not provide a suitable representation for the glide

125

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39 Although schwa alternates with r in English, it is [a] that is related to r in many other languages. Given the adoption of Schane's particle phonology and in particular his use of A we are able to account for this variation among languages.
forming vowels, I returned to particle theories and considered the representation of schwa in ET and DP. I argued that the problem with the representation of vowels using this type of approach was the presence of a centrality particle and that this lay at the heart of our inability to express GF using ET or DP. In section 2.6, we saw that Schane’s Particle Phonology (PP), which lacks a centrality component, was able to equate schwa with A and capture the mid-low and low vowels as a class so that GF can therefore be straightforwardly expressed as the spread of I, U, A heads.

2.8. Development

The question now arises: if schwa in an onset gives rise to r, where does the coronality come from? In Broadbent (1991), I assumed, following Avery and Rice (1989), that coronality was assigned by phonetic default rule. However, default coronal is assigned to ‘placeless’ segments and a schwa is specified for place. The FG account of GF demonstrates this point very clearly. In section 2.4 we saw that [- high] was assumed to be the terminal feature which spread to give rise to r. However, if the terminal feature [-high] spreads, then a dorsal node, place node and so on need to be interpolated. This means that when [- high] spreads to form an r-glide the resulting segment will be a dorsal segment. Therefore, why should coronal be added to a segment which is already specified Dorsal? I shall consider the answer to this question in Chapter 3.
CHAPTER 3

In chapter 2 a connection was suggested between the post-alveolar median approximant [j] and schwa, represented in particle terms by A. In this chapter, I intend to explore this connection and consider whether this is simply an isolated incident or whether A can be related to the class of coronals as a whole. In section 3.1, I shall set out to demonstrate that a connection can be established between A and a number of coronal consonants. In particular, I shall attempt to demonstrate a connection between schwa and 1) consonantal /r/ and 2) /l/, and between /r/ and 1) /s/, /z/ and 2) /t/, /d/. Once the case for a A-coronal connection has been put forward, I shall take up the question posed at the end of chapter 2, namely, if A (the representation for schwa in English) in an onset gives rise to /r/, where does the coronality come from? In section 3.2, I will consider the way in which coronality is derived from A. In section 3.3, I will consider a number of alternative particle representations of coronal in order to determine whether an approach which equates coronal with A is in any way superior to those already available.

3.1. A as the coronal representative: the evidence

In all particle theories, A is equated with lowering and, in addition, Schane (1984, 1987 and 1990) equates A with laxing. We have seen that when A occurs in combination with another particle such as I, for example, the effect of A on I is to lower it. If A has a lowering/laxing effect, and if A represents coronal, then we might expect to find
coronals causing vowel lowering/laxing. In what follows, I will argue that this is exactly what we do find.

3.1.1. r-related vowel lowering/laxing

There are cases of /r/ causing neighbouring vowels to lower, where /r/ is a true consonant ([r], [ɾ] etc). Lindau (1985), in a discussion of the properties which r-sounds share in common, notes that uvular r in Danish and French provokes vowel lowering effects. But Lindau comments that it is not just uvular r’s which have this effect, apical r’s do so too. She claims that in standard Southern Swedish apical r causes vowel lowering. This is illustrated below.

(1)

| 'att dö'    | [dɔ:]    | 'to die' |
| 'jag dör'  | [dœ:r]   | 'I die'  |
| 'hö'       | [hœ:]    | 'hay'    |
| 'hör'      | [hœ:r]   | 'listen!'|

Hume (1994: 128) provides the example of Acadian French. The type of r exhibited in this variety is apical and it triggers the lowering of /ɛ/ as in [sɛɾtɛ] ~ [sartɛ] certain, [pɛɾʃ] ~ [parʃ] perch.

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1 In Chapter 4, I will consider a representation of uvular r which will enable us to explain the cause of vowel lowering effects.

2 Lindau does not provide any examples of apical r promoting lowering.

3 I am grateful to Gunnel Melchers (Stockholm University) for supplying and discussing this data.

In addition to Swedish and Acadian French, there are cases of vowel 'lowering/laxing' caused by apical r to be found in English. Jones (1989) gives the example of fifteenth century vowel lowering which was particularly common in Northern dialects whereby [ɛ] was lowered to [a] when it occurred before [r]. (Data from Jones 1989: 247.)

\[(2)\]

<table>
<thead>
<tr>
<th>13th-century ME</th>
<th>15th-century ME</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;sergeaunt&gt;</td>
<td>&lt;sargeaunt&gt;</td>
</tr>
<tr>
<td>&lt;sergeant&gt;</td>
<td>&lt;sargeaunt&gt;</td>
</tr>
<tr>
<td>&lt;serpent&gt;</td>
<td>&lt;sarpent&gt;</td>
</tr>
<tr>
<td>&lt;sermon&gt;</td>
<td>&lt;sarmon&gt;</td>
</tr>
<tr>
<td>&lt;sarmoun&gt;</td>
<td></td>
</tr>
<tr>
<td>&lt;servaunt&gt;</td>
<td>&lt;sarvaunt&gt;</td>
</tr>
<tr>
<td>&lt;serwand&gt;</td>
<td></td>
</tr>
<tr>
<td>&lt;certain&gt;</td>
<td>&lt;sartan&gt;</td>
</tr>
<tr>
<td>&lt;certen&gt;</td>
<td>&lt;sartayn&gt;</td>
</tr>
<tr>
<td>&lt;ferthing&gt;</td>
<td>&lt;farthing&gt;</td>
</tr>
<tr>
<td>&lt;ferding&gt;</td>
<td>&lt;farding&gt;</td>
</tr>
<tr>
<td>&lt;herte&gt;</td>
<td>&lt;hart&gt;</td>
</tr>
<tr>
<td>&lt;fer&gt;</td>
<td>&lt;farre&gt;</td>
</tr>
</tbody>
</table>

If A is assumed to be present in [r] as the place particle, then the cause of vowel lowering would be present in the representation. The claim is then that it was the coronal representative A which caused [ɛ] to lower to [a].

However, the example from English which I propose to consider in more detail concerns the origin of the restricted set of vowels that can occur before /r/ in certain contemporary non-rhotic varieties of English. As we have already seen in the GF account of r-sandhi,

---

5 Jones uses <> to enclose orthographic examples, such as <sergeaunt> and transcriptions are enclosed in []. In my discussion of Jones' data I will follow his practice. However, Jones' use of square brackets is unusual. Traditionally, historical forms are enclosed in slant brackets and preceded by a star. So for example, Lass (1994) describing the same OE breaking phenomena gives */i/ and */e/ as examples of front vowels which underwent breaking.

6 I am not concerned here with the type of non-rhotic system that Harris (1994) labels as system D. "Non-rhotic System D lies at the 'deep vernacular' end of the Southern U.S. dialect continuum." This
only mid-low (including centring diphthongs) and low vowels can precede the occurrence of the r-glise, as in (3), for example:

(3) fear of [fiər əv] far away [fərə əwer]
more and [mɔ: r ən] chair is [ʧəə ɪz]

Furthermore, we never find r-sandhi after high vowels, as in (4).

(4) see if *[si: r ɪf] Sue is *[su: r ɪz]

In contrast, rhotic forms of English, such as Scots English, exhibit /r/ after [i:], [u:], [e:] and [o:].

(5) [bi:r] beer [mo:r] more
[tʃe:r] chair [ʃu:r] sure

So what is the connection between the restricted non-rhotic vowel set and vowel lowering effects? In an attempt to answer this question, what I propose to do first of all is to consider two accounts of the restricted pre-r vowel set: Wells 1982; and Harris 1994.  

3.1.2. Wells (1982)

Wells (1982) presents a diachronic account of the restricted vowel set problem. Wells assumes that historically rhotic English forms were identical to those of contemporary rhotic Scots English. He argues that long non-low tense vowels which preceded /r/ were...
subject to schwa epenthesis (or pre-r breaking). (6) below sets out some examples of the underlying forms and the results of schwa epenthesis assumed by Wells (1982: 214).

(6)(a)

<table>
<thead>
<tr>
<th>Input</th>
<th>Pre-r breaking</th>
</tr>
</thead>
<tbody>
<tr>
<td>beer</td>
<td>bi:r bi:ər</td>
</tr>
<tr>
<td>sure</td>
<td>ju:r ju:ər</td>
</tr>
<tr>
<td>chair</td>
<td>tʃe:r tʃe:ər</td>
</tr>
<tr>
<td>more</td>
<td>mɔ:r mɔ:ər</td>
</tr>
<tr>
<td>fire</td>
<td>fər fər</td>
</tr>
<tr>
<td>tower</td>
<td>tɔər tɔər</td>
</tr>
</tbody>
</table>

(Wells 1982: 214)

(b)

| beard | bi:rd bi:ərd |
| scarce| ske:rs ske:ərs |
| force | fo:rs fo:ərs |

(Wells 1982: 216)

(c)

| vary  | ve:ri ve:əri |
| jury  | dʒu:ri dʒu:əri |
| glory | glo:ri glo:əri |

(Wells 1982: 216)

In order to derive the pre-r schwa, Wells posits the following rule of schwa epenthesis:

(7) \( \emptyset \rightarrow \text{ə/ [-low, + long V]} \_r \)

(Wells 1982: 214)

He argues that the motivation for schwa epenthesis before /r/ is that "To pass from a 'tense' close or half-close vowel to the post alveolar or retroflex posture associated with /r/ requires considerable movement of the tongue. If this is somewhat slowed, an epenthetic glide readily develops as the tongue passes via the [ə] area."

---

8 Breaking is the term used to refer to a process of epenthesis which results in a diphthong.

9 I have followed Wells (1982) here and not enclosed these forms in either slant or square brackets.
Wells argues that at some stage either before or after *r-drop*, a second process took place which laxed the long tense vowels and gave rise to the following:\(^{10}\)

\[
\begin{array}{l}
\text{beer} \quad \text{biə} \\
\text{chair} \quad \text{ʃeə} \\
\text{sure} \quad \text{ʃuə} \\
\text{more} \quad \text{mər} \\
\text{beard} \quad \text{bræd} \\
\text{scarce} \quad \text{skeəs} \\
\text{force} \quad \text{fɔəs} \\
\text{vary} \quad \text{vɛəri} \\
\text{jury} \quad \text{dʒuəri} \\
\text{glory} \quad \text{ɡləri}
\end{array}
\]

(Wells 1982: 215-16)

On this account, the restricted vowel set is derived as a result of two diachronic processes: schwa-epenthesis and vowel laxing. Although the laxing process posited by Wells is tied to a schwa trigger, the relationship between schwa and /r/ is entirely arbitrary. Such a rule-based account has no principled way of ruling out a system in which, say, pre-r /i/-insertion occurred which then triggered vowel laxing.

The second approach to the pre-r vowel set is a synchronic account couched within Element Theory.

\(^{10}\) Not all varieties that exhibit breaking also exhibit laxing. See the example of Dounby (page 155) below.
In chapter 2 we considered the floating segment analysis of r-sandhi in certain varieties of non-rhotic English and it is likewise the floating r which affects the quality of pre-r vowels.\footnote{In chapter 2 we saw that Harris' approach to so-called intrusive r cases was to assume that words which exhibited intrusive/linking r contained a floating r in their lexical entries.}

\[ (9) \]

The claim, repeated here for convenience, is that the schwa of the surface form [fɪə] derives from the underlying floating r, where a floating r is composed of a cold vowel [ə] and the coronal element [R]. [R] can only be licensed by an onset and so if [fɪ@-R]
is followed by a vowel initial word as in \([fI@-R @]\) *fear a*, for example, the coronal element is licensed and realised.

In *fear the*, on the other hand, \([R]\) remains unlicensed and is not pronounced. The cold vowel can be licensed and is obligatorily incorporated into the nucleus and so, regardless of the final licensed status of \([R]\), the cold vowel is licensed and realised. Consider finally the behaviour of /r/ before vowels such as \([a]\) and \([o]\). Harris assumes that vowel incorporation in many systems does not result in an 'ingliding' pattern (an example of an ingliding diphthong is \([ao]\)), the vowel spreads rightwards from the first nuclear position to the second one. Harris claims that this rightward spread of vocalic material "preferentially affects" relatively lower vowels e.g. \([a]\) in *bar* and \([o]\) in *horse*. But why should this be? If schwa is represented by the cold vowel, and all vowels contain the cold vowel, then why should lower vowels receive "preferential treatment"? We might expect the cold vowel to be absorbed by the first position of the nucleus in every case.

Although this account of the pre-\(r\) vowel set is implausible, it does raise a number of interesting points. First of all, it is an attempt to relate the appearance of schwa in \([fIa]\), for example, to the /r/ and secondly in the notion of the /r/ breaking rather than the vowel.\(^1\)

\(^1\) Harris describes the breaking process as giving rise to the vocalic component of the approximant \(r\) \([@]\) and the place component \([R]\). It is therefore the vocalic component responsible for the appearance of schwa and not the place particle. In addition, notice that Harris assumes that the vowel of *fear* is already a lax vowel.
In what follows, I shall pursue a course which takes aspects of the diachronic account and aspects of the synchronic account to offer an approach which links the quality of the pre-r vowel set with the /r/ whilst maintaining the r-sandhi account.

3.1.4. **Particle Account**

I have assumed elsewhere (Broadbent 1992, 1994) that the restricted pre-r vowel set of RP, for example, was largely determined by historical *r-loss* in the following way. First of all, I assume, following Wells (1982), that the underlying forms of, for example, *fear, beard* etc. in the precursor to RP would approximate to those of contemporary Scots. The forms in (5) above are repeated in (10) for convenience.\(^{13}\)

\[(10)\]

(a) Input | Pre-r breaking
--- | ---
beer | biːr | biːɔr
sure | Juːr | Juːɔr
chair | tʃeːr | tʃeːɔr
more | moːr | moːɔr
fire | faiːr | faiːɔr
tower | tɔːr | tɔːɔr

(Wells 1982: 214-5)

(b) beard | biːrd | biːɔrd
scarce | skeːrs | skeːɔrs
force | foːrs | foːɔrs

(Wells 1982: 216)

(c) vary | veːrɪ | veːɔrɪ
jury | dʒuːrɪ | dʒuːɔrɪ
glory | gloːrɪ | gloːɔrɪ

(Wells 1982: 216)

\(^{13}\) If the schwa of the disintegrating *r* was syllabified into the preceding nucleus at the stage when *r* had not been totally lost, then I disagree with Wells on the length of the vowel. However, the schwa and *r* could have formed a syllable in their own right. This would not have had any effect on the preceding vowel's length.
In line with the aim of contemporary phonological theory, if the occurrence of schwa is
to be tied to the context, then there are two possible sources of that schwa: the preceding
vowel or the following /r/. First of all consider the particle representation of the historical
vowels which preceded "schwa-epenthesis".

(11) /i/ I U /u/
  /i/ and /e/ I U /u/ and /o/
  A A

Given that schwa is represented by A, in order to break and reveal A, the vowel
concerned must contain A in its representation. In (11) we can see that two of the vowels
lack A altogether and in those vowels where A is present it is not present as the head. So
/i:/ and /u:/ could not break to give rise to schwa. It is, however, possible that /e:/ and /o:/
could do so. But if /e:/, for example, broke, the result would be a raised first half of the
diphthong and not a lowered one. I have illustrated this below.

(12) N  N
  X X —^ X X
  I I A
   [e:]  [iə]

14 Traditionally the term 'breaking' refers to diphthongisation processes which are achieved by means of
epenthesis. But such epenthesis accounts are highly arbitrary in that there is no reason why, in the pre-r
environment, the vowel inserted should be schwa as opposed to any other vowel. More recently the
term breaking has been used to indicate a segment disintegrating and revealing its internal composition
(Harris and Kaye 1991; Harris 1994). In their discussion of t-lenition, Kaye and Harris describe the
first stage of lenition as breaking which is subsequently followed by loss of part of the element
material.
However, this did not happen, so there are good grounds for concluding that the vowels themselves did not 'break' and that the source of the schwa was therefore /r/. I have argued at length that the place component of /r/ is A which, in English, is the representation of schwa. Therefore, this would suggest that prior to loss, /r/ broke, revealing its place particle.

(13)\(^{15}\)

```
     x
    / \        x
   r   A   X
```

But if this is what happened, why should /r/ have broken only after these long high tense vowels? Presumably /r/ broke regardless of the preceding vowel, but the nature of that vowel determined whether any trace of A remained. First of all, consider /r/ breaking after vowels which do not contain A in their makeup i.e. /i:/ or /u:. We could argue that the A is syllabified in the second timing unit of the nucleus causing the /i:/ or /u:/ to shorten.

(14)\(^{16}\)

```
  x  x
 I  A  \\..../
```

```
  x  x
 U  A  \\..../
```

This opens up two possibilities. First of all, we could assume that /i/ and /u/ are represented by I and differ in terms of length only. Given this, we could argue that historical /i:/ → [iə] is a one step process whereby the absorption of A into the nucleus

\(^{15}\) Where X represents all other consonantal information.

\(^{16}\)
triggers the change from /i:/ to [ə]. The second possibility is that shortening is not equivalent to laxing.

There are a number of difficulties with the first contender. It would, for example, preclude the possibility of [i] in British English. However, the main problem with this account is that it cannot be extended to relate /e:/ and /o:/ with /e/ and /o/. As we noted in (11) above, /e:/ and /o:/ both contain A, albeit not as the head. If we assume that the absorption of A into the nucleus results in [e] and [o] respectively by virtue of shortening, in other words, if we assume that the only difference between [e] and [e] and between [o] and [o] is length, then we must assume the following structures:

\[
\begin{array}{cccc}
\text{(15)} & x & x & x \\
& I & I & U \\
& A & A & A \\
[e:] & [e] & [o:] & [o]
\end{array}
\]

The problem with this is that [e] is now I-headed and [o] is U-headed. They should therefore give rise to [j] and [w] respectively during glide formation. Since they give rise to [ə] instead, I have argued that they are A-headed.

Alternatively we could assume that /i:/ → [ə] is a two stage process. During the first stage, A is absorbed into the nucleus producing short /i/.
During the second stage, A spreads into the first half of the nucleus and laxes the vowel.

When A causes laxing in /e/ and /o/, a headship change is triggered. That is, since the first portion of the vowel now contains a predominance of A, A becomes the head.

In Hayes (1990) terms, I is coindexed with the first slot and A is coindexed with both timing slots.
This enables us to group [e] and [o] with the A-headed vowels, which enables us to correctly capture the fact that they give rise to the [i]-glide during glide formation.\footnote{In addition we can also allow for the possibility of short /i/ and /u/ before schwa.}

Before we consider r-breaking after [a:], for example, it should be noted that r-loss does not guarantee vowels lowering. There are varieties of English in which the result of /t/ breaking was that schwa became syllabic.

Varieties of non-rhotic English such as Durham and Llanelli are examples of this latter system.\footnote{Both systems have r-sandhi.} Words such as sure and beer are pronounced with the schwa forming a distinct syllable and there is a pronounced syllable-initial glide [ju:wə], [bi:ja]. In such systems we could argue that when /t/ vocalised, the consonantal information was lost and the A particle was simply syllabified as a nuclear component.
In (19b) the /r/ has vocalised to schwa. If schwa were to be syllabified into the nucleus, the result would be an illegal 3-slot nucleus.

Linguistic structure in general favours maximally binary branching structures. Within phonology this is the position of metrical phonologists, Levin (1985), Charrette (1989) and KLV (1990). On this assumption, if schwa were to be syllabified in a rhyme, the vowel would automatically shorten. In order to avoid this illegal structure, three possibilities are open: r-vocalisation can lead to effacement of the r leaving no trace i.e. no schwa; vocalisation can leave schwa which then is absorbed into the preceding nuclear space (as in RP); the schwa can form a distinct syllable. So in contemporary Llanelli English, for example, the schwa occupies a syllable of its own and glide formation produces the hiatus breaking glide.
So far we have accounted for the appearance of schwa after /i, u, e, o/. We still have to account for the absence of schwa after mid-low and low vowels, that is in words such as far [faː]. In fact, we can provide an account of this set of vowels in that the mid-low and low vowels share the same type of head as schwa i.e. they are all A-headed. So the reason why this vowel group receives 'preferential' treatment, in Harris' terms, is that the A of the schwa is simply merged (perhaps as a result of the OCP) with the A head of the preceding vowel as in (22) below.
In the examples discussed so far, the vowel is long. The place particle of the breaking /rl/ has invaded the vowel timing allocation and provoked shortening. But there are cases where the result of r-loss has been long schwa (i.e. [3:1]) in words such as fir and fur. In such cases it would appear that when the A was absorbed into the nucleus, the deletion of the existing short vowel was triggered.19

Finally, I should point out that there are substantial differences between this account and that proposed in Harris (1994). First of all, the restricted pre-r vowel set is determined by the loss of rhoticity i.e. this is a diachronic account. Secondly the representation of schwa is entirely different not only in substance but also in its role in the segment. In my account, A is the place representative of the /rl/, whereas for Harris the coronal element is [R]. Unlike A, [R] has no effect on the vowels whatsoever. The account being developed here ties down the suggestions made by the previous accounts in such a way that the explanation falls out from the representation. First of all, 'schwa-epenthesis' emerges naturally. We can now say why it was schwa as opposed to [i] that was 'inserted' historically. Secondly, we have established a link between schwa and laxing. And furthermore, to return to the aim of this section, we have an example whereby the place element of consonantal /rl/ has triggered vowel laxing and so provides additional support for the link between schwa and coronal consonants.

19 In many varieties of Yorkshire and Lancashire English words such as work, word, nurse, and worse are pronounced [wak], [wad], [nas], [was]. In other words, only the schwa resulting from /rl/ vocalisation remains. The original vowel has been effaced.
But if this example of consonantal /r/ disgorging its place particle is an isolated case, then this account would appear to be nothing other than special pleading. In fact, there is evidence to suggest that place separation from a consonant with or without total loss is a common process and there are abundant examples of it from both diachronic and synchronic English phonology.

3.1.5. Breaking

The history of English is replete with diphthongisation processes which suggest that a disintegrating consonant yields its place particle. In this section, I shall consider examples of breaking/diphthongisation from OE, ME and contemporary English.

According to Jones (1989), Old English (OE) exhibited a highly restricted breaking process which appears to have affected short stressed front vowels [i], [e] and [æ], before [r], [l] or [x]. OE breaking seems to have occurred more usually before [x], than [r] and [l]. However, [r] and [l] triggered breaking when they formed part of a consonant cluster or geminate structure (Jones 1989: 39).

20 However, it should be pointed out that some breaking did affect long front vowels too.

21 OE breaking is also reported to have taken place before [w]. However, I shall not be concerned with such forms here.

22 Jones issues a cautionary note to the effect that OE breaking was a complex process and that he was simply providing an outline of it. Cases of one sound triggering the process more often than others is one of the complexities of this phenomenon. Further complexities will be indicated as they arise.
The two examples in (23) illustrate pre-r breaking. On the basis of a comparison between two early Germanic languages, historical phonologists claim that the digraphs in OE, which do not appear in Old High German (OHG), suggest that diphthongisation took place in OE. This is claimed to be a characteristic of OE (although it is also widespread in North Germanic languages). In addition, when West Saxon (WS), a form of OE, is compared with its ancestor, it appears that breaking was a two stage process. In the early stages of diphthongisation, the second half of the diphthong was [u], as in OE *child* <bæurn>, and then in later forms of OE, the second half of the diphthong underwent height harmony so that both parts of the diphthong agreed for height. Given this rough characterisation of OE breaking (24), (25) and (26) below provide some further examples to illustrate it.

(24a) pre-r <i> breaking

<table>
<thead>
<tr>
<th></th>
<th>WS</th>
<th>late WS</th>
</tr>
</thead>
<tbody>
<tr>
<td>[i]/[e]</td>
<td>[io]</td>
<td>[eo]</td>
</tr>
<tr>
<td>OHG &lt;hirti&gt;</td>
<td>&lt;hiorde&gt;</td>
<td>&lt;heordes&gt;</td>
</tr>
<tr>
<td>OHG &lt;irri&gt;</td>
<td>&lt;iorre&gt;</td>
<td>&lt;eorrre&gt;</td>
</tr>
<tr>
<td>GO &lt;limojan&gt;</td>
<td>&lt;liornian&gt;</td>
<td>&lt;leornian&gt;</td>
</tr>
<tr>
<td>OS &lt;berht&gt;</td>
<td>&lt;biorht&gt;</td>
<td>&lt;beorht&gt;</td>
</tr>
</tbody>
</table>

'shepherd'

'anger'

'to learn'

'bright'

---

23 Jones (1989: 36) notes that there is evidence suggesting that <ea> was an orthographic convention for representing [æa].

24 According to Jones (1989: 45) there are no instances of pre-1 <i>-breaking, which is a further instance of the distributional complexities of OE breaking.
(24b) pre-x <i> breaking

<table>
<thead>
<tr>
<th>WS</th>
<th>[io]</th>
</tr>
</thead>
<tbody>
<tr>
<td>GO &lt;tihhojan&gt;</td>
<td>&lt;tiohhian&gt;</td>
</tr>
<tr>
<td>GO &lt;mihst&gt;</td>
<td>&lt;miox&gt;/&lt;meox&gt;</td>
</tr>
<tr>
<td></td>
<td>&lt;Wioht&gt;</td>
</tr>
<tr>
<td></td>
<td>&lt;Piohtas&gt;/&lt;Peohtas&gt;</td>
</tr>
</tbody>
</table>

(Jones 1989: 45)

(25a) pre-r <e> breaking

<table>
<thead>
<tr>
<th>OE</th>
<th>[eo]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS &lt;herta&gt;</td>
<td>&lt;heorte&gt;</td>
</tr>
<tr>
<td>OHG &lt;erda&gt;</td>
<td>&lt;eordan&gt;</td>
</tr>
<tr>
<td>OHG &lt;werden&gt;</td>
<td>&lt;weordan&gt;</td>
</tr>
<tr>
<td>OS &lt;erl&gt;</td>
<td>&lt;ealr&gt;</td>
</tr>
<tr>
<td>OS &lt;swerd&gt;</td>
<td>&lt;swoard&gt;</td>
</tr>
</tbody>
</table>

(Jones 1989: 42)

(25b) pre-x <e> breaking

<table>
<thead>
<tr>
<th>WS</th>
<th>[eo]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OHG &lt;sehs&gt;</td>
<td>&lt;seox&gt;</td>
</tr>
<tr>
<td>OHG &lt;kneht&gt;</td>
<td>&lt;kneocht&gt;</td>
</tr>
<tr>
<td>OHG &lt;fehtan&gt;</td>
<td>&lt;feohtan&gt;</td>
</tr>
<tr>
<td>OS &lt;ehu&gt;</td>
<td>&lt;eoh&gt;</td>
</tr>
</tbody>
</table>

(Jones 1989: 43)

(25c) pre-l <e> breaking

<table>
<thead>
<tr>
<th>[e]</th>
<th>[eo]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OHG &lt;melkan&gt;</td>
<td>&lt;meolcan&gt;</td>
</tr>
<tr>
<td>OHG &lt;elaho&gt;</td>
<td>&lt;eloh&gt;</td>
</tr>
<tr>
<td>OHG &lt;celhh&gt;</td>
<td>&lt;celoh&gt;</td>
</tr>
</tbody>
</table>

(Jones 1989: 43)

---

25 Jones states that "many scholars hold that the sound represented by the graph <h> was the voiceless velar fricative." (Jones 1989: 37.)

26 Jones (1989: 42) notes that pre-l <e>-breaking was "severely constrained". It was most prevalent before a back consonant such as [x] or [k]. Consequently we do not observe diphthongisation where [I] is followed by a labial, or a coronal for example. Hence, <helpan> 'to help'; <delfan> 'to dig'; <elm> 'elm'; <elnung> 'comfort'; <sweltan> 'to die'. There are exceptions. John Anderson <fc> states that breaking did occur before [I] or labial in WS <seolf>.
(26a) pre-<æ> breaking\(^{27}\)

<table>
<thead>
<tr>
<th>OHG</th>
<th>WS</th>
</tr>
</thead>
<tbody>
<tr>
<td>[a]</td>
<td>[æa]</td>
</tr>
<tr>
<td>&lt;arm&gt;</td>
<td>&lt;earm&gt;</td>
</tr>
<tr>
<td>&lt;hard&gt;</td>
<td>&lt;heard&gt;</td>
</tr>
<tr>
<td>&lt;barn&gt;</td>
<td>&lt;bearn&gt;</td>
</tr>
<tr>
<td>&lt;warp&gt;</td>
<td>&lt;wearp&gt;</td>
</tr>
<tr>
<td>&lt;maruh&gt;</td>
<td>&lt;mearh&gt;</td>
</tr>
<tr>
<td>&lt;maruk&gt;</td>
<td>&lt;mearc&gt;</td>
</tr>
<tr>
<td>&lt;haruc&gt;</td>
<td>&lt;hearh&gt;</td>
</tr>
</tbody>
</table>

(26b) pre-l <æ> breaking (This was restricted to West Saxon and Kentish varieties.)

<table>
<thead>
<tr>
<th>Non-English</th>
<th>Old</th>
<th>English</th>
<th>non-WS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>early WS</td>
<td>WS</td>
<td></td>
</tr>
<tr>
<td>[a]</td>
<td>[æ]</td>
<td>[æa]</td>
<td>[æ]</td>
</tr>
<tr>
<td>OHG &lt;all&gt;</td>
<td>&lt;alle&gt;</td>
<td>&lt;eall&gt;</td>
<td>&lt;all&gt;</td>
</tr>
<tr>
<td>GO/OS &lt;chaldan&gt;</td>
<td>&lt;haldan&gt;</td>
<td>&lt;healdan&gt;</td>
<td>&lt;haldan&gt;</td>
</tr>
<tr>
<td>OHG/OS &lt;ald&gt;</td>
<td>&lt;alda&gt;</td>
<td>&lt;eald&gt;</td>
<td>&lt;ald&gt;</td>
</tr>
<tr>
<td>OHG &lt;kalt&gt;</td>
<td>&lt;ceald&gt;</td>
<td>'cold'</td>
<td></td>
</tr>
<tr>
<td>OHG &lt;halp&gt;</td>
<td>&lt;healp&gt;</td>
<td>'he helped'</td>
<td></td>
</tr>
<tr>
<td>OS &lt;wal&gt;</td>
<td>&lt;weall&gt;</td>
<td>'wall'</td>
<td></td>
</tr>
<tr>
<td>OHG &lt;halla&gt;</td>
<td>&lt;heall&gt;</td>
<td>'hall'</td>
<td></td>
</tr>
<tr>
<td>OHG &lt;fallan&gt;</td>
<td>&lt;feallan&gt;</td>
<td>'to fall'</td>
<td></td>
</tr>
</tbody>
</table>

(26c) pre-x <æ> breaking

<table>
<thead>
<tr>
<th>Non-English</th>
<th>OE(WS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[a]</td>
<td>[æa]</td>
</tr>
<tr>
<td>GO &lt;mahts&gt;</td>
<td>&lt;meaht&gt;</td>
</tr>
<tr>
<td>OHG &lt;ahto&gt;</td>
<td>&lt;eahta&gt;</td>
</tr>
<tr>
<td>OHG &lt;sah&gt;</td>
<td>&lt;seah&gt;</td>
</tr>
<tr>
<td>OHG &lt;fahs&gt;</td>
<td>&lt;feax&gt;</td>
</tr>
</tbody>
</table>

(26d) pre-<æ> breaking

Non-English | OE(WS) |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[a]</td>
<td>[æa]</td>
</tr>
<tr>
<td>GO &lt;mahts&gt;</td>
<td>&lt;meaht&gt;</td>
</tr>
<tr>
<td>OHG &lt;ahto&gt;</td>
<td>&lt;eahta&gt;</td>
</tr>
<tr>
<td>OHG &lt;sah&gt;</td>
<td>&lt;seah&gt;</td>
</tr>
<tr>
<td>OHG &lt;fahs&gt;</td>
<td>&lt;feax&gt;</td>
</tr>
</tbody>
</table>

\(^{27}\) Regional variation further complicates OE breaking. <æ> breaking before [r] is a case in point. According to Jones all regional varieties exhibited <æ> breaking before [r] except for Nothumbrian (e.g. cf NH <barn> and WS <bearn> 'child'). However, documentary evidence from the tenth century suggests the existence of diphthongal forms in Northumbrian too (Jones 1989: 40).
Despite the complexities of the data, it would appear to be the case that when orthographic evidence from early Germanic languages compared, OE appears to represent diphthongs where Old Saxon (OS), for example, has monophthongs. What caused pre-[x]/[r]/[l] breaking? And what did these three segments have in common? According to Jones (1989) the traditional view is that all three segments were back, and that the movement from a front to a back position involved passing through [u]. 28 Once OE breaking is compared with other forms of breaking, as Jones points out, this traditional account of OE breaking becomes untenable.

Late OE provides the first counter-example to the 'transition' account. Late OE exhibits evidence of pre-j breaking. 29 This evidence in part comes from the Lindisfarne Gospels (Jones 1989: 55).

(27)

<table>
<thead>
<tr>
<th>WS OE</th>
<th>10th Century Northumbrian OE</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;strægd&gt; 'he strewed'</td>
<td>[æ] &lt;strægd&gt; [æi] &lt;straigden&gt;</td>
</tr>
<tr>
<td>&lt;frægn&gt; 'he asked'</td>
<td>[æ] &lt;frægn&gt; [ei] &lt;fraign&gt;</td>
</tr>
<tr>
<td>&lt;mægden&gt; 'young girl'</td>
<td>[æ] &lt;mægden&gt; [ei] &lt;maiden&gt;</td>
</tr>
<tr>
<td>&lt;hæg&gt; 'meadow'</td>
<td>[e] &lt;hæg&gt; [ei] &lt;heig&gt;</td>
</tr>
<tr>
<td>&lt;δegn&gt; 'lord'</td>
<td>[e] &lt;δegn&gt; [ei] &lt;δeign&gt;</td>
</tr>
<tr>
<td>&lt;weg&gt; 'way'</td>
<td>[ü] &lt;weg&gt; [üi] &lt;weg&gt;, &lt;we&gt;</td>
</tr>
<tr>
<td>&lt;drýge&gt; 'arid'</td>
<td>[ü] &lt;dryge&gt; [üi] &lt;druige&gt;, &lt;drui&gt;</td>
</tr>
</tbody>
</table>

---

28 Daunt (1939) suggested that <-o> in <eo>, for example, did not represent a diphthong at all, the vowel was a monophthong and <-o>, for example, was simply a scribal diacritic used to indicate that the following consonant was back.

29 OE had both the voiced palatal and voiced velar fricative and both sounds were represented orthographically by <g>.
When WS OE is compared with 10th century Northumbrian OE, we find that the orthography once again suggests diphthongisation. In this case, however, the second portion of the diphthong is a high front vowel. There are two points to be made here. First, if both the vowel and the consonant are front, then why is a transition sound required? Secondly, we can see that the result of pre-ı breaking is [i].

As regards Middle English, two aspects of ME breaking are of particular interest. First of all, long and short front and back vowels were involved. Secondly, there was widespread breaking before the voiced and voiceless velar fricative and before the voiced palatal fricative. (28) illustrates ME breaking.

Furthermore, examples such as <we> way and <drui> dry contain no triggering consonant, which Jones assumes could indicate that the consonant had been lost.

However, unlike OE breaking there was no height harmony operational in ME breaking. Furthermore, [r] and [l] were not particularly affected by ME breaking, although Jones (1989: 159) provides some examples of pre-l breaking.
(28) (a) pre-x breaking

<table>
<thead>
<tr>
<th>OE</th>
<th>13th-15th century</th>
<th>15th-century</th>
</tr>
</thead>
<tbody>
<tr>
<td>[o]/[oo]</td>
<td>[ou]</td>
<td>[uu]</td>
</tr>
<tr>
<td>&lt;inoh&gt;</td>
<td>&lt;inouh&gt;</td>
<td>&lt;enughe&gt;</td>
</tr>
<tr>
<td>&lt;anog&gt;</td>
<td>&lt;anou3&gt;</td>
<td>&lt;enugh&gt;</td>
</tr>
<tr>
<td>&lt;enogh&gt;</td>
<td>&lt;inoughe&gt;</td>
<td>&lt;inou&gt;</td>
</tr>
<tr>
<td>&lt;ploh&gt;</td>
<td>&lt;plou3&gt;</td>
<td>&lt;plughe&gt;</td>
</tr>
<tr>
<td>&lt;plogh&gt;</td>
<td>&lt;plow3&gt;</td>
<td>&lt;plugh&gt;</td>
</tr>
<tr>
<td>&lt;dohter&gt;</td>
<td>&lt;douhtur&gt;</td>
<td>'daughter'</td>
</tr>
<tr>
<td>&lt;dohhter&gt;</td>
<td>&lt;dou3ter&gt;</td>
<td>&lt;dowhter&gt;</td>
</tr>
</tbody>
</table>

(b) pre-j breaking

<table>
<thead>
<tr>
<th>WS/OE</th>
<th>12th-15th century</th>
</tr>
</thead>
<tbody>
<tr>
<td>[æ]</td>
<td>[æi] / [ei]</td>
</tr>
<tr>
<td>&lt;da3&gt; [dæj]</td>
<td>&lt;da3&gt; &lt;dei&gt;</td>
</tr>
<tr>
<td></td>
<td>&lt;dai&gt;</td>
</tr>
<tr>
<td></td>
<td>&lt;day&gt;</td>
</tr>
<tr>
<td>&lt;clæg&gt; [klæj]</td>
<td>&lt;clei3&gt; &lt;clay&gt;</td>
</tr>
<tr>
<td></td>
<td>&lt;cleigh&gt; &lt;clei&gt;</td>
</tr>
<tr>
<td></td>
<td>&lt;clai&gt;</td>
</tr>
<tr>
<td>[e]</td>
<td>[ei]/[æi]</td>
</tr>
<tr>
<td>&lt;hēg&gt; [heej]</td>
<td>&lt;heigh&gt; &lt;hai&gt;</td>
</tr>
<tr>
<td>&lt;hīg&gt; [hiij]</td>
<td>&lt;heize&gt; &lt;hei&gt;</td>
</tr>
<tr>
<td></td>
<td>&lt;heyz&gt; &lt;ai&gt;</td>
</tr>
</tbody>
</table>

(Jones 1989: 145)

---

32 I have not followed Jones, who uses the symbol [j] to represent the voiced palatal fricative. I use the IPA symbol [j] instead.
Pre-x breaking is problematic, although the point I'm trying to make holds good. First of all, the data reveals that the final consonant was variably spelt <gh>, <g>, <h>, <ch>, <ʒ> and <zh>. <g> and <ʒ> are generally taken to represent [ɣ] in both OE and ME. However, <ch> and <h> are generally taken to represent [x]. Consequently, as Jones points out (1989: 151), it is not obvious whether all these examples represent breaking before a voiced velar fricative or a voiceless one. Whichever way it was, the second half of the diphthong is still [u].

For both the velar and palatal fricative there is evidence from ME that this particular breaking process resulted in consonant loss. For example, compare WS OE <dæʒ> with 12-15th C ME <dei> or <dai> day, or OE <plog> with <plou> plough and so on. This data lends further support to Jones' claim that the traditional account of breaking cannot
be maintained. In both the late OE and the ME examples, [j] is not a back consonant, so
the transition theory is not supported. Furthermore, in the case of <dohter> for example,
the [u] cannot, as Jones points out, be the result of a transition from a front to back
vowel, since [o] is already back.

As in the discussion of the appearance of schwa before /l/, we can rule out the vowel as
the source of diphthongisation in OE and ME. In the OE examples where front vowels
diphthongised, the result was [u], and yet none of these vowels contain U in their particle
make-up. Once again we must conclude that the source of the second portion of the
diphthong was the consonant.

This is precisely what Jones does. He suggests that the reason why [x, y, j, r, l] are
subject to breaking is that they are themselves closer to vowels in the sonority hierarchy
than say plosives. Focusing primarily on [y] and [g] Jones suggests that these sounds
"bear a considerable resemblance in their acoustic 'fingerprint' to the palatal and labial
pure vowels [i] and [u] respectively" (Jones 1989: 152). He suggests that a rhyme
occupied by [j] or [y] tends to be interpreted as the second half of the vowel space.33 34
This is illustrated in (29) below, which conflates two diagrams from Jones (1989: 153).

33 "vowel space" here is Jones' terminology. He does not mean vowel space in the usual sense of the
term, but rather he is referring to the second part of a diphthong.

34 In chapter 2: 118, we noted the DP, of which Jones is a proponent, claim that liquids and fricatives
contain [IVI] in their phonatory subgesture. So a consonant such as [x] has u in its articulatory
subgesture and (IVI) in the phonatory subgesture.
However, Jones does not comment on the fact that the [i] and [u] components which result are the place particles of the palatal and velar fricatives respectively.

Regardless of the precise mechanism by which consonants break, the data from ME and OE suggest that certain consonant groups reveal their place particles when they are subject to this process (which may or may not result in consonant loss). If this is the case, what does OE breaking tell us about the nature of /r/ and /l/ in OE? More particularly, is OE a counter-example to the relationship which we are trying to establish between coronals and A? First of all, we find a similar connection between /l/ and /u/ in certain contemporary varieties of English in the process of l-vocalisation. Where [l] vocalises, the result is not a schwa, but rather [u]. However, in order to vocalise, /l/ has to be velarised. In other words the U particle is present in the make-up of [l]. On the assumption that OE /l/ was velarised, [l] and [x] would both contain the velar particle. However, recall that the claim is that pre-x breaking, where U is the primary place particle, was more common, whereas in [l] U only played a secondary role. This could go some way towards explaining the more restricted nature of OE pre-l breaking.
If /r/ was back, then presumably it was either velar/velarised or uvular. However, on the assumption that it was one of these types of segments, /r/ would have contained the U particle. There is however a fourth possibility: U could have been present (though /r/ need not have been back) giving rise to lip rounding as in present-day pronunciations of red as [r̩ed]. This would enable us to say that when U was the place particle, widespread breaking took place but, when U was present as a 'colouring', the breaking pattern was more restricted.

The point is that on the basis of these examples, when palatals 'break' the result is an I, for velars/velarised/labialised segments the result of breaking is U. Thus /r/ breaking to reveal its place particle schwa is not an isolated case. Furthermore, examples of this kind are not historical artifacts. Jones, quoting Mather and Speitel (1986: 20-1), provides examples of "Modern Scottish English Breaking" from Dounby, Orkney. This system demonstrates breaking before pre-[l, r, x, ç] environments.

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35 Lass (1994: 50) considers a number of alternatives that would guarantee /r/’s inclusion in a natural class with /l/ and /x/. Lass and Anderson (1975) assumed that OE /r/ was uvular; Wright and Wright (1925) assumed that it was retroflex. Lass’ current position is that OE /r/ was velarised.

36 The behaviour of /r/ in OE may provide a clue to the numerous ways in which contemporary varieties of English manifest /r/. In chapter 4 I shall discuss this issue further.

37 The presence of U in the articulation of /r/ is supported by Dobson (1957) who discusses r-vowel rounding in English.
(30)  

<table>
<thead>
<tr>
<th>Sound</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>[eə]</td>
<td>[beəm] 'bairn'</td>
</tr>
<tr>
<td>[eə]</td>
<td>[seəl] 'seal'</td>
</tr>
<tr>
<td>[eə]</td>
<td>[teə] 'tell'</td>
</tr>
<tr>
<td>[biə]</td>
<td>[beə] 'bell'</td>
</tr>
<tr>
<td>[hiə]</td>
<td>[teə] 'tell'</td>
</tr>
<tr>
<td>[eo]</td>
<td>[heə] 'haɪl'</td>
</tr>
<tr>
<td>[eo]</td>
<td>[seəl] 'sail'</td>
</tr>
<tr>
<td>[eo]</td>
<td>[teə] 'tail'</td>
</tr>
<tr>
<td>[ei]</td>
<td>[dreɪç] 'wet'</td>
</tr>
<tr>
<td>[ei]</td>
<td>[eɪt] 'eight'</td>
</tr>
<tr>
<td>[aʊ]</td>
<td>[streɪt] 'straight'</td>
</tr>
</tbody>
</table>


First of all, these cases illustrate that breaking can occur without loss\(^{38}\). And secondly, the consonants are breaking exactly in the way that we would predict. That is, the coronals yield [ə], the palatals [i] and the velars [u].

Dounby is not the only accent of English which exhibits this pre-ɪ schwa. For example, in many varieties of English [ɪ] is preceded by a schwa in environments reminiscent of historical pre-r schwa, i.e. schwa appears after certain vowels and before [ɪ], if [ɪ] is either pre-consonantal or pre-pausal, otherwise there is no schwa. This process is fairly widespread in contemporary varieties of English. For example, it is present in SSE and WY as well as Scottish varieties. This is illustrated in (31) below.

(31)  

<table>
<thead>
<tr>
<th>Sound</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>[fɪə]</td>
<td>feel</td>
</tr>
<tr>
<td>[fiəd]</td>
<td>field</td>
</tr>
<tr>
<td>[puə]</td>
<td>pool</td>
</tr>
<tr>
<td>[fuəd]</td>
<td>fooled</td>
</tr>
<tr>
<td>vs</td>
<td>feeling [fiːlɪŋ] and foolish [fuːliʃ]</td>
</tr>
</tbody>
</table>

\(^{38}\) Although it will be interesting to see if any of the consonants are subsequently lost from this dialect in time.
/l/ has already dropped out of English in certain words such as *palm, calm, psalm, yolk, folk*, and so on. It may be that in Southeastern accents, /l/ is beginning to drop out altogether in the same contexts that /r/ dropped out. On the basis of the account being developed here, the appearance of pre-l schwa and [I] vocalising to U suggests that /l/ is shedding both its primary and secondary place particles.

But what of a particle approach in which the cold vowel [@] is schwa? Such an approach could also account for the appearance of schwa before /r/ and /l/, but only in so far as [@] is everywhere present in segments. (Recall that [@] indicates the absence of an element.) Given this, there is no principled way of ruling out [@] after a palatal, and indeed, [u] would be predicted after a velar, rather than [u], since [@] is the velar element. Hence such an approach makes entirely the wrong predictions.

These diachronic and synchronic examples suggest that the more vowel-like consonants have a tendency to reveal their place particles and, if such consonants subsequently drop out, they may leave their place particles behind. Furthermore, we have seen that both true consonantal /r/ and /l/ exhibit a relationship to schwa and we have evidence which suggests that a disgorged A causes vowel lowering.39

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39 *Jibbali*, a South Arabian language, provides an interesting example of a schwa coronal connection in that in the perfect form of the following verbs if the stem initial consonant [r], [l] or [n], then that consonant is either syllabic or it is preceded by schwa.

<table>
<thead>
<tr>
<th>stem</th>
<th>perfect</th>
<th>meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>rdm</td>
<td>ḍūm/rdūm</td>
<td>'to pile up stones'</td>
</tr>
<tr>
<td>rgm</td>
<td>ḍūm/rqūm</td>
<td>'to cover'</td>
</tr>
<tr>
<td>rkt</td>
<td>ḍūt/rtqūt</td>
<td>'to step on'</td>
</tr>
<tr>
<td>ldf</td>
<td>ḍūf/lūf</td>
<td>'to bang down'</td>
</tr>
</tbody>
</table>
There is also some evidence to suggest a connection between A and certain coronal obstruents: /s, z, t, d/ although this evidence is more indirect. What I propose to do now is to present some examples which show /r/ alternating with /s/ or /z/ and also with /t/ or /d/. It is worth emphasising here that all approaches can relate /s/ and /z/, for example, with /r/, simply because these three segments are coronal. The point which I am trying to establish is that if /s/ or /z/ and /t/ or /d/ alternate with /r/, then the representation must make this possible in such a way that we do not lose the ability to explain r-sandhi and r-triggered vowel lowering effects. It is precisely this which distinguishes my approach from all other approaches to the representation of coronal.

3.1.6. A and the coronal obstruents /s, z, t, d/

In OE, fricatives such as /f, s, x/ became /v, z, y/ respectively when they occurred either medially or finally and were immediately preceded by an unstressed vowel. What is of particular interest to us here is that medial /z/ > /r/ (Wright and Wright 1925). For example:

| lkd | alkd/|kːd | 'to patch leather' |
| nfg | anfg/afg | 'to emerge/jump' |
| nfr | anfr/nfr | 'to reject utterly' |

(Data provided by R. Hayward (pc).)

Vennemann (1974) discusses examples of vowel lowering triggered by a dental [t,d], a uvular [h] and the labio-velar glide [w].

Whereas final /z/ dropped out.

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Lass describes this */s/ > [z] as an illustration of Verner's Law and */z/ > [r] as Rhotacism. However, he notes that it is now usual to conflate the voicing and rhotacism under Verner's Law. Indeed, this phenomenon was not restricted to OE, all Germanic languages except Gothic exhibited these changes. Wright and Wright (1925: 135) provide the following examples.

In addition, other Indo European languages exhibit these /s/ and /z/ to /r/ alternations. In Latin, for example, intervocalic /s/ > /r/.

L (34)

L flos (nom,sg) > floris < *[flo:zis] < *[flo:sis]  

OL Valesius (= a name) > CIL Valerius  

L *honozi > honoris 'honor, esteem' gen sg.  

(Howell 1987: 328.)

(32)
c ēosan to choose  
c ēas pret.sg  
curon pret.plu  
cyre choice  

wesan 'be'  

(was pret.sg  

Lass 1994: 23)
Perhaps the most relevant of these examples, however, are the OE cases, since this variety was the predecessor of EModE in which the /r/ is alleged to have caused vowel laxing effects. If we relate /s/ and /z/ with /r/ as ‘coronals’, we can account for their alternation but not for the ability of /r/ to promote lowering. Hence, the argument is that if the place component of /r/ can promote lowering and if /s/ and /z/ can alternate with /r/, then they too must contain the same kind of place representative, specifically A.

Howell (1987) provides an example from Andalusian and Puerto Rican Spanish in which final /s/ and /z/ reduced to [h] and [h] subsequently dropped out. When /s/ and /z/ reduced to [h], what is interesting is that the preceding non-low vowels lowered. Consider the examples in (35).

(35)

| [dios]  |  >  | [diçh] | god |
| [pies]  |  >  | [piçh] | feet |
| [perdiz]  |  >  | [perdjh] | partridge |

(Howell 1987: 324, citing Navarro 1968: 37.)

Howell attributes this lowering to the [h], but the account being developed here suggests an alternative, namely, that when /s/ and /z/ began to disintegrate the reason why the

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42 Howell (1987) notes that the reverse occurred in French as in

French: *chaire > chaise, 'chair'

bericles > besicles, 'spectacles'

Howell 1987, 328.
preceding vowel lowered was because it absorbed the place marker: A. Howell himself dismisses the possibility that /s/ and /z/ are the source of vowel lowering.

A very different case of /z/-/r/ alternation comes from hypocoristic formation, or name shortening, in English. Kenstowicz (1994) describes this as a process which manipulates the prosodic structure of the word. When polysyllabic names are shortened, cases that would result in r-final forms change to z-final (or l-final) instead as in (36) below.

(36) (a)
Nicholas → Nick
Susan → Sue
David → Dave
Gillian → Gill
Timothy → Tim
(b)
Terry → Tez/Tel
Darren → Daz
Garry → Gaz
Barry → Baz
Gerry → Gez
Karen → Kaz
Sharon → Shaz

So /r/ alternates with /s/ and /z/ both in historical changes and in contemporary systems. Although a cautionary note has been issued with respect to the Spanish lowering cases, clearly if coronal in consonantal/glide r is A and /sl/-/l/ alternate with /r/ (and vice versa) then in order to maintain the /r/ vowel lowering effects and to maintain a naturalised

43 This is an attractive proposal under the assumptions being made in this thesis. However, a note of caution is necessary. Iggy Roca (pc) has suggested that Howell provides a simplification of the facts and that in his opinion neither approach is sufficient as it stands.

44 The z-final forms are found in WY for example and other Northern varieties. l-final forms such as Derek - Del and Terry - Tel are Southern English.
account of r-sandhi we have to assume that A represents coronal place not only in /r/, but also in /s/ and /z/.

One final example which connects /r/ with the coronals /t/ and /d/ comes from nineteenth century Leeds speech. According to Ellis (1889) both /t/ and /d/ vocalized to /r/ in Leeds phonology. He comments that "t, d preceding a vowel and after a short vowel become very vulgarly (r)." (Ellis 1889: 395). In (37) below I have set out data from Ellis. However, this data set is simply a list of words with short vowels and is consequently unrevealing. To complement this list I have included a number of instances of /t/-/r/ substitutions from contemporary Leeds speech in (38).

(37) at, chat, what, spat, cat, hat (past of hit),
ad, glad, swaddy (soldier), bad, shadow,
dad, mad, et, (past of eat), let, get, met, wet, set
wed, led, bled, sled (slipper)
it, hit, sit, flit, split, little, bit, hiddy (to hide)
smiddy (smith), did, bid,
ot, got, cot, spot, od (hold), sod, not, modern
but, foot, shut, glutton, mutty (calf), mud (might)
good, stood, huddle, budding, sud (should).

(38) shut up [ʃuʃʌp]
get off [ɡɛtʃəf]
not hungry [nɒtˈhʌŋgri]
but if [bʊtɪf]

This /t/ or /d/ ~ /r/ process, like the /s/ /z/ ~ /r/ alternations considered above, suggests that if /r/ has A as its place representative and /t/ and /d/ vocalise to /r/, then they must

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45 Twentieth century /t/ ~ /r/ is a restricted version of its predecessor.

46 I have observed instances of /d/ ~ /r/ in contemporary Llanelli English: Yestē[r]ay - Yesterday. This variety of English also exhibits /t/ ~ /r/.
also contain \( A \). So this provides further evidence to suggest linking the \( A \) particle with coronal segments more generally. \(^{47}\)

Having established a more general \( A \)-coronal connection, I shall return to the question posed at the end of chapter 2: if schwa (\( A \)) in an onset gives rise to \( r \), where does the coronality come from?

### 3.2. Deriving coronal from \( A \).

Perhaps the best way to approach this question is to consider once again, but in somewhat more detail, the relationship between glides and their cognate vowels. In chapter 2, we considered Catford's characterisation of the relation between glides and vowels: the difference between a glide and its cognate vowel is that the former lacks a hold phase. There is, however, an alternative approach which is that /\( j \)/ and /\( w \)/ are made with a greater constriction of the vocal tract than /\( i \)/ and /\( u \)/. This is the position adopted by Maddieson and Emmorey (1985) and they describe this characterisation as the 'consonantal' hypothesis.

Maddieson and Emmorey (1985) carried out an investigation of the relationship between the glides /\( j \)/ and /\( w \)/ and their cognate vowels in Amharic, Yoruba and Zuni. Six vowel-

\(^{47}\) Notice that the \( A \) coronal connection has not been established between the dental fricatives or the palato-alveolars and \( A \). There may well be a very good reason why evidence for their relationship to \( A \) is not visible in quite the same way. First of all, notice that they correspond to the non-special coronals and the reason why they are non-special is because dependents of "coronal" are required in order to represent them.
glide-vowel sequences (/iji/, /uju/, /aja/, /awa/, /iwi/, /uwu/) were inserted into "carrier" phrases in order to compare their formant frequencies (e.g. Amharic /anta b / 'you say' Maddieson and Emmorey 1985: 116). The aim was to demonstrate that cross-language differences occur as regards the acoustic target of the glide, but that this difference can be correlated with cross-language differences in the cognate vowel. Furthermore they set out to show that palatals differ from language to language as to the degree of resistance they exhibit to co-articulation. What is of interest to us here is not the statistically significant results which were achieved with respect to their two primary aims, but the implications their work has for the relationship between glides and vowels. Having characterised the two competing positions, Maddieson and Emmorey argue that their study of formant frequencies should enable us to make a choice between them. They argued that if the 'glides are just vowels in a different syllabic position' stance was correct, then there should be no difference in the formant frequencies of /j/ and /i/ or in /w/ and /u/ in a given language. However, if the 'consonantal' position was correct, Maddieson and Emmorey predicted the following differences should be observed. First of all, F1 should be lower for /j/ and /w/, than for /i/ and /u/ as a result of the tongue body being in closer proximity to the roof of the mouth. Secondly, F2 should be lower for /w/ than for /u/ as a result of the greater degree of lip constriction. They also suggested that F3 should be higher for /j/ than /i/. Focusing on the words /iji/ and /uwu/ they found that there were significant differences between F1 in the glides as opposed to in their cognate vowels; there was a significant difference between F2 in /u/ as opposed to /w/ and F3 was higher in /j/ than in /i/. On the basis of their findings, they concluded that /j/ and /w/
were produced with a greater degree of constriction than /i/ and /u/. In other words, their study supported the 'consonantal' hypothesis of semivowel production.

We could argue that the application of Catford's experiment, which was used to demonstrate the relationship between schwa and /r/ in chapter 2 (page 103), lends further support to this second position in that when /ɜ/ is prolonged it does not simply revert back to its cognate vowel as /j/ and /w/ do, but rather it reverts to an r-coloured schwa. In other words the application of this experiment to /r/ demonstrates that a constriction has been added.48

The GF claim developed in chapter 2 requires that information from a vowel spreads into an onset position. Once in an onset position, that information is then treated as part of a 'consonantal' structure. (NB, the point of GF was to act as a hiatus breaker, creating a non-vocalic unit between two vocalic entities.) So if I, U, and A occupy an onset position, then they must be rendered more consonant-like and this can be achieved by two alterations. First of all, onsets are durationally shorter than nuclei and presumably this requirement guarantees the absence of the hold phase and secondly, onsets require a greater degree of constriction than nuclei and so a greater degree of constriction will be added.

48 Jones (1969: 205) describes [ɜ] as "a weakly pronounced 'retroflexed' a".
Consider first of all the consonantal constriction which would be required in order to turn I into a 'consonant'. In the segmental structure the place of constriction is clearly stated: the front of the body of the tongue should form a constriction at the palate. Therefore, in order to increase the degree of constriction, the tongue simply needs to make a closer approximation to the palate. Nothing is added; the instruction present is implemented in line with the non-vocalic location. Similarly, in the case of U, a precise instruction is already present: that there should be a simultaneous constriction at the velum and at the lips. If the simultaneous constrictions are increased, the instruction can be implemented without altering the nature of that instruction. So, how can A be constricted to produce a consonantal articulation? The important point to notice here is that in the case of I/U, all that was required to change vowels to non-vowels was to implement a form of the instruction already present. Given that we cannot change A, how can we make it less vowel-like? One possibility is that the tongue could be retracted. Presumably, this would be in the direction of uvular. However, A (which we are equating in English with schwa) is not 'back' enough to give rise to a uvular and so in order to close in the uvular position we would have to change the place instruction. If the centre of the body of the tongue was raised sufficiently, a bunched/molar r would be

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49 Where consonant is being used to mean more C-like, less V-like.

50 The 'consonantal' hypothesis might have certain consequences for the fact that Schane does not stack I and U. If we compare I, for example, in a vowel with I in an onset, then the claim is that I has a greater degree of constriction in an onset than in a nucleus. Consequently, it is other aspects of the representation which have determined the 'slight' increase in height and so, as this can be achieved without stacking I there seems no reason why more than one should be used. (This observation applies equally to U).

51 This assumption will be defended in Chapter 4, when the structure of uvular will be considered with reference to both English and German.
produced. But, unlike the minor 'alterations' applied to I and U, this would involve a considerable movement away from the schwa position, i.e. once again it would require a change in the instruction. This inability to increase A without adding a new instruction suggests that A in an onset is a very imprecise structure. Assuming that the 'render more consonant-like' requirement for a glide seeks to maintain and implement the articulatory instruction already present, we must accept that the low-mid tongue body position is there to stay. However, the question of how A can be implemented in a consonant still remains to be answered. The idea that I shall propose and continue to develop throughout the rest of the thesis is that all consonantal place elements, with the exception of coronal, correspond directly, or are equivalent, to a vocalic element. Coronal is, however, related to a vowel in the sense that it is represented by a vowel: A (i.e. schwa/a-type vowel). So the position being developed here is entirely consistent with the view that consonants and vowels share the same set of place features. David Leslie has suggested to me that the brain may operate a "labio-dorsal calculus" where I, U and A relate directly to the body of the tongue and U also relates to the lips. If A occurs in a consonantal position, this causes a problem for implementation in that a constriction has to be formed whilst at the same time maintaining a non-high dorsal position. Because this does not fit with the labio-dorsal calculus in any straightforward way, the response is to mobilise the only articulator which can be moved. In other words, the tongue blade.  

52 Leslie has suggested that we should view this tongue blade movement as a 'virtual' movement of the tongue body.

53 In chapter 1 (Foot note 41, page 41) I quoted Chomsky and Halle's observation that we do not find non-high, non-back consonants "as a direct consequence of the fact that the body of the tongue can only form a constriction if it is high or back." Given the position being explored, we have filled in this gap. In other words, there are non-high, non-back consonants: coronals.
So, although A does play a role in consonants, it does not correspond directly to a consonantal constriction. Therefore, when a consonantal representation enters "phonetic implementation", it has to be repaired. To explain precisely what is meant by this, consider Pierrehumbert’s description of phonetic implementation:

"Rules of phonetic implementation, by contrast to phonological rules, relate the categorial representations of phonology to representations of a completely different character - quantitative descriptions of speech as a physical phenomenon. By doing so, phonetic implementation rules specify what phonological representations mean..." (Pierrehumbert 1991: 224)

On the assumption that coronal is a default setting, coronality will be assigned to such a structure in the absence of a more precise instruction. I am using default here in the sense that it is used in, for example, a computer printer. The printer will have a set of manufacturer’s default settings which will come into play if the user does not select a particular setting. The position that we are moving towards is one in which the phonetic component will contain a series of manufacturer’s default settings. A triggers the default oral place setting. For the reasons given above, I do not intend in this thesis to attempt to determine what all the hard-wired default settings might be, although one which might also achieve this is [?] in that if a consonantal articulation is required but no supralaryngeal information is available, then the default stop will be supplied. Evidence for this comes from languages such as English and German. In Chapter 5 I shall return to the notion of default when this use of the term is compared with the standard use in, for example, Archangeli (1984; 1988). The assumption being made then is that coronal

\[54\] This would allow us to explain the appearance of the glottal stop as a means of blocking certain forms of r-sandhi in RP: the need to spell out the consonant as a hiatus breaker would occur but the sociolinguistic suppression would prevent supralaryngeal information from being supplied. Therefore on entry to the phonetic implementation the default setting for a consonant would be supplied.
is a phonetic, not a phonological, concept. This assumption has certain implications which I shall discuss in chapter 5.

**Summary** So far, we have considered evidence which suggests that there is a connection between A and coronals in general, and we have suggested that A represents [coronal] in the phonology and acquires coronality in the phonetic implementation. In the remainder of this chapter I will consider a number of other particle representations of coronal to determine whether the approach being developed here is in any way superior to existing representations. This will serve to set the scene for Chapter 4 in which I will consider the representation of place more generally in a particle theory which equates A with coronal place.

### 3.3 Alternative Particle Representations of Coronal.

Within particle-type theories there are two main approaches to the representation of supralaryngeal place in consonants: those that use the three basic vowel primes (I, U, A) only (Smith 1988, for example) and those that supplement the basic primes with additional elements (Harris 1994; Harris and Lindsey 1995; Anderson and Ewen 1987). For ET as set out in Harris 1994 (see also Harris and Lindsey 1995), first of all, there is a partial overlap between consonants and vowels in that consonantal place is represented using the vocalic elements [I] (palatality), [U] (labiality) and [@] (velarity, when [@] occurs as the head). The only exception to this equation of place with vocalic elements is
coronal, which is represented by the element [R]. In isolation, [R] corresponds to a tap [r]. I have set out the ET representations for /p, t, c, k, q, / in (39) below.

(39)  

[U, ?] p  
[?, R] t  
[?, I] c  

[?, @] k  
[?, A] q

In addition to the absence of a coronal-vowel connection, the choice of @ as velarity and U as labiality means that there is no connection possible between labials and velars and between velars and round vowels.

Although ET can account for /s/, /z/ ~ /t/ and /l/, /?/ ~ /t/ alternations as lenition processes, whereby all other segment internal information is lost except the coronal element, this cannot be achieved together with a non-arbitrary account of r-sandhi and vowel lowering/laxing. Harris (1994) attempts to achieve this position, but as we have argued, his account of r-sandhi is arbitrary. In addition, his attempts to equate [@] with vowel laxing is problematic. When we compare the role of the cold vowel as a head in consonants and vowels, we find that Harris runs into yet another difficulty. In consonants, the cold vowel as a head gives rise to velarity. In vowels, on the other hand, a cold vowel has the effect of laxing the vowel:

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55 I originally proposed the connection between A and coronal in Broadbent (1992) and developed this position in Broadbent (1994). Since this thesis was written and following these presentations, GP has adopted A as the coronal element.

56 In our discussion of Harris’ approach to r-sandhi and the pre-r vowel set, we have seen the post-alveolar median approximant represented as [R, @].
If the representations for /i/ and /I/, for example, are compared, then we find that the only difference is in the head element. /i/ is [I]-headed, whereas /I/ is cold vowel-headed and so on. But when [@] is the head of a consonantal structure, the result is a high back tongue configuration. This, in turn, must cast doubt on the role of the cold vowel head as a potential laxing agent.

Dependency Phonology, like the ET account sketched above, makes use of the basic primes in addition to the component 'linguality' (⟨Ill⟩) in order to characterise place within consonants. If a segment contains the linguality component then its production actively involves the tongue blade/body (Anderson and Ewen 1987: 237). So, coronals, palatals, velars and uvulars all contain the linguality component. They differ in that they may contain additional components. In this framework, labials are represented by

\[
\begin{array}{cccccccccc}
\text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} \\
\text{I} & \text{I} & \text{I} & \text{I} & \text{U} & \text{U} & \text{U} & \text{U} & \text{U} & \text{U} \\
@ & @ & A & A & A & A & A & @ & @ & @ \\
@ & @ & @ & @ & @ & @ & @ & @ & @ & @ \\
i & i & e & e & o & o & o & u & u
\end{array}
\]

\[57\] Anderson and Ewen (1987: 243) express doubt about the precise structure of uvulars in DP. They are certain that Ill, lul, and lal are the main contenders but they are uncertain about the combination. They explain by saying that "The hesitancy arises partly from the fact that there is little information on the status of these segments with respect to their behaviour in natural recurrent processes..." But see Hayward and Hayward (1989) who assume that uvulars pattern with pharyngeals and laryngeals in their paper which argues for a natural class of gutturals. See also Trigo (1991).
{lul}, the gravity component, in isolation and can therefore be related to velars, which contain {lul} together with the linguality component.

(41)

\[
\begin{array}{cccc}
{\text{Labials}} & {\text{dentals/alveolars}} & {\text{palatals}} & {\text{velars}} & {\text{uvulars}} \\
{lul} & {\text{III}} & {\text{II,il}} & {\text{II,ul}} & {\text{II,u,al}} \\
\end{array}
\]

But if we adopt the representation of coronal given in (41), coronality cannot be equated with vowel laxing. DP has greater freedom of combinatorial possibilities than ET, so it is possible to propose {II,al} as the representation of coronal place. This would enable DP to account for occurrences of pre-\text{-r/l/n schwa, but the inclusion of the centrality component would be entirely arbitrary and it still would not permit an account of schwa-triggered laxing.}^{59}

The EDP approach of Smith (1988) characterises consonantal place entirely in terms of the components I, U, A. The table in (42) sets out the interpretation which I, U and A receive when they occupy dominant or dependent positions in vowels and consonants.

(42)

<table>
<thead>
<tr>
<th>VOWELS</th>
<th>Dominant</th>
<th>Dependent</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>palatal constriction</td>
<td>pharyngeal expansion (ATR)</td>
</tr>
<tr>
<td>U</td>
<td>velar constriction</td>
<td>Labial expansion (round)</td>
</tr>
<tr>
<td>A</td>
<td>pharyngeal constriction</td>
<td>oral expansion Jaw opening (low)</td>
</tr>
</tbody>
</table>

[Smith1988:213-214]

---

58 Pharyngeals are represented as {Ir, (u), al}, where Ir is the retracted tongue root component (Anderson and Ewen 1987: 243). U is enclosed in brackets to indicate its optionality.

59 See also chapter 2 section 2.5.2, where we argued that the vowel representation in DP does not permit the implementation of GF.
CONSONANTS

<table>
<thead>
<tr>
<th>Place</th>
<th>Dominant</th>
<th>Dependent</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Coronal constriction</td>
<td>palatal constriction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pharyngeal expansion</td>
</tr>
<tr>
<td>U</td>
<td>Labial constriction</td>
<td>velar constriction/</td>
</tr>
<tr>
<td></td>
<td></td>
<td>labial expansion</td>
</tr>
<tr>
<td>A</td>
<td>dorsal constriction</td>
<td>pharyngeal constriction/</td>
</tr>
<tr>
<td></td>
<td></td>
<td>oral expansion</td>
</tr>
</tbody>
</table>

(Smith 1988: 214)

On the basis of this interpretation of the components, Smith assumes that when the segment is specified as [CONSONANTAL], the place values will be represented as follows (Smith 1988: 215-6):[60]

(43)

```
                C   C   C   C   C   C
               /
              /   /
             /     /
            /       /
           /         /
          /           /
         /             /
        /               /
       /                 /
      /                   /
     /                     /
    /                       /
   /                         /
  /                           /
 /                             /
/                               /
```

Labials    Coronals    Palatals    Velars    Uvulars    Pharyngeals

---

[60] Smith (1988: 213) intends these trees as short-hand forms for:

```
ROOT
    /\  consonantal
     /   /
    /     /
   /       /
  /         /
 /           /
/             /
```

PLACE

---

172
Within the class of coronals, Smith differentiates dentals, alveolars and palatals in the following way:

\[ (44) \]

\[ \text{Dental} \quad \text{Alveolar} \quad \text{Palatal} \]

Smith assumes that I represents alveolar, rather than, say, dental, in a system which contains both dentals and alveolars such as English, because alveolar is the unmarked coronal articulation. In a language such as French, which has dentals but no alveolars, I is taken to represent dentals. Smith's characterisation of dentals in languages such as English, for example, is particularly interesting. His idea is that dentals are 'fronted' alveolars, i.e. the presence of the dependent I fronts the dominant I.

Despite the fact that Smith's approach is perhaps the closest to the position that we are moving towards in this thesis, in that it unifies consonant and vowel place using the three vowel particles only, the equation of I with coronal would mean that r-sandhi could not be equated with schwa. Furthermore, a non-arbitrary account of r-related vowel laxing/lowering would be impossible.
In this section, we have seen that there are two types of approach to the representation of coronal. The first type does not establish a relationship between coronals and a vowel group: the approach of ET e.g. Harris (1994), DP e.g. Anderson and Ewen (1987). There is also the EDP approach of Smith (1988) where coronal is equated with \( I \). Although all of these approaches can account for coronal alternations such as \( /l/ \rightarrow /r/ \), or \( /\ell/ \rightarrow /r/ \), they cannot provide a non-arbitrary account of r-sandhi, whereby the appearance of the r glide is tied to the preceding vowel; account for the vowel lowering/laxing effects of \( r \), or account for the appearance of schwa before /\ell/.

### 3.4. Summary

In this chapter, I have argued that the connection between schwa (represented by \( A \)) and the r-glide can also be established with other coronals. In order to do this, I have considered consonantal /\ell/-triggered vowel lowering effects and suggested that the appearance of schwa before /\ell/ and /l/ provides examples of consonants revealing their place particles. I also demonstrated that it is not only coronal consonants that do this. I considered a number of diachronic and synchronic phenomena from English which revealed palatals and velars exhibiting the same behaviour. The connection between /s, z, t, d/ and \( A \) was suggested by the fact that in order to capture alternations between these coronals and /\ell/, whilst at the same time maintaining the GF account of r-sandhi and the vowel lowering effects, the simplest assumption to make was that these consonants also contained \( A \) as their place component. I then considered the way in which coronal might be derived from schwa. If I had simply argued that \( A \) was interpreted as coronal, then...
this would not rule out the possibility of any particle being interpreted as coronal. Instead, I argued that only A could receive such an interpretation. I proposed that unlike I or U, A in a consonantal position provides an imprecise structure. A cannot achieve closure without the addition of information, and since this option is not open to us, the claim was that in the phonetic implementation, the only available response to this inadequate instruction is to mobilise the tongue blade. The consequence of the arguments set out above is that coronal is no longer viewed as a phonological unit, it is rather a phonetic event. In the next chapter, I will consider what a particle representation of place might look like if A is adopted as the coronal place representative.
Chapter 4

In chapter 3 we considered evidence which suggests that A is the coronal representative in the phonological component and it was suggested that coronality might be a phonetic property. This equation of A with coronal raises a number of questions about the representation of place more generally and so in this chapter I shall consider the way in which consonant place might be represented using particle combinations.\(^1\) The aim of this chapter is to provide a particle representation of place for labial, dental, alveolar, palatal, velar, uvular and pharyngeal which accommodates certain vowel-consonant natural classes such as round vowels, velars and labials; and palatals and front vowels outlined in chapter 1, and the coronal-schwa-/a/-type vowels considered in chapters 2 and 3.\(^2\) I should point out that the discussion of place could form a thesis in its own right, but this would shift the focus of the discussion from the nature of coronal to place in consonants more generally. With this in mind the discussion of place in this chapter is intended as nothing more than the outline of an approach put forward as a working hypothesis to be used throughout the rest of the thesis. Exploration and development of this approach will be the subject of future research.

---

\(^1\) The approach being developed in this chapter resembles Smith (1988) in that place is characterised solely in terms of A I U. Smith's approach differs in the interpretation of certain of the particles: A as dorsal and I as coronal (Smith 1988).

\(^2\) The coronal-front vowel natural class will be considered in chapter 6.
4.1. Coronals

4.1.1. A and Coronal

On the basis of the arguments in chapter 3 I have claimed that coronal in /l, l, n, t, d, s, z/ should be represented by A.

\[(1)^3\] PLACE

\[A\]

The main problem with a representation of coronal such as the one given in (1) is that /l, n, t, d, s, z/ are ANTERIOR coronals whereas [j] is non-anterior. In other words how can we reconcile the fact that we have A giving rise to an anterior coronal in segments such as /l, l, n/, or /n/, for example, whilst also giving rise to the non-anterior coronal such as the post-alveolar median approximant which occurs as a result of Glide Formation, for example.

I will assume that the phonetic form of r determines whether it is anterior or posterior.

First of all, notice that in English if apical r is a full consonant it is an alveolar trill or tap. Only when it is a glide is [j] non-anterior.\(^4\) Glides are more closely related to vowels and vowels are universally non-anterior sounds. One reason why a fully consonant

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\(^3\) In section 4.3. I shall extend this diagram so that the particle representation of place is part of a hierarchically organised structure.

\(^4\) The labio-dental median approximant does not constitute a counter example as we will see when we consider the representation of r-types in English below.
coronal /r/ is [anterior] might have to do with the position of the tip/blade at rest. Catford (1988: 82) suggests that the first 1-1.5 cms of the tongue constitutes the blade, and that this is the portion of the tongue which lies immediately under the alveolar ridge when the tongue is at rest. The front of the tongue is said to be that portion of the tongue which rests under the palate and the back of the tongue is therefore that portion of the body of the tongue which is at rest under the soft palate (see also Ladefoged 1982: 4). I shall assume that A in a full consonantal segment will result in the unmarked coronal place: alveolar. The segment will not be further back because that is not the crucial part of the instruction in a coronal. Instead the point is that some degree of consonantal stricture is required and that the instruction A is inadequate in this respect. So, presumably the presence of a particle which indicates full consonantal stricture will be sufficient to ensure that A results in an anterior articulation. (Other non-anterior coronal consonants, e.g. /f/ and /tʃ/, do not constitute counter-examples to this position. See 4.1.3 below.)

5 Keating (1991) contrasts this definition of tongue blade with an alternative position, which is that the blade extends further back than Catford or Ladefoged assume. Presumably, this latter position is partly based upon the desire to equate coronals with front vowels and palatal consonants. If we assume that this is not a consideration, then we might follow Catford and Ladefoged and assume that the blade of the tongue is that part of the tongue which at rest is located immediately below the alveolar ridge. The main reason for doing this is that if the consonantal instruction contains a place specification which will not result in an appropriate degree of stricture: A, then the phonetic implementation will supply coronal by default.

6 [Anterior] is a controversial feature. It provides an abstract division of the oral cavity rather than denoting a phonetic property. Originally [anterior] together with [coronal] provided the four basic divisions of consonantal place. So, for example, labials were characterised as [+anterior, -coronal]. In contemporary feature theory the role of [anterior] has been greatly reduced. [Anterior] no longer plays a part in the characterisation of labials which are represented by the presence of the labial node. In fact the only use for [±anterior] nowadays is to distinguish coronals.
4.1.2. Dentals

If A gives rise to alveolar consonants such as /t, d, n, l, s, z/ how are the dental coronal consonants /θ, δ/ to be represented? In other words, what is the difference between a dental and an alveolar consonant?

In Element Theory, the difference between /s/ and /θ/ is captured by a difference in headship.

(2) (a) [h, R] /s/ (b) [h, R] /θ/  

(Harris and Lindsey 1995: 70)

If [R] is the head, as in (2b) then the segment is a dental fricative. If, on the other hand [h] is the head then the segment is an alveolar fricative. 7

To capture the difference between dentals and alveolars Dependency Phonologists Anderson and Ewen (1987) introduce an additional component: {ldl}. 8 This component is the equivalent of [distributed] in feature frameworks. In DP then /s z/ will be represented by the linguality component whereas dentals /θ, δ/ will be represented by the linguality component in combination with {ldl} as in (3) below. 9

---

7 To distinguish a bilabial from a labiodental, Element Theorists point out, is unproblematic for English. The bilabials are stops and the labiodentals are fricatives, hence manner distinguishes bilabial from labiodental.
8 Anderson and Ewen (1987: 241) use {ldl} to distinguish bilabials from labiodentals in languages such as Ewe which distinguishes bilabial and labio-dental fricatives.
9 Anderson and Ewen (1987: 239) discuss the component apicality {ltl}. As a dependent of linguality, the result is a laminal as in (a) where {lll} dominates {ltl}. When {lll} and {ltl} are mutually dependent the result is an apical as in (b) and when {ltl} dominates {lll} the result is a retroflex as in (c).
Smith (1988) captures the dental-alveolar distinction without the addition of a new particle. He assumes that if a language lacks alveolars, but has dentals, such as French, then dentals will be represented by $I$ (coronal). In languages such as English, Smith argues that dentals are best thought of as 'fronted' alveolars. This is represented in Smith’s terms as in (4).

In (4) above the upper $I$ represents coronal and the dependent $I$ (the lower $I$ represents fronting)\(^\text{10}\).

\(^{10}\) At this point we can consider Smith’s representation of labio-dentals. He claims that labio-dentals should be represented by the 'dental' and 'labial' component i.e.
Of these three approaches, ET and EDP provide the most straightforward representations, in that they do not introduce new particles. Of these two, EDP is to be preferred over ET on two counts. First of all, it only makes use of vocalic particles to represent place, and secondly, it is able to represent the marked status of dentals vis à vis alveolars. I shall therefore assume that the Particle representation of dental follows Smith (1988) as being fronted alveolars.

Since an alveolar is represented by \( A \) and fronting can be achieved by adding \( I \) this suggests that a combination of \( A \) and \( I \) results in a dental. Translating this directly into PP gives the following structure:

\[
(5) \quad \begin{array}{c}
    x \\
    \downarrow \\
    I \\
    A
\end{array}
\]

The representation in (5) is equivalent to the vowel representation for /ɛl/. /ɛl/ has a relatively high tongue body configuration and during GF it is one of the vowels that

\[
\begin{array}{c}
    C \\
    \downarrow \\
    U \\
    I
\end{array}
\]

(Smith 1988: 215)

But if \( I \) is 'fronted' in dental consonants and coronal then why is Smith's representation not a fronted labial or a lingua-labial rather than a labio-dental? Alternatively we could assume that Smith is employing \( I \) as [+distributed]. Even if this is the case, it is usually bilabials that are taken to be [+distributed] in English not labiodentals and if \( I = [+\text{distributed}] \) and fronted and coronal, then Smith should spell this out clearly.
gives rise to the palatal glide. This can be taken as support for the claim that I is the dominant force in /e/. As a contender for the representation of dental, however, this is not suitable because, on the assumption that dental is a 'fronted' alveolar, A should be the dominant force, with I providing the fine tuning. But notice that the translation of Smith's representation for dental into Particle Phonology highlights a problem which was touched upon briefly in chapter 2: the representation of headedness. Before we consider the exact arrangement of A and I for dentals, it is worth digressing briefly to consider the representation of headedness in Particle Phonology.

Schane, in effect, has two methods of representing headedness, an issue which he never addresses, although it is clearly germane. In chapter 2 we concluded that when two particles combine- an aperture particle (A) and a tonality particle (I/U)-the tonality particle is the head. Aperture achieves headship/dominance by means of stacking (i.e. two or more A’s).

A comparison of the particle representation of /e/ with two representations of /e/ from DP is revealing.

\[(6) \quad (a) \quad I \quad (b) \quad \{li,al\} \quad (c) \quad \{li \rightarrow al\}\]

The structure in (6a) is Schane's representation for /e/. The particles are said to be stacked. On the basis of this description we might assume that (6a) is equivalent to DP's simple combination in (6b). However in simple combination neither I nor A are heads -
there is no dominant force. DP uses simple combination in 5 vowel systems and for more complex vowel systems the representation in (6c) is assumed where I dominates A.

Clearly in the English vowel systems of WY and RP, /e/ cannot be represented by simple combination, I is assumed to dominate A and this is evidenced by /e/’s palatal glide forming capacity. I shall assume therefore that (6a) is a notational variant of (6c), since if we assume otherwise, PP is unworkable. So in the representation in (5), I is the head and it is 'lowered' by A.

Next consider the particle representation of /e/ in 7 below.

(7) I
    A
    A

/e/ is a potential r-former which suggests that the balance of power has shifted from I to A. But are two instances of A strictly necessary here? Once again a comparison of the Particle representation in (7) above with the two dependency representations of /e/ is revealing.

(8) (a) {la→ il} (b) {li ← al}

11 It might be enlightening to consider Schane’s background. Schane abandoned feature theory and developed PP because he argued that feature theory was unable to provide an insightful account of a wide variety of vowel phenomena. Presumably he did not consider asymmetrical relations because in his particle combinations he is functioning still as a feature theorist. That is to say, when features are combined there is no need for asymmetrical relations.
The representation in (8a) is the one which Dependency Phonologists posit for the structure of /e/ in 7 vowel systems. (8b) on the other hand is assumed for /ε/ in 9 vowel systems. The representation of /e/ in particle terms is equivalent to the structure of /e/ in (8a). In other words AA guarantees that A dominates I. If IAA can be assumed to be equivalent to {lₐ→₁l}, then /ε/ is better represented as AI, provided we want to avoid using two representations of headedness. In other words, we should modify the Schane-type representation so that the head particle is placed uppermost regardless of whether that particle is an aperture particle or a tonality particle.

(9)  

```
  C
   x
   A
    I HEAD dependent
```

This will have only minor effects on the vowel representation. Consider the front vowels /e/ and /ε/ in (10).

(10)  

```
  /e/  I /ε/  A
   A
    I
```

Notice that if A is schwa then /ε/ can be thought of as a fronted schwa. This proposal to make headship explicit does not affect the main tenets of PP in that system dependency.  

---

12 Iggy Roca has suggested (pc) that a non-head interpretation is most appropriate for PP and that this would maintain the r-sandhi account in chapter 2. In IA both particles are present in equal force. In IAA the I particle and one of the As cancel each other out but one A is available for GF. Likewise in IAAA the I is neutralised by one of the A’s. If this is adopted there is no reason why I should spread from mid-high vowels since A cancels out I. This is in just the same way that I prevents /ε/ being an r-former, A prevents /ε/ from being a j-former.
is not affected and we can still employ multiple occurrences of A, although, as I shall attempt to demonstrate below, using more than one A is more constrained. To illustrate this I propose to consider the representation of /æ/ in a 4 height system and the representation of /ɔ/, /ʌ/ and /ɑ/ in RP.

To represent /æ/ we could (a) adopt a further element as in ET, but as we have seen this is a highly undesirable move; (b) incorporate different methods of combination as in DP or (c) maintain the idea of aperture as characterised by multiple instances of A, since this would not effect the representation of headship.

(11)  
\[
\begin{array}{c}
A = \text{schwa} \\
A = \text{fronted schwa i.e. } /\varepsilon/ \\
\hline
\end{array}
\]

therefore \( A + A = A \)

To summarise a partial vowel system composed of /i, e, æ/ can be represented as follows:

(12)  
\[
\begin{array}{cccccccc}
/i/ & I & /e/ & I & /æ/ & I & /æ/ & A \\
\hline
A & I & A & I & A
\end{array}
\]

The case of the central and back vowels would remain unaltered. The representations for /ɔ/, /ʌ/ and /ɑ/ are set out in (13) below.

(13)  
\[
\begin{array}{cccccccc}
/ɔ/ & A & /ʌ/ & A & /ɑ/ & A \\
\hline
A & A & A & A
\end{array}
\]

185
A is the head in all three vowels and additional A's do nothing to affect headship but rather distinguish the different heights. The additional A's are simply operators/dependents. There is no inconsistency between headship and multiple use of a particle, and what is more we can find similar instances of such multiple use in other particle approaches. DP, for example, employs the categorial gesture \{IVI\} twice in the representation of sonorant consonants, for example

\[(14) \quad \{IV \rightarrow V:Cl\}^{13}\]

In other words, once head-dependents are recognised in PP multiple instances of A are instances of dependents.

In this digression, I have attempted to show that although Schane makes no reference to asymmetrical relations, such relations must be at least implicitly assumed and I have suggested that this implicit headedness should be made explicit. I have argued that this does not detract from any of the tenets of Schane's approach. From now on, I shall incorporate explicit headedness in the modified particle representation being developed.

So what are the implications of this digression for the representation of dental? On page 186 above we said that I 'fronted' A and that consequently A should be regarded as the dominant component. This suggests the representation in (15) below.

---

\(^{13}\) ': represents mutual dominance. It is equivalent to '↔'.

186
This, I shall assume, is the representation of dental. On the basis of (15) we can see that dentals have the same place representation as /θ/.

4.1.3. Palato-alveolar

If dentals are represented as in (15) above, how do we represent palato-alveolars? The question arises because I, which has the effect of fronting in consonants, is uncontroversially associated with palatalization and so dentals must be distinguished from palato-alveolars and also from palatalised alveolars and yet all three forms will constitute some arrangement of A and I. What we have to decide here is the form that these arrangements should take.

Palato-alveolars in English are an interesting class. They have two main sources: coalescence, whereby /t, d, z/ merged with /j/ as in /tʃju:/ → [tʃju:], for example, and so-called 'velar fronting' (which will be considered in some detail in chapter 6). It is

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14 Smith (1988: 219) suggests the following representation for palato-alveolars

---
worth quoting Lass (1976) at length here, because his comments on palato-alveolars have been accepted by a number of phonologists, including Anderson and Ewen (1987).

"To take the phonetic side first: [s ʃ ] for instance vary considerably from dialect to dialect, and even from speaker to speaker, in the backness of the coronal occlusion. Thus for some [ʃ ] is indeed quite posterior to [s], while for others it is only marginally so (if at all). What is however distinctive in all these cases is tongue SHAPE, not position, in two ways. Thus in the first place [ʃ ] always has the blade of the tongue domed, whereas it is hollowed for [s]...And in the second place, they are strongly PALATALIZED: there is a definite raising of the tongue toward the hard palate...The palato-alveolars are hyphenated not because of an 'intermediate' position, but -properly - because of their SECONDARY ARTICULATION." (Lass 1976: 189)

If we accept that palato-alveolars are alveolars with secondary articulation, then the question of how to represent palato-alveolars is also the question of how precisely to represent secondary articulation?

Ladefoged (1982: 210) defines secondary articulation as "an articulation with a lesser degree of closure occurring at the same time as another (primary) articulation." Catford (1988: 103) describes two types of co-articulation: double articulation and secondary articulation. He claims that the main difference between the two is the rank of the articulation.¹⁵ What he means by this is that in the case of a double articulation, such as [kʰ] for example, both the labial and velar instructions have equal status i.e. they are both stops. However in secondary articulation the two places of articulation do not have equal rank: the secondary articulation is usually an approximant. Sagey (1988; see also Kenstowicz 1994) argues that double articulations and secondary articulations have the

¹⁵ On page 104 he defines rank as "degree of stricture".
same representation and that it is languages that differ in the way in which they interpret such representations in the phonetic implementation.

Sagey (1988) assumes that in the phonetic implementation the segment's manner features are copied under the articulator node responsible for the primary articulation. The manner features of the secondary node are "supplied" and the manner features for approximant are the default settings. The major articulator is indicated by an arrow from the root to that node. This is illustrated in (16).

An alternative approach might be to assume that when a 'double' articulation is produced, e.g. [kp], both labial and velar are indexed to the manner feature [-continuant]. However, when the correspondence between manner and place is strictly one to one the primary articulation will be read with the manner specification and the remaining articulation will be read as a glide, since it is vocalic information in an onset position.
Dependency Phonologists draw a representational distinction between secondary articulations and double articulations as follows: "Consonants showing secondary articulation are, at least phonologically, single segments in which the components characterising the place of secondary articulation are subjoined to those characterising the place of the primary articulation." (Anderson and Ewen 1987: 247) This is illustrated in (17)

(17)  
```
    1       1  
  \   /     \   /  
 / i,i   / i,u  
```

palatalised alveolar  velarised alveolar \(^{16}\)

(Anderson and Ewen 1987: 247)

Double articulations are represented in DP simply as 'double'articulations:

(18)  
```
    {ICl}     {ICl}  
  \   /     \   /  
 / [II,ul,ul] / [II,ul]  
[kp]       [tp]  
```

(Anderson and Ewen 1987: 250)

\(^{16}\) Notice that on a DP approach secondary articulation is not viewed as the superimposition of vocalic features since the linguality component \{III\} is non-vocalic.
But since a combination of A and I has been used to represent a simple articulation: dental, we do not want to say that this kind of representation can be used to represent a 'fronted' segment, a palatalized segment and a doubly articulated segment. What we have seen so far supports the adoption of the structure in (19) for palato-alveolars, a structure used by Smith (1988) to represent palato-alveolar.\(^{17}\)

\[
\begin{array}{c}
\text{C} \\
\vdots \\
\vdots \\
\text{Place} \\
/ \backslash \\
\text{A} & \text{I}
\end{array}
\]

We can further assume (following Sagey and Kenstowicz) that this structure can be used to represent \([t^i]\) or \([t^j]\). Presumably the difference between the two is that for \([t^i]\), the I is read as vocalic information in an onset i.e. as a glide, whereas in \([t^j]\) it is often assumed that the manner features equivalent to stop, continuant are ordered on the same tier and result in the stop fricative interpretation characteristic of an affricate.\(^{18}\)

In the remainder of this thesis, I will assume that dentals and palato-alveolars are represented as follows:

\(^{17}\) Although Smith's interpretation, as already pointed out, interprets A and I differently.

\(^{18}\) This suggests a one-to-one reading of manner to place. I shall return to consider the derivation of \([t^j]\) in more detail in chapter 6.
If we adopt this representation of dentals and palato-alveolars, an interesting consequence ensues. According to Lahiri and Evers (1991: 95) "Palatalised dentals often undergo a change of place and become palato-alveolars." Notice that a palatalised dental (given in (21) below) bears considerable resemblance to a palato-alveolar.19

(21) C
   
   A
   I

In coastal dialects of kiSwahili, palato-alveolars become dentals as in *[ŋti] → [nti]*

country.20

---

19 Hume (1994: 145) provides the interesting example of Ngiyambaa in which dentalised alveolars become palatal stops (described as postalveolar) [j p] when immediately preceded by a front vowel.

20 I am grateful to Dick Hayward for this example.
4.2. Palatals.

Palatals in languages which exhibit them are uncontroversially represented by the I particle, a representation which aligns them, equally uncontroversially, with front vowels. But what is not so clear is why palatal place is highly marked and why languages prefer palato-alveolar to palatal. In languages with a four stop series the preference is for labial, alveolar, palato-alveolar and velar, rather than labial, alveolar, palatal and velar (see for e.g. Chomsky and Halle 1968).

4.3. Labials and Velars.

In chapter 1 we considered arguments for the natural class labials and round vowels. Evidence for the existence of such a natural class comes from vocalisation phenomenon whereby labial consonants change to [w] (Spanish pre-consonantal /b/ vocalises to [u] as in absencia → ausencia, absence and Rumanian pre-liquid /b/ vocalises to [u]) and examples such as Tulu in which not only round vowels but also labial consonants are responsible for rounding the central/back vowel [i]. The examples in (22) below are repeated from chapter 1 for convenience.

(22)

<table>
<thead>
<tr>
<th>nağli</th>
<th>katti</th>
<th>kanni</th>
<th>pudari</th>
<th>ugari</th>
<th>ari-n-i</th>
</tr>
</thead>
<tbody>
<tr>
<td>country</td>
<td>bond</td>
<td>eye</td>
<td>name</td>
<td>brackish</td>
<td>rice (acc)</td>
</tr>
</tbody>
</table>
All the theories which have been considered in this thesis can relate round vowels and labial consonants. In Feature Geometry this is achieved by making the feature [+round] dependant on the Labial node. In particle type theories this is achieved using the unit U.

In addition we considered the relationship between round vowels and velars. Velars and velarised segments vocalise to u/w and they may also promote vowel rounding phenomena (e.g. Austrian German front vowels were rounded before velarised-l). In addition to these two natural classes, we considered evidence put forward to suggest the existence of the natural class velars, labials and round vowels. Evidence for such a natural class comes from the fact that both labials and velars vocalise to u/w as well as alternating with one another. For example in Middle English the velar fricative *[x] changed to [f] in laugh, cough, rough etc.

The representation which we adopt in this thesis should be able to capture this natural class, but at the same time be able to distinguish velars from labials. During the course of the discussion so far we have seen that Element Theory makes no connection between velars and labials although, as pointed out above, labials and round vowels are related by the element U. ET therefore has no straightforward way of capturing alternations

(Clements 1991: 7-8)
between labials and velars or velars vocalising to round vowels. Dependency phonologists assume a labial-velar natural class is desirable and the component lul is included in the representation of both groups. They distinguish the two consonantal places by combining {lul} with {III}, the linguality component which indicates tongue body/blade involvement, in velars. However this means that Dependency phonologists cannot capture place solely in terms of vocalic components.  

Smith's EDP approach is somewhat more complex. In chapter 3 we saw that A gives rise to dorsal consonants and low vowels; U to labial consonants and round vowels. However, when U occurs as a dependent it functions to give rise to either labialisation or velarization. Consequently Smith can account for the vowel rounding effects of velarised segments and also for velarised-I vocalisation. Although Smith captures place with a single set of features he equates velar with low vowels, thereby predicting a natural class which is not attested, and he is unable to capture the natural class velar, labial and round vowels. Notice that on Smith's approach Middle English [x] to [f] is an arbitrary change from A to U.

Given the goal of searching for a unified set of consonant and vowel place features and given that we are limited to combinations of I, U and A, the prime candidate to represent labials, velars and round vowels is U. But although this particle can relate all three, the

---

21 Recall that in chapter 3 we noted this point in our discussion of DP's representation of coronal which is {III}, i.e. the linguality component, a non-vocalic component, in isolation gives rise to coronal.
problem is how can we distinguish velars from labials without the addition, as in DP, of some non-vocalic particle?

It was argued above that the Particle Phonology representation adopted in this thesis should make explicit the head/operator, (dominant/dependent) relations in the segments and that these should be represented in a unified manner. Consequently we might assume that U as head will give rise to one of the places whereas U as operator will give rise to the other. If we consider the other particle theories we do not find a unified use of U. In other words it is sometimes used as the head to give labiality (as in EDP) and other times as the dependent (as in some proponents of ET). Schane's gloss for U is 'labiality', but in isolation the U particle is realised as a labio-velar, i.e. it has both lip and tongue body characteristics. It seems fairly open to the individual to select U as head for either labial or velar and it remains an open question which is the most appropriate (I shall return to this point in chapter 6). Given that U is generally assumed to give rise to a high back rounded (or unrounded) vowel when it is the head and roundness when U is the operator we could assume that for consonants head U gives velarity and dependent U labiality. The problem that still remains is how to represent this difference. Consider in this regard the Element Theory representation of [t] and [p]. (I shall assume an element representation of [p] in which U is an operator.)
If this information were to be hierarchically organised a solution to our representational dilemma would present itself.

In a particle approach we can assume that $U$ is the head in a velar structure but the dependent (with, for example, a manner head) in a labial. I have represented this in (25) below.
This hierarchical organisation of the particles (including 2 to indicate [-cont]) illustrates that the difference between labials and velars is that the place component is dominant in velars but the manner component, say, is dominant in labials with the result that we are able to distinguish the two. Notice that this is the logic of the Element Theory approach and it is obscured by the fact that the segments are represented as two-dimensional structures. Support for this representation of labial and velar, comes from palatalisation processes (which will be discussed fully in chapter 6).

In chapter 1 we considered evidence for the hierarchical organisation of features. Although Schane does not consider hierarchical particle organisation in any depth, it is clear from his (1995) paper that he is now moving towards such a structure. Particle theory is entirely compatible with such structure and in what follows I shall assume,

---

22 Harris (1994) presents a hierarchically organised element theory and places the 2 element and the h element under the root node. In a Sagey-type model they might be placed under the laryngeal node because they are interpreted in isolation as the glottal stop and fricative respectively and in combination with other elements they ensure stop and fricative manner.

23 A similar proposal has been suggested by Dependency Phonologists, not with respect to place but with respect to the main gestures.

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following Sagey (1986), Anderson and Ewen (1987) and Smith (1988) that phonological features should be hierarchically organised in such a way as to explain why certain features pattern together during phonological processes. I shall adopt the following shorthand form, similar to the one employed by Smith (1988).24

(26)

```
C
  \x
  :   :
   PLACE
  |    |
   A
``` 

The diagram in (26) is meant as a short hand form whereby all information which would be present in a fully elaborated hierarchical particle structure is missing. This is meant to reflect the fact that we are only concerned in this thesis with the representation of place.

4.3.1. Bilabials vs Labio-dentals

I shall follow Kaye, Lowenstamm and Vergnaud, and Anderson and Ewen in assuming that bilabials and labiodentals are distinguished in English by manner not by place.

Therefore, if $U$ occurs in a dependent place position in a fricative consonant that consonant will be realised as a labio-dental. Conversely if the consonant is a stop and $U$

---

24 See for example, Hayes (1990) who employs Schane's aperture particle $A$ in the hierarchical structure which he employs to account for certain complex diphthongisation processes. See also Smith (1988) who employs components to characterise place within a hierarchical structure.
is in dependent place the result will be a bilabial. This type of position allows a straightforward account of the historical change from [x] to [f] in Middle English. This can be viewed as a change in power relations, i.e. the headship has changed from the place to the manner feature.

4.4. Uvulars and Pharyngeals.

There are two potential representations for uvular which suggest themselves in particle theory and there would appear to be some evidence for both types of representation. The first type would take uvular to be a lowered velar.

(27)

U
A

The second type of representation for uvular would be one which would relate it more closely with pharyngeal.

(28)

A
A

Where pharyngeals would be represented as:

---

25 This approach works for system with a straightforward distinction between bilabials and labiodentals. Systems with bilabial and labio-dental fricatives, for example, would pose a problem for this position. However, in this chapter I have presented a first approximation and one which works for English. Further work would have to be done for systems which pose a counter example to the system.

26 I am not especially interested in uvulars or pharyngeals. The representation of pharyngeal is subject to no discussion because it is not directly relevant to our consideration of coronal. It is mentioned simply to show that there is a means of representing it in particle phonology. However, see Hayward and Hayward (1989) for a discussion of the relationship between uvulars, pharyngeals and laryngeals.

27 This representation equates pharyngeals with the low vowel [a].
What I propose to do is to consider some arguments which support the first type of representation for uvulars since English seems to provide some support for this structure.

Trigo (1991) sets out data from Turkana which strongly suggests that the structure of uvular in Turkana is UA.

This data can be contrasted with the following data, also from Trigo, in which the [k] does not change.
If we compare the two sets of data then we can see that [k] becomes [q] under the influence of a tautosyllabic [o], [ɔ], or [a]. High vowels do not trigger [k] to [q] and nor do front vowels. Back non-high vowels cause [k]-[q] alternation. If we consider this as the spread of A from back non-high vowels to the velar then the result will be UA:

\[(32) \quad U + A \rightarrow U \quad A\]

Further support for the representation of uvular as UA comes from the history of r in English.

Howells (1990) considers the question of which came first in Germanic languages uvular or apical r. In chapter 3 we saw that diphthongization processes in OE suggested that the r was some kind of back segment, i.e. velar/velarised or uvular, because the second portion of the diphthongal space was [u]. We concluded that the diphthongisation was a result of the r-breaking. If we assume that the r was uvular and that uvular is represented as in (27) above then we have a source for the U portion of the diphthong.\(^{28}\) If we assume that English r is composed from the set \{A,U\} then the different r-forms exhibited throughout the history of English can be characterised as different arrangements of the contents of this set. First of all, UA allows us to capture uvular r, possibly the form of OE r and exhibited by Tyneside English until fairly recently. The choice of U in isolation would explain the occurrence of the labio-dental median approximant in, for example Stockport English (Lodge (1984), a form of r widely regarded as defective or as an affectation which is increasing in usage. U would also

\(^{28}\) However, velarised or velar r would also contain the source for U.
explain another r form often regarded as 'defective' r namely the velar approximant [ɯ].

In chapter 3 we commented on the presence of lip-rounding on r as in [ʁ̩'ed]. If the source of the lip-rounding is the U from the r set then we can account for the occurrence of lip rounding on r as a 'trace' of its uvular origin. We have already argued that A will give rise to an alveolar tapped or trilled r and also to a post-alveolar median approximant. These forms of r are permissible selections from the r-set. Finally the r-set {U,A} allows us to say why uvular can alternate with apical: uvular and alveolar are both derivable from this set.29

In this chapter I have put together a tentative representation of place in particle phonology terms. Much work remains to be done but for the purposes of this thesis I shall assume the following place representations.

29 However, German uvular r alternates with [ʌ] or [ɔ] which seems to support the AA representation of uvular: a representation which also permits a link between alveolar and uvular r. But it should be pointed out that this representation may be appropriate for German, but it seems uninsightful for English since it then rules out the possibility of accounting for the considerable variation involving lip, and velar articulations.
(34)

hd indicates that something other than U is the head of the structure. See section 4.3. above.
4.5. Summary and Development

The aim of this thesis is to find the best representation for coronal segments. So far, we have considered evidence which suggests that coronals should be represented in the phonology by the A particle. In this chapter we have considered the way in which such an approach can represent consonant place more generally. Indeed the representation which has been proposed is a hierarchically organised Particle Phonology.

In Chapter 1, two debates were considered in which coronals are central: the 'unified place features' debate and the 'special status of coronals' debate. In the remaining two chapters, I will return to these two debates. Since the unified place features debate typically equates coronals with front vowels, it does not have any immediate bearing on the representational issue. However, in chapter 6, I shall reconsider the coronal-front vowel evidence in the light of the proposals made in this thesis and argue that it is largely compatible with a coronal-A approach. First of all, in Chapter 5, however, I shall
return to the special status debate and consider the final representational issue raised in chapter 1: is underspecification required?
CHAPTER 5

In chapter one, we considered the work of Avery and Rice and Paradis and Prunet, among others, who adduced frequency facts and examples of asymmetrical behaviour as evidence of the unmarked and special status of coronals. Such researchers argue that the unmarked and special status of coronal can be reflected in the representation if coronal underspecification is adopted. In chapters two and three, the representation of coronal has been equated with the representation of schwa in English. This equation of A with the unmarked place and unmarked vowel in English has the effect of collapsing 3 unmarked entities into one. If coronals exhibit asymmetrical behaviour in English, then some degree of underspecification is required. However, it cannot be underspecification of coronal, since this is not regarded as a phonological property. If underspecification is motivated then it will be the underspecification of A. In this chapter, therefore, I will first of all consider evidence that coronals are special in English and that underspecification of A is motivated. In 5.2 I will consider why it is A that is underspecified and what this might add to the level of explanation achieved by special status proponents such as Avery and Rice and Paradis and Prunet.

5.1. The Special Status of Coronals: Evidence from English

In the literature on the special status of coronals, English is often used as an example of a language in which coronals exhibit asymmetrical behaviour with respect to other place types.
5.1.1. t-glottalling.

As Avery and Rice (1989) point out, t-glottalling provides an example of asymmetrical behaviour. There are varieties of English where the voiceless stops /p, t, k/ glottal (e.g. Newcastle). However, whilst such systems are rare, t-glottalling to some degree is extremely common. In my own Leeds (WY) system, /t/ can glottal in data such as that set out in (1) below.

(1)

<table>
<thead>
<tr>
<th>fault</th>
<th>little</th>
<th>bent</th>
<th>bottle</th>
<th>cat</th>
<th>button</th>
<th>atlas</th>
<th>watson</th>
</tr>
</thead>
<tbody>
<tr>
<td>[fɔt]</td>
<td>[lɪt]</td>
<td>[bɛnt]</td>
<td>[boʊt]</td>
<td>[kæt]</td>
<td>[buʃn]</td>
<td>[ætlæs]</td>
<td>[waʊtən]</td>
</tr>
</tbody>
</table>

A second system found in London, Fife and also in Leeds, permits glottalling in the data items given above but glottalling has a much wider distribution (Leslie 1983, Broadbent 1985). Specifically, t-glottalling is permitted so long as the stress immediately following the /t/ is less than the stress immediately preceding it. For example:

(2)

<table>
<thead>
<tr>
<th>water</th>
<th>antique</th>
<th>artist</th>
<th>*artiste</th>
<th>syntax</th>
<th>*habitat</th>
<th>contest (n)</th>
<th>contest (v)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[wɔt]</td>
<td>[an'tɪk]</td>
<td>[a:'tɪst]</td>
<td>[sɪn'ækt]</td>
<td>[kɔn'test]</td>
<td>[hæbɪ'tæt]</td>
<td>[kɔntɛst]</td>
<td></td>
</tr>
</tbody>
</table>

As far as t-glottalling is concerned much work has been carried out on British systems over the past fifteen years or so, most notably by Leslie (1976, 1983, 1989 and 1991) and also by Broadbent (1985, 1990). Leslie has done much not only to reveal but also to attempt to relate the various glottal distributions in a way that no other researcher has come close to doing. (See also Harris (1990) and Harris and Kaye (1989). It should be noted however, that they erroneously regard all glottalling systems as close relatives of the one outlined by Kahn (1976) for General American (GA).)
Proponents of the special status of coronals argue that since t-glottals with greater ease
than /p/ or /k/, its representation must reflect this ability. Avery and Rice (1989) assume
that /t/ in English has the following structure.

(3)

\[
\begin{array}{c}
\text{Root} \\
\text{Laryngeal} \\
\text{Supralaryngeal} \\
\text{Place}
\end{array}
\]

(Avery and Rice 1989: 190.)

They argue that the representation of /t/ has much in common with that of glottal stop, in
that both lack oral place features. On the assumption that default coronal assignment is
optional, they argue that if coronal is assigned, /t/ is realised, otherwise it is realised as
glottal stop. This account goes against the widely held view that glottal stop is a
consonant which not only lacks place but also all supralaryngeal information (Lass
1976). Moreover, it seems counterintuitive that the presence of a Supra-Laryngeal node
would permit a glottal interpretation.

Once their account of t-glottalling is applied to a system which glottals /p/ and /k/,
problems arise. Specifically, t-glottalling is seen as a distinct process from /p/ and /k/
glottalling. t-glottalling is determined by optional default assignment, whereas /p, k/
glottalling is the loss of supralaryngeal (or at least place) information. In spite of these
objections to the precise details of their account, t-glottalling is a good example of
asymmetrical behaviour and if we follow Avery and Rice and assume that the reason
why /t/ in English is more likely to glottal than /p/ or /k/ is that /t/ is underspecified for place, then we have a representational means of capturing a reason why /t/, under appropriate conditions, glottals. ²

5.1.2. Yorkshire Assimilation

A second example of asymmetrical behaviour is that of Yorkshire assimilation (YA). YA is a regressive devoicing process which affects any voiced obstruent or cluster of voiced obstruents which occur immediately before a voiceless one, as in the data set out in (4).

(4)  

| vow | p
---|---
| crab sticks | [kɹap stɪks] | crab meat | [kɹab miːt]
| job club | [dʒɒp klʊb] | job loss | [dʒɒb lɒs]
| jazz singer | [dʒæs sɪŋə] | jazz dancing | [dʒæz dænsɪŋ]
| buzz to enter | [bʌs tuənə] | buzz buzz | [bʌz bʌz]
| g | k
| bag | bæk, bæks | big | bɪg
| bagpipes | baɪŋpɜɪps | big ben | bɪg bɛn
| big shop | bɪkʃɔp | big market | bɪg ma:kɪt
| dʒ | tʃ
| Bridge street | [bɹɪdʒ streɪt] | bridge over | [bɹɪdʒ oʊˈvə]
| Dodge City | [dɔdʒ sɪtɪ] |

Wells (1982) presents an account of YA as a straightforward devoicing process. However, when examples affecting /d/ are considered, the picture becomes more complicated.

(5)  

d → IPA
| vodka | [vɒˈkə] |
| godfather | [ɡəðfaˈðə] | vs godmother | [ɡədmʌˈðə]
| woodpecker | [wuˈpɛkə] |
| good concert | [ɡʊˈkɒntʃɑrt] |
| Leeds City | [liːz sɪtɪ] |

² t-glottalling is extremely complex and to discuss it here would go beyond the scope of the current discussion. See Broadbent (1985, 1990) and Leslie (1976, 1983, 1989 and 1991) for details.
When /d/ is subject to YA, at least in the WY variety under consideration, the /d/ never surfaces as a [t], as one might expect, so *vo[t]ka and *go[t]father are impossible realizations. The application of YA to /d/ always results in a [ʔ]. The question arises, why is it that all the other voiced obstruents, including a number of other coronals, simply devoice to their voiceless counterparts, whilst /d/ is obligatorily realized as glottal stop?³ We cannot claim that /d/ to [ʔ] illustrates an interaction between t-glottalling and YA, because t-glottalling is not obligatory. If the [ʔ] in [voʔkə] was a result of t-glottalling we would expect both [votkə] and [voʔkə]. So the problem is, why is it that /d/ is special with respect to YA in that it devoices to a glottal stop without ever surfacing as [t].

As yet no plausible account of the obligatory /d/ to /2/ is available. However, if /d/ is underspecified for A it is marked out as different from other obstruents. Consequently, YA provides a second example of the special status of coronals in English.

5.1.3. English Place Assimilation.

English Place Assimilation (EPA) provides a third example of asymmetrical behaviour.

The data in (6) below, is from Avery and Rice (1989: 191).

(6) i[m] Brussels
    i[m] France
    i[ŋ] there
    i[n] Toronto
    i[ŋ] Kingston (Avery and Rice 1989: 191)

³ On the matter of why some coronals pattern with the non-coronals (e.g. the palato-alveolar [dʒ]), in chapter 1 (ref 1.2.2.2) we saw that in Avery and Rice's modified contrastive underspecification approach, if a dependent of coronal was required in order to distinguish between two sounds, then the coronal node also had to be present. Consequently /s/ /z/ etc are specified for coronal and are therefore not special. However, the case is inconclusive, since if /z/ was also special it might be expected to surface as [h], but this segment is impossible in final position in English.
When this data is compared with the data in (7), we can see that the alveolar nasal /n/ assimilates freely, and this contrasts with the limited assimilation of [m].

(7) fro[m] Brussels
    fro[m] France
    fro[m] there
    fro[m] Toronto
    fro[m] Kingston

    (Avery and Rice 1989: 191)

Place assimilation in English is more extensive than this and includes not only the nasals but also /t/ and /d/. In his discussion of RP Gimson (1980) presents data which demonstrates this wider occurrence of place assimilation.

(a) tha[k] cup  tha[k] girl
    goo[b] pen  goo[b] boy  goo[b] morning
    goo[g] concert  goo[g] girl
    te[m] men  te[m] pairs  te[m] boys
(b) te[n] names,  te[n] tons  te[n] dogs
    te[n] kings  te[n] concerts  te[n] girls

    [Gimson 1980]
    (See Gimson 1980: 294-5)

First of all, notice that /t/, /d/ and /n/ freely undergo place assimilation, whereas /s/ and /z/, on the other hand, undergo assimilation just so long as the following consonant is either /ʃ/, /ʃ/ or /ʃ/. In this respect /s/ and /z/ assimilation looks like /m/ assimilation to a following labiodental as in fro[m] France, for example. Similarly, /l/ undergoes limited assimilation to other coronal place types: it will have a dental articulation when a dental

---

4 Stemberger (1991) provides evidence from speech errors that suggests that /s/ and /z/ are underlyingly underspecified.
fricative follows (e.g., *fill the*) and a palato-alveolar articulation when a palato-alveolar
follows (e.g., *call Jim*).

Finally, we should take into account the fact that neither the dentals nor the palato-
alveolars undergo place assimilation despite the fact that they too are coronal
consonants. This is entirely consistent with the claim that not all coronals are equally
special. Dentals and palato-alveolars have the same status as labials and velars in that
their place nodes are full, and place assimilation would require spreading and delinking.

As we have already seen in Chapter 1 (ref 1.2.2.2) Avery and Rice can account for EPA
as the spread of a place feature to an empty place node and furthermore they can account
for the greater frequency of coronal place assimilation as opposed to other place
assimilations in that all other place assimilation involves spread to a node that is already
occupied.

In sum, there is abundant evidence to support the claim that coronals have special status
in English and that the representation should reflect this. Given the representation
adopted in this thesis, asymmetrical behaviour indicates the underspecification of A.

What I propose to do now is to consider the implications of the fact that the
representation adopted in this thesis links the unmarked place with the unmarked vowel
in English for the claim that coronals are special because their place is underspecified.
5.2. The Implications of A-Coronal Approach

Since underspecification was first proposed it has provoked much criticism and is currently a far from uncontroversial theory. In the early stages Stanley and Lightner were concerned that underspecification permitted ternary oppositions: +, - and 0. This was successfully overcome by Archangeli’s model which included among other things the requirement that only one value for a specified feature should be specified underlyingly (with the other value supplied by a complement rule automatically created during alphabet formation). But many phonologists have remained wary of underspecification, often preferring full specification of features to any degree of underspecification whatsoever. One peculiar inconsistency in this reluctance to acknowledge feature underspecification is that many phonologists accept that syllable structure and stress may be built up during the course of the derivation, which, as Archangeli (1988) points out, is just the application of underspecification in other phonological modules. The point is that underspecification in syllable structure, for example, is simple because of the small number of possibilities involved, whereas in subsegmental structure the number of units and possible combinations is quite large and this gives the application of underspecification to subsegmental structure the appearance of being unconstrained. However, this is a superficial problem as recent changes in the literature show and we should bear in mind that there are a number of advantages to underspecification. For example, an approach which utilises underspecification has something insightful to say about the asymmetrical behaviour of certain consonants and vowels.

In recent years, underspecification has been dramatically affected by changes in the overall look of sub-segmental representation. Early forms of the theory, including
Archangeli’s (1984) version, required the eventual fill-in of all features. So for example, a vowel would ultimately receive specification for consonantal features, such as [-lateral], [-strident] etc. With the acceptance of feature geometry and the adoption of monovalent features much of the machinery required by underspecification (albeit cost free) has been done away with, making underspecification more constrained. Both Steriade (1987b) and Archangeli (1988) discuss ‘trivial’, or ‘inherent’ underspecification. A property may be said to be trivially (or inherently) underspecified if monovalent features are assumed. That is to say, if a feature such as [round], for example, is monovalent then such a feature may be present, or absent, but a segment can never be specified [- round]. Therefore, segments that are non-round are trivially (or inherently) underspecified for [round] by virtue of the monovalent nature of this feature. Alternatively, whenever a segment is specified for an articulator node such as [LABIAL], for example, it is trivially underspecified for [anterior], because [anterior] is a dependent of [coronal] and may only be specified if [coronal] is specified. So the adoption of monovalency has had a dramatic effect on the amount of information that is potentially underspecifiable. Particle phonologies are monovalent ‘feature’ theories and as such encode inherent or trivial underspecification.\footnote{In a series of papers Anderson and Durand (1988a, b; 1991) explore the possibility that in certain types of vowel system it might be possible to derive the underspecified vowel from the system-geometry. For example, Yawelmani has 4 vowels underlyingly /i, a, o, u/ (and /i, a, o, u/). In DP this system can be represented using components as in (1):}

\begin{verbatim}
  /i/ {il /u/ (u}
  /a/ (a)
  /o/ {al (a, u)
  /u/ {a}
\end{verbatim}

Anderson and Durand (1988a: 17) comment that /i/ is the odd man out in this system in the sense that /il/ is the only component that does not occur in combination with /lal/ or /ulu/. So /i/ is a candidate for underspecification not only because it is the epenthetic vowel in this language but also for structural reasons. Anderson and Durand therefore propose that for systems such as Yawelmani, the underspecified vowel can be selected on the basis of the geometry of the system and they propose a principle to capture this:

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Related to underspecification is the issue of markedness. "Markedness refers to the formal properties that account for cross linguistic patterns in languages." (Archangeli 1988: 195). So formal properties should reflect the fact that coronals are less marked than, say, labials; 3 vowel systems are less marked than 5 or 7 vowel systems; palatals are highly marked whereas palato-alveolars are unmarked for the palatal zone of articulation.  

Anderson and Durand (1988a), and Anderson and Ewen (1981) argue that markedness considerations are built into DP representations. Anderson and Ewen (1981: 21) state that:

"Basic to the characterisation of segments within dependency phonology is the notion that the representation of segment-types should reflect their relative inherent complexity."

So, for example, the unmarked nature of a three vowel system is reflected by the fact that the particles are not required to combine. Five vowel systems are also relatively unmarked, they are certainly less marked than 7 and 9 vowel systems which require increasing degrees of combinatorial complexity. Similarly, the unmarked nature of front

---

(2) system-geometrical principle 1

\[
\begin{align*}
\text{system geometry} & \quad \text{minimally specified} \\
\{X\}, \{X, a\}, \{a\}, \{Y, a\}, \{Y\} & \quad \{Y\} \\
\end{align*}
\]

(Anderson and Durand 1988a: 17)

Since X and Y are variables ranging over \{i\} and \{u\}, and \{\} indicates the absence of this combination, the minimally specified vowel is \{Y\}. Only one fill-in rule is required: the default rule given in (3) below.

(3) \{\} \rightarrow i

Anderson and Durand 1988a:18

This equation of underspecified vowel with the component that does not enter into combination is an interesting proposal, in that there is an attempt to explain why this particular system selects a particular vowel as the underspecified vowel. In further papers (Anderson and Durand 1988b, 1991) they have considered deriving the underspecified vowel for 5-vowel systems such as Nez Perce.

Perhaps the fact that palatal is marked and palato-alveolar is selected as the unmarked option for that zone supports the claim that palatals are not coronals. That is to say, palato-alveolars are selected in preference to palatal precisely because they are coronals. (See Chapter 6, section 6.2.)
unrounded vowels is captured by the fact that they are simpler to express than their marked counterparts front rounded vowels. This is illustrated in (9).

(9)  

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>/i/</td>
<td>/i/</td>
<td>/y/</td>
</tr>
<tr>
<td>/e/</td>
<td>/i,al</td>
<td>/ø/</td>
</tr>
</tbody>
</table>

British English exhibits the marked low back round vowel [ɔ] and according to Archangeli (1988) has a learned rule which overrides the universal preference for low back non-round vowels. On a Dependency approach the low back round vowel is simply more complex than its nonround counterpart by virtue of the fact that it incorporates combination. Therefore, complexity is mirrored by particle combinations and does not require additional machinery. In sum, the preferred vowel configurations are preferred precisely because they are the simplest to express. Thus much of the 'cost free' universal default/complement rules and the 'cost full' learned rules proposed by Archangeli have become redundant. A Particle Phonology approach like the Dependency approach can mirror markedness. So, for example, when the PP representation for front round vowels is compared with that of their non-round congeners we can see that the former are more complex than the latter.

(10)  

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>/y/</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>/i/</td>
<td>/i/</td>
<td>/y/</td>
<td>U</td>
</tr>
<tr>
<td>/e/</td>
<td>/i,al</td>
<td>/ø/</td>
<td>/lu,i,al</td>
</tr>
<tr>
<td>/e/</td>
<td>/e/</td>
<td>/ø/</td>
<td>/æ/</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>/æ/</td>
<td>A</td>
</tr>
<tr>
<td>/e/</td>
<td>/e/</td>
<td>/æ/</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>/æ/</td>
<td>U</td>
<td></td>
</tr>
</tbody>
</table>

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But what is it about the representation of coronal (i.e. A) that is less marked than the representation of labial (i.e. U)?

It is generally accepted that English can be accounted for in terms of universal markedness considerations. However, just as lip service was paid to the claim that coronal is the unmarked and special category, universal markedness considerations have been treated in much the same way, although Particle theories, as we have seen above, have made important advances in this respect. Therefore in this section I shall set out to determine an approach to underspecification in English and attempt to show why it might be that the coronal representative is universally unmarked.

In English the vowel that is assumed to be the underspecified vowel is schwa. Support for this claim comes from the fact that it is the most common vowel in English and it is the reduction vowel. As far as consonants are concerned, the unmarked and special status of certain coronals is evidenced by their asymmetrical behaviour in a number of phonological processes.

Although it is uncontroversial to say that the unmarked vowel in English is schwa and that coronal is the unmarked place, there is no established relationship between the two in any theory. Consider, in this regard, the DP representation of Schwa. In chapter 2, we discussed the fact that the DP approach to schwa in English took into account its role as the reduction vowel. Recall that DP has two possible representations for schwa: the centrality component ləl, which represents schwa in non-vowel-reducing languages and the categorial gesture lvl, which represents schwa in vowel-reducing languages. Dependency phonologists account for vowel reduction in English as the loss of
articulatory information leaving IVI. This account of vowel reduction has a certain appeal. However, we have already argued at length that if we assume IVI is the representative of schwa, then we lose the principled account of r-sandhi as Glide Formation; we lose the schwa/A vowel lowering effects and on this account we cannot establish a link between [t], schwa and [r], since [t] would only contain {ICI} in its categorial gesture, and {IVI} would not be present.

As we have seen above it is not only schwa that is special in English. We have seen evidence to support the claim that coronal is the unmarked place. Anderson and Ewen (1981) specifically address the representation of coronal in their consideration of the voiced stop series /b, d, g/. /b/ and /g/, first of all, as characterised in (11) share in common the gravity component lul.

\[
\begin{array}{c}
/g/ \quad \text{lul} \\
|C:VI| \\
\end{array}
\quad
\begin{array}{c}
/b/ \quad \text{lul} \\
|C:VI| \\
\end{array}
\quad
\text{Anderson and Ewen (1981: 21)}
\]

The linguality component lll, is also present in /g/ to indicate the activity of the tongue blade/body. However, in /d/, illustrated in (12), the linguality component is redundant since this is the unmarked position for consonants.

\[
\begin{array}{c}
/d/ \\
\{C:VI\} \\
\end{array}
\quad
\text{Anderson and Ewen (1981: 21)}
\]

In this way Anderson and Ewen (1981) encode coronal underspecification in DP. However, there appears to be no reason why it should be the linguality component that is unmarked and underspecified rather than the gravity component.
The account proposed and developed in previous chapters has one very interesting consequence namely, that schwa (the unmarked vowel in English) is represented by A (the unmarked particle)\(^7\) and coronal (the unmarked consonant place) has been equated with A. In other words the representation argued for in this thesis collapses three unmarked entities into one. Consequently the issue that we are now concerned with, is why A should be underspecified. First of all, I assume that English is a language which can be dealt with by appealing to universal markedness considerations. At first sight it might appear that all I have done is to reiterate what other people have already claimed. However, this is not so. So far, people have simply stated that coronal is the universally unmarked place so that it can be underspecified. The basis for claiming that coronal is underspecified is the fact that coronals are the most frequent consonants in the world's languages and, furthermore, that they exhibit another property associated with unmarked/underspecified properties namely, asymmetrical behaviour. Now in the same way that Paradis and Prunet challenged the blind acceptance that coronal was special without attempting to relate that specialness to the representation, we are now in a position to take this one step further. Since A is to be underspecified, the question, which we need to address is, why is A the unmarked particle which makes it such a good candidate for underspecification?

Presumably A is unmarked for much the same reason that Paradis and Prunet were able to argue for the unmarked status of [+anterior].

\(^7\) It is interesting from the point of view of the account being proposed in this thesis that A is regarded by Dependency Phonologists as the unmarked articulatory feature for vowels.
"The physiological rationale behind the phonological claim that [+anterior] coronal is the unmarked place of articulation for consonants is that the position involved in [+ anterior] coronals is the basic position of the tongue body, neither front nor back."

(Paradis and Prunet 1989: 321)

Following this line of reasoning, we can propose that A is unmarked in that it is the position closest to 'rest'. So movement away from 'rest' is more marked and this explains why I and U are more marked than A. Support for this view can certainly be drawn from the fact that /a/ is the only universal vowel. In other words, all languages have a vowel which comes close to the 'rest' position.⁹

Given the claim that the position closest to rest is the unmarked particle A, any language which chooses to underspecify its A particle is adopting the unmarked option. Notice that on this approach the underspecification of schwa and a-type vowels is the same thing. If a language has one central vowel /a/, then A corresponds to /a/. If the language has /a/, as in English, then A corresponds to /ə/.

As for the role of A in consonantal place, it is important to stress that there is no contradiction here between coronal which involves tip/blade raising and the claim that A (i.e. schwa/a) is, roughly speaking, the 'rest' position. In the phonology we have claimed that combinations of I, U, and A are our points of reference. If A is equated with the rest position (or neutral position) and A is present in a consonantal structure, this should

⁸ Archangeli notes (1984: 63) that "if there is no phonological evidence in the language about vowel quality, /a/ is the least marked vowel..." Since A can represent schwa and a range of vowels including /ə/ and /a/, we can account for all languages which represent these vowels by A.

⁹ As I have already mentioned, Clements (1976: 97) took issue with Chomsky and Halle's definition of the neutral position. Clements argued that this was better thought of as schwa.
suggest that the tongue body is in the "neutral position". Tongue tip raising will be supplied in the Phonetic Component.

So if A is the least-marked particle and can therefore be underspecified, which instances of A will be underspecified? Consider the West Yorkshire vowel system once again.

\[
\begin{array}{cccc}
/l/ & I & U & /u/ \\
/l/ & I & U & /u/ \\
 & A & A \\
/e/ & I & U & /o/ \\
 & A & A \\
/e/ & A & /o/ & A \\
 & A & /o/ \\
/a/ & A & A & /o/ \\
 & I & U \\
 & A & A \\
\end{array}
\]

Since English elects to underspecify the unmarked particle, perhaps the simplest assumption to make is that A (i.e. schwa) is absent in a system such as the one given above. This will require one default rule:

\[
[ ] \rightarrow A
\]

In the remaining mid-low and low vowels, head A is in combination with a tonality particle and so following the reasoning that a node will be specified if some other feature is dependent upon it, I shall assume that head A’s are underlyingly present. Essentially, this is just to adopt the argumentation of Avery and Rice and of Paradis and Prunet, and to apply it to a particle theory. Both assume that universal markedness can be overridden.
by other considerations. Avery and Rice label this the Node activation Constraint (NAC)
repeated from Chapter 1 page 59 for convenience:

(14) **Node Activation Constraint**

"If a secondary content node is the sole discriminating feature between
two segments, then the primary feature is activated for the segments
distinguished. Active nodes must be present in underlying representation." (1989: 183)

Paradis and Prunet label this the Node Generation constraint (NGC)

(15) **Node Generation Constraint**

"A rule or convention assigning some feature or node x to some node b creates a
path from x to b."

The upshot of this is that if A is the head of mid low vowels, for example, it will have
dependents and so it cannot be underspecified.

This leaves the possibility that dependent As could be underspecified. However, if this
was possible, it would require two default rules, one providing [ ] → A dependent -
which would supply A in its lowering/laxing capacity - and the default rule posited in
(14) supplying A as a head. Consequently, I shall assume that only A that does not occur
in combination may be underspecified.

If we turn our attention to coronal consonants, I shall assume for now that the only
instance of A which can potentially be left underspecified is the alveolar representative
in (16b), where A occurs in isolation.
More specifically, as far as the representation of /t, d, n, l, r/ in English is concerned, I shall tentatively assume the following structures.

I assume that /l/ is specified for A whereas /r/ is not. We have seen two examples which suggest that A is specified in /l/. In chapter 3, data was presented in which the appearance of schwa before /l/ in certain varieties of English was given as evidence that /l/ contains this particle (e.g. feel [fɪəl]). The claim was that the schwa is the place component of a weakening /l/. In section 5.1.3 above, I commented on the fact that /l/

---

I have avoided the discussion of other features throughout. In these diagrams I have employed the following shorthand forms: voi = voice; Nas = nasal. Presumably /l/ will be specified for sonorant and possibly also for lateral. However, I have assumed here that /l/ differs from /r/ in that /l/ is specified for place and /r/ is not.

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undergoes limited place assimilation. Once again, this suggests that \( A \) is specified. This in turn suggests that \(/r/\) and \(/l/\) are contrastive and that the model of underspecification we should adopt is a modified contrastive approach following Avery and Rice (1989). This line of reasoning has certain consequences for the representation of \(/s/\) and \(/z/\). Specifically, it means that they will be specified underlyingly for \( A \), since they contrast with both \(/θ\), \( δ/\) and \(/ʃ, ʒ/\).

So \( A \) is underspecified resulting in schwa and alveolar coronal underspecification in English. But at what point is \( A \) filled in? First of all, we may ask whether vowel reduction provides any clue in this regard. The answer depends upon which vowels can reduce. If all vowels can reduce to schwa then, on the approach being developed here, vowel reduction is the loss of \( v \)-place information. \( A \) would then be filled in by phonological default resulting in schwa. (If, on the other hand, all vowels except \(/i/\) and \(/u/\) reduce, then the account would be that vowel reduction would be the loss of the tonality particle.) However, we do know that vowel reduction must occur prior to GF since vowels that have reduced to schwa produce an r-glide. Their non-reduced counterparts exhibit their usual head glides.

(19) piano in non-reduced [pianowin] reduced [pianər in]

Notice that schwa itself participates in glide formation. So \( A \) must be filled in in vowels prior to GF. We also know that some GF is lexical. For example, \textit{fearing} and \textit{bananary} exhibit obligatory cases of the r-glide. This suggests that the vowels are fully specified
by this stage of the phonology. However, the same cannot be said for the
underspecified consonants.

Some of the phenomena that reveal the special status of coronals such as t-lenition, and
EPA occur fairly late in the phonology. So when do alveolars receive A? Do they need to
receive A? We could argue that A is assigned to non-consonant forms lexically and then
post-lexically at the very end of the derivation A is assigned to consonantal positions.
People who argue for the full specification of the inventory before entering the phonetics
would want to see this. However, the question arises: why would we want to do this?
There might be a certain reluctance to supply A to a consonant, after all it will still be
'incomplete'. But this is misleading, in that the structure that results once A is filled in is
only imperfect from the point of view of the phonetic implementation. As far as the
phonology is concerned A is an active phonological unit. Consequently, I will assume, in
line with mainstream underspecification theory, that A is supplied to consonants at the
last possible stage in the phonological component. In languages where coronals are not
special, or where the underspecification of A is limited, A is either present throughout or
will be filled in early in the derivation.

So we have suggested that English is a universally unmarked particle selector, which
means that it selects 'rest' as the predictable place for consonants and vowels.

In chapter 3 we considered the possibility that properties such as coronal and glottal stop
might usefully be regarded as 'manufacturers' default settings which come into play when
the 'user', i.e. the phonological component in this case, has failed to provide an adequate

---

11 It may be that A fill-in is far more widely available than is being suggested here. For example, on-
line hesitation phenomena often result in a long schwa-type unit.
setting of its own. On the account proposed above, coronal is hardwired, whereas A default is not. A-default need not be selected i.e. schwa/a need not be underspecified, but any system which does not do so, presumably does not do so at a price. However, whether a system selects A in line with universal markedness or not, coronal is always assigned by the phonetic implementation. There is still much work to be done to flesh this out, but this is a thesis on subsegmental structure and not an attempt to develop a full theory of underspecification.

5.3. Summary

In this chapter I have considered evidence which suggests that coronals have special status in English. Underspecification of coronal provides a convincing means of capturing this special status. However the position adopted here is that it cannot be coronal itself that is underspecified since coronal is not a phonological feature. Rather, we are concerned with A underspecification. Furthermore, on the account developed in this thesis the unmarked place, coronal, is related to the unmarked vowel schwa and with the unmarked component A, thereby tying the special coronals in with the asymmetrical vowel: something which no other particle or feature approach has achieved.

5.4. Development

We have now concluded our considerations of the representational issues surrounding coronals. The representation adopted is a hierarchically organised particle approach which employs underspecification. The selection of this representation is motivated by a wide range of data considered throughout. However in general, proponents of unified place features for consonants and vowels, assume that coronals share their place
representation with front vowels. Consequently in the final chapter of this thesis, I shall look once again at the coronal-front vowel connection and consider what the approach developed in this theory has to say about some of the key data adduced for that assumption.
CHAPTER 6

In this thesis, a relationship has been established between coronal place and A. In chapter 5 we considered the implications of this relationship for the Special Status of Coronals debate and claimed not only that the account developed in the initial chapters was compatible with this debate, but that it contributed to the level of explanation achieved, in that we had collapsed the problem of the unmarked natures of schwa-/a/ type vowels, the particle A and coronal place into one. However, as we saw in chapter 1, the widely held view is that coronals (including palatal) consonants and front vowels form a natural class characterised by the feature [+coronal]. In this chapter, therefore, I shall reconsider some of the evidence put forward in support of this natural class. I will argue that in some cases there is really no coronal-front vowel interaction. In other cases, however, there is, and I will argue that in such cases although a natural class composed of coronals, palatals and front vowels appears to be motivated, it is not the natural class [+coronal]. I will set out to show that this evidence can be adequately accounted for in an approach which equates coronals with schwa-/a/ type vowels, represented in the phonology by A. I will also argue that exponents of the front vowel-coronal connection are forced to adopt a number of undesirable theoretical assumptions which call their approach into question. This chapter is structured as follows. In section 6.1, I shall outline the main points of the most recent characterisation of the coronal front vowel position developed by Hume (1994) and Clements and Hume (1995). 6.2 will consider the case of palatalisation, which I will argue does not provide support for coronals, front vowels and palatals forming the natural class [+coronal]. Section 6.3 will look at the case
study of Maltese Arabic presented in Hume (1994) as support for coronals and front vowels forming the natural class [+coronal]. Finally, in section 6.4, I will consider three examples that arguably do support a natural class composed of coronals, front vowels and palatals.

6.1. The Coronal-front vowel model

The purpose of this section is twofold. First of all, it will provide an outline of the coronal-front vowel model so that we can then evaluate the account of palatalisation described in (6.2) and aspects of Hume’s work on Maltese Arabic (6.3). Secondly, to demonstrate that a model which assumes coronals and front vowels share the place feature [coronal] encounters a number of undesirable theoretical consequences. I shall focus primarily on the version of the model described in Hume (1994) since this is the most detailed exposition of the coronal-front vowel position. ¹ 6.1.1. will therefore focus on Hume’s Feature Geometry and 6.1.2. will focus on the definition of [coronal].

¹ There are a number of minor differences between the model of Hume (1994) and that of Clements and Hume (1995) and these will be indicated where appropriate.

In chapter 1, we considered the way in which unified place features have been incorporated into Feature Geometry. Specifically, we saw that Hume (1994) and Clements and Hume (1995) assume that [Labial], [Coronal] (with dependents [anterior] and [distributed]), [Dorsal] and [Pharyngeal] are present under place in both consonants and vowels. Since we are concerned here with the use of this model to justify the natural class of coronal consonants and front vowels, I shall recap and develop the outline given in chapter 1. Hume (1994) adopts a constriction-based feature geometry.

"...any segment produced in the oral tract has a characteristic constriction, defined by two principal parameters, constriction degree and constriction location. Since vocal tract constrictions determine the shape of the acoustic signal and thus contribute directly to the way in which speech is perceived, they can be regarded as constituting the effective goal of articulatory activity." (Clements and Hume 1995:275-6)

Consider the partial representation of /s/ given in (1) using Hume’s (1994) model.3

---

2 I shall henceforth refer only to Hume (1994) for the sake of brevity. This should, however, be interpreted as Hume (1994) and Clements and Hume (1995).

3 One respect in which Hume (1994) is different from Hume (1993) and Clements and Hume (1995) is that they differ in certain aspects of the geometry. So, the stricture node does not exist in the latter paper. In Clements and Hume (1995) consonant stricture features are dominated by the oral cavity node whereas in vowels they are dominated by the aperture node. In Hume (1994), stricture features are dominated by consonantal and vocalic.
In a consonant, the consonantal node dominates the nodes stricture and place. Stricture dominates features which characterise the type of constriction: [continuant] and [strident]. Place dominates articulator nodes: [labial], [coronal], [dorsal] and [pharyngeal]. (2) below illustrates in more detail the place node assumed by Hume (1994):

---

4 In SPE the distinctive features were largely articulatory and in this respect [strident] was peculiar in that it was an acoustically defined feature. Katamba (1989: 51) describes it as "a relic retained from the original Jakobsonian system." Modern feature geometries are based on articulatory phonetic features. I can find no trace of the feature [strident] in (Sagey 1986). However, Kenstowicz (1994) discussing feature geometric models includes [strident] without any discussion of its position in an essentially articulatory system. Likewise Hume does not discuss the role of this feature in the system she employs.
The structure of /i/ given in (3) illustrates the structure assumed for vowels:

(3) Root
   .
   .
   .
Cons
  place
Voc
  stricture
  place
  [+high]
  [+coronal]

Hume (1994:100)
In vowels, the stricture and place nodes are immediately dominated by Vocalic (Voc). In a consonant with secondary articulation both the consonantal and vocalic place nodes are present and dominate features. Hume illustrates this with an example of a palatalised labial:

\[
\begin{array}{c}
p^j \\
\text{Root} \\
\text{•} \\
\text{•} \\
\text{•} \\
\text{Cons} \\
\text{stricture} \\
\text{[labial]} \\
[-\text{cont}] \\
\text{Voc} \\
\text{place} \\
[+\text{coronal}] \\
\end{array}
\]

Structure of \(p^j\)

(Hume 1994: 101)

To guarantee that the primary articulation is a labial rather than a coronal, Hume assumes that the stricture features apply to the Place features immediately dominated by Cons place. She formalises this relationship as follows:
(5) The Constriction Relationship Principle (CRP)

Feature [F] immediately dominated by a stricture node S applies to articulator [G] immediately dominated by a place node P if S and P are sisters. (Hume 1994: 101)

Hume states "Consistent with Sagey, I assume that the stricture features of the minor articulator need not be specified underlyingly as they are generally predictable." (Hume 1994: 101). Hume argues that this allows her to dispense with the arrow notation employed by Sagey (1986) to indicate the primary articulation in a complex segment.

There are a number of additional points to notice about this approach. First of all, as already pointed out in chapter 1, all vowels contain a consonantal node and this enables Hume to account for the relative ease with which vowels spread across intervening consonants. Secondly, although consonantal and vocalic exist on separate planes, the articulator features occur on the same tier. Consequently, if /s/ is followed by /i/ the two instances of [coronal] will be adjacent on the [coronal] tier. Thirdly, articulator features such as [coronal] are monovalent in consonants, but bivalent in vowels, whereas [anterior] is bivalent in consonants but monovalent (i.e. [-anterior]) in vowels.5 (I shall return to this point below.)

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5 Clements and Hume (1995) differ from Hume in this respect. They address the problem that if features are monovalent in consonants they should presumably be monovalent in vowels. But problems arise in vowel harmony of the type found in Turkish, for example, which relies on [alpha back]. In order to avoid [-back], they consider the inclusion of [lingual] in their geometry. [Lingual] would dominate [coronal] and [dorsal] and Turkish harmony could be accounted for with reference solely to [lingual]. Hume (1994) does not adopt [lingual].
6.1.2. Defining [Coronal].

Hume (1994) looks in considerable detail at what it means to say that palatal consonants and front vowels are [coronal], because she argues that although people have claimed that front vowels, for example, are [coronal] no one has really considered what such a claim amounts to. There is, of course, one notable exception to this: Clements (1976). Recall from the discussion in chapter 1 that in order to relate coronals and front vowels, Clements challenged the definition of the neutral position. He proposed that if the neutral position was assumed to be schwa rather than [e], as in SPE, then the front vowels would by definition be coronal. Hume (1994) on the other hand sets out to demonstrate that the 'crown' of the tongue is not only the tip and blade of the tongue, but also the front of the tongue body as well. That is to say that the definition of coronal is tongue tip, blade and/or front raising. To achieve this she looks at languages in which palatal consonants pattern with alveolars.

6.1.2.1. Hungarian Palatals.

Hungarian is a language which has palatal consonants. Using X-ray tracings of the palatal consonants [c, j] Hume observes that the blade and tip of the tongue are not

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6 Hume (1994: 34) gives the underlying inventory of Hungarian consonants

Hungarian Consonantal Inventory:

<table>
<thead>
<tr>
<th>Stops</th>
<th>labial</th>
<th>labio-dental</th>
<th>dental</th>
<th>palato-alveolar</th>
<th>palatal</th>
<th>velar</th>
<th>laryngeal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labials</td>
<td>p, b</td>
<td>t, d</td>
<td>s, ʃ</td>
<td>ʒ</td>
<td>c, j</td>
<td>k, g</td>
<td>h</td>
</tr>
<tr>
<td>Fricts</td>
<td>f, v</td>
<td>s, z</td>
<td>s, ʒ</td>
<td>tʃ</td>
<td>ʒ, c, j</td>
<td>h</td>
<td>ɣ</td>
</tr>
<tr>
<td>Affs</td>
<td>s, ŋ</td>
<td>ʃ, ʒ</td>
<td>ʒ, ɣ</td>
<td>h</td>
<td>p</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasals</td>
<td>m, n</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquids</td>
<td>l, r</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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involved in the articulation of palatal consonants, they are made with the front of the tongue body. Having established this, Hume considers two processes of Hungarian phonology in which palatals pattern with coronals. In the first of these, palatals and coronals act as triggers in a process known as fricative affrication. In the second process, known as stop affrication, palatals and coronals are the target.

In fricative affrication, then, /s, j/ become the corresponding affricate [ts, dz] respectively when they are preceded by /t, d, c, y/. This is illustrated by the data in (6).

<table>
<thead>
<tr>
<th></th>
<th>mountain</th>
<th>hej+je:g</th>
<th>[hejje:g]</th>
<th>'mountain range'</th>
</tr>
</thead>
<tbody>
<tr>
<td>barat</td>
<td>friend</td>
<td>barat:ja:g</td>
<td>[bara:tya:g]</td>
<td>'friendship'</td>
</tr>
<tr>
<td>öt</td>
<td>five</td>
<td>öt+sör</td>
<td>[öttösör]</td>
<td>'five times'</td>
</tr>
</tbody>
</table>

(Hume 1994: 35)

---

7 According to Vago (1980: 34) an obstruent agrees in voicing with a following obstruent. For example:

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>kalap</td>
<td>'hat'</td>
<td>kalapban [bb]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>kút</td>
<td>'well'</td>
<td>kútban [db]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>zsák</td>
<td>'sack'</td>
<td>zsákban [gb]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rész</td>
<td>'part'</td>
<td>részben [zb]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ketrec</td>
<td>'cage'</td>
<td>ketrecben [dzb]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>rab</td>
<td>'prisoner'</td>
<td>rabtól [pt]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>kád</td>
<td>'tub'</td>
<td>kádtól [tt]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>meleg</td>
<td>'warm'</td>
<td>melegtól [kt]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>viz</td>
<td>'water'</td>
<td>víztöl [št]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>varázs</td>
<td>'magic'</td>
<td>varázstól [st]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ágy</td>
<td>'bed'</td>
<td>ágytól [tvt]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On page 37 Vago makes specific reference to 'mountain' hegy and 'mountain range' hegyseg [ČČ], indicating that voicing assimilation has taken place.

8 According to Vago (1980: 37) the result of affrication is a geminate affricate. He represents these geminates as [tst], for example. Geminate affricates are more usually represented as [ts].

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When the data in (6) above is compared with that in (7) we find that this process occurs within the word only.

(7)  

| [kə:t se:k] | two chairs  | *[kə:tse:k]  |
| [nəjsobor] | large statue | *[nəjsobor]  |
| [rovid ʃor] | short line   | *[rovid ʃor] |

(Hume 1994: 35)

Finally Hume gives data such as that in (8) to illustrate that it is only coronals and palatal stops that trigger this process.

(8)  

| [təpʃi] | baking tin | *[təpʃi]  |
| [emʃe]   | sow        | *[emʃe]   |
| [vakʃa:g] | blindness  | *[vakʃa:g] |

(Hume 1994: 35)

On the basis of this data Hume characterises fricative affrication as:

(9)  

| operation: | spread [-cont]  |
| trigger:   | [coronal,-continuant,-sonorant]  |
| target:    | [coronal,+continuant,-sonorant]  |
| direction: | left to right  |
| domain:    | word  |

---

9 Dick Hayward (pc) has questioned the usefulness of this data. He points out that we would not expect [p] to interact with [ʃ], whereas we might expect it to interact with [f] giving rise to the affricate [pf].

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The second process, that of stop affrication, is a total assimilation process whereby /t, d, c, ʃ/ totally assimilate to a following affricate. This is illustrated by the data in (11) and Hume's characterisation of the process is given in (12).

(Hume 1994: 36)
On the basis of these two processes Hume argues that since palatal stops are seen to pattern with coronals and since Hungarian palatals are demonstrably made with the front of the tongue rather than with the tip or blade, [coronal] should be redefined to include...
the tongue front. In other words, palatals pattern with traditional coronals, and therefore palatals must also be coronals.

Once one has included tongue front in the definition of coronal, not only palatal consonants but also front vowels can be characterised as [+coronal]. To establish this fully, Hume goes on to compare /i/ with /j/ in Hungarian and with /ç/ in German, and shows that both are formed with the front of the tongue raised towards the hard palate.

(13)

![Diagram showing Hungarian /j/ and /i/](image)

Hungarian /j/ /i/

She then compares front and back vowels i.e. /i/ versus /u/ to show that in front vowels it is the front of the tongue which is raised more than the back of the tongue.

(14)

![Diagram showing Hungarian /i/ and /u/](image)

Hungarian /i/ /u/

---

10 Hume refers to K. Bolla (1980).
Hume concludes that coronal has to be redefined to include raising the front of the tongue.

With [coronal] defined as tongue tip/blade/front raising, we find that [coronal] demonstrates a greater 'flexibility' in consonants than it does in vowels. First of all, coronal consonants can be produced anywhere from the teeth to the hard palate. Coronal vowels, on the other hand, are restricted to the hard palate. Notice that we cannot make the same observation with respect to the use of [labial] or [dorsal] in consonants and vowels. And although this observation does not necessarily undermine the overall approach to unified place features for consonants and vowels, it suggests that [coronal] is in some way different.

Secondly, this 'flexibility' applies not only to regions but also to parts of the tongue. Front vowels involve the front of the tongue and are never made with the tongue
tip/blade only, whereas coronal consonants can be made with the tip or blade or, on Hume's approach, the tongue front. If coronal exists on one tier for both consonants and vowels why is there such a disparity i.e. why can consonants employ the full range of possibilities whereas vowels do not?

Further problems arise when we consider Hume's account of palatalisation. In 6.2.1 I shall look at the way in which Clements and Hume's position has been developed in order to answer much of the recent criticism levelled against their model. I will argue that as this position has been developed, new problems have replaced the old ones. In 6.2.2, I shall then argue that palatalisation processes can be accounted for with a coronal-A approach.

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11 Hume citing Wood (1979) claims that in languages such as Dutch, Swedish, Danish, German, and French the front vowels involve front and blade raising where blade raising is said to contribute to the stability of resonance in /y/.

12 In my account palatals and front vowels involve tongue front raising, thus there is no mismatch between the use of the particle in consonants and vowels. Coronals are blade or tip raising and the flexibility in place covered by this value does not show any mismatch between consonants and vowels, moreover coronal is phonetic. What is more, the [anterior] problem falls away too.
6.2. Palatalisation

6.2.1. The Feature Geometric Approach to Palatalisation Processes

As we saw in chapter 1, the mainstream approach to the coronal-front vowel connection can be traced back to Clements (1976). Clements took as his starting point the palatalisation process velar fronting (see chapter 1 49-51). One example of velar fronting comes from Slavic where the velars /k, g, x, y/ become [tʃ, dʒ, ʃ, ʒ] when followed by /i, e, æ, j/ as in

(15) k → tʃ

vnuk 'grandson'
vnúk + ik → [vnutʃik] (dimin)
vnúk + æ → [vnútʃa] (dimin)
tʃlovek 'man'
tʃlovek + e → [tʃlovetʃe] (voc)
tʃlovek + æ → tʃlovietʃæ → [tʃlovietʃa] 'children'
g → dʒ
cveng 'sound'
cveng + +t' → cvendʒæt' → [cvendʒat'] to sound
x → s
strach 'fright'
strach + i + t' → [straʃit'] 'frighten'
y → z
boh 'god'
boh + e → [bozɛ] (voc)
beh 'run (N)
beh +æ+ı' → beʒæt' → beʒat' 'to run'

(Hume 1994:143)

13 Although Clements was not the only exponent of a coronal-front vowel connection in the early 70's other approaches, such as that of Hyman (1973), did not win widespread support (see the discussion of these early claims in chapter 1 section 1.2.1.2).
In essence his argument was that since the result of velar fronting by a front vowel was a coronal consonant (e.g. /k/ → [tf]/_/i/), the velar must be assimilating to some property of the front vowel. Since the palato-alveolar affricate and the front vowel must have something in common, the conclusion was that that property was [+coronal]. On the basis of this, Clements proposed that front vowels were [+coronal]. In Clements (1989, 1991), where this relation between coronal and front vowels was incorporated into mainstream feature geometry, palatalisation was viewed as a two-stage process. First of all the vowel-place [coronal] spread to the V-place of the consonant as in (16a). Clements argued that the newly created v-place coronal was tier promoted, that is to say “reassigned”, to the c-place tier, as in (16b), changing /k/ into [tf].

(16a) Place
     \      \                        Place
  c-place      vocalic          vocalic
     Dorsal
   v-place
  v-place
     Coronal
But /k/ to [tʃ] is not the only type of palatalisation that should be taken into consideration, there is also /t/ to [tʃ]. In Clements' approach the question arises why would coronal spread and undergo tier promotion to replace an existing coronal value?

In addition, Lahiri and Evers (1991) pointed out that Clements' approach to palatalisation processes predicts that such processes always pass through a transitional phase where the
target exhibits secondary articulation. Citing Bhat (1976), they point out that although such two-stage processes do occur, they are rare.

In Hume (1994) these points are addressed. But as we shall see, attempts to secure this position have forced the adoption of some ad hoc assumptions.

Hume is careful to separate secondary articulation-type palatalisation from the process which she calls coronalisation: velar fronting and coronal place change (CPC). Perhaps the main difference between coronalisation and palatalisation proper lies in whether the place value that spreads from the vowel is subject to a constriction status change.

Consider the following.

In (18) above the feature [F] spreads from the vocalic plane of the vowel to the interpolated vocalic plane of the consonant (where bracketed nodes indicate interpolated
structure). The feature [F] has not undergone a constriction status change and so it will still receive a vocalic interpretation. In this way Hume accounts for secondary articulation-type palatalisation processes.

This type of spreading is the unmarked option. It is unmarked because the feature spreads within the same plane, triggering the interpolation of appropriate structure. Coronalisation, on the other hand, is the marked option in that a constriction status change is required and is essential in order to block interpolation. Hume, following Piggot, Paradis, etc., assumes that the constriction status change is parametrically determined. The parameter adopted is given in (19) below.

(19) constriction status change YES/NO (Hume 1994: 135)

For coronalisation, then, the parameter is set to YES. This means that when the vocalic feature [F] spreads, it spreads from the vowel plane to the consonantal plane where it is interpreted as consonantal information. \(^{14}\) In (20) below, this is illustrated by velar

\(^{14}\) Hume (1994) gives the case of Acadian French which appears to be an example in which velars and coronals can be optionally realised as plain [k, t], palatalised [k\(^i\), t\(^i\)] or as palato-alveolar [tj]. Hume notes that this occurs word internally and these options are not available finally. She also notes that the palato-alveolar realisation is more likely in older speakers whereas the palatalised version is most common amongst younger speakers. She claims that this illustrates a change in progress and that this change can be characterised as a change from the more highly marked coronalisation form which requires a constriction status change to the unmarked palatalisation which requires no status change.

\[
\begin{array}{c|c|c|c|c}
\text{velar} & \text{coronal} & \text{palatalised} & \text{palato-alveolar} \\
/kol/ & /k\^0/ & /k\^0/ & /k\^0/ \\
/gate/ & /g\^ete/ & /g\^ete/ & /g\^ete/ \\
\end{array}
\]

tail to watch for (Clements and Hume 1995)
fronting triggered by /i/ in (20a) and coronal place change likewise triggered by /i/ in (20b). Lahiri and Evers (1991) refer to this as 'change of place within coronal consonants'. Bhat (1976) calls it tongue raising.

\[15 \text{ Lahiri and Evers (1991) refer to this as 'change of place within coronal consonants'. Bhat (1976) calls it tongue raising.}\]
Notice that the place feature spreads directly to the consonant place provoking the
delinking of the feature [dorsal] in (20a) and of [coronal] in (20b). Hume (1994) argues
that in underlying representation vowels are underspecified for [-anterior], but that this
is filled in prior to palatalisation/coronalisation. Despite claims that the inclusion of
[-anterior] "is not crucial to this account" (Hume 1994: 177) quite the reverse is true. In
this approach, if vocalic [coronal] were to be trivially underspecified for [-anterior], as in
(21) below, when [coronal] spreads to the consonant place of /k/, or of /t/, we would
expect the result to be [t] (i.e. [coronal, +anterior]), as the unmarked specification for
[coronal] is [+anterior], the presence of [coronal] on its own would guarantee a
[-anterior] articulation.
We have considered this in detail because adopting this type of approach enables Hume (1994) to overcome some of the problems encountered by the earlier work of Clements. First of all, velar fronting and coronal place change are now characterised as a one-stage process. And an intermediate stage of secondary articulation is no longer required. So Lahiri and Evers' (1991) criticism of Clements (1989) has been neutralised. And secondly the inclusion of [-anterior] under voc [coronal] ensures the appropriate outcome: a non-anterior coronal. But the point is that in order to circumvent these problems, Hume is forced to adopt some rather tenuous assumptions. The problems which arise chiefly concern the feature [anterior].

We have already commented that, in this model, [-anterior] is the only possibility for vowels. Hume assumes that although consonants are characterised by the presence or absence of e.g. [coronal], vowels are treated as in SPE. So /u/, for example, is [-coronal, -anterior]. Presumably she does this to avoid deriving [-anterior] in two ways, but this is
bizarre and is surely an undesirable step.\textsuperscript{16} Clements and Hume (1995) take a different approach. They can derive non-anteriority in vowels in two ways. Firstly, by the presence of [-anterior] under the coronal node in front vowels and secondly by the absence of [-anterior] due to the absence of [coronal] in non-front vowels.

A very different criticism has been put forward by Goad and Narasimhan. Goad and Narasimhan (1994) criticise Clements and Hume because there is nothing in their approach to preclude the palatalisation of labials before front vowels. Their point is that whilst coronal place change and velar fronting are both common processes, labial palatalisation (resulting in [f]) is at best extremely rare.\textsuperscript{17}

In sum, in Hume's account of palatalisation processes, a number of undesirable consequences are produced. At the root of the problem is [-anterior] which is required in front vowels in order to prevent [t] as the result of velar fronting or coronal place change. One effect of the need for [-anterior] is that Hume requires a mixture of bivalent and monovalent features. So, for example, although vowels are specified as either + or -coronal etc, they are always [-anterior].

\textsuperscript{16} [ANTERIOR] has always been one of the more controversial features. Unlike most other features it has no phonetic correlate, rather it refers to regions of the mouth: pre and post palato-alveolar ridge.

\textsuperscript{17} Goad and Narasimhan (1994) cite Spencer's comment on Linguist List 27, April 1993 that "[While] k > ch type softenings are extremely common historically and abound in synchronic morphophonological systems,...it's extremely hard to track down this type of process as a genuine postlexical allophonic rule (akin to aspiration in English). This is despite the fact that t > ch type softenings are common as postlexical rules and in principle can easily give rise to non-structure preserving alternations and despite the frequency with which post lexical palatalisation processes induce allophony in the form of secondary articulations." (Goad and Narasimhan 1994: 29.)
6.2.2. The Particle Account of Palatalisation Processes

But how can we account for these cases of velar fronting and coronal place change if we do not accept that palato-alveolars and front vowels are members of the natural class [+coronal]? And what role, if any, does [anterior] play in this? Consider velar fronting first of all.

(22)  
```
   C   V   C
  .   .   .
  .   .   →  .
  .   .   .
 U   I   U   I
  k   i   ?
```

On the assumption that 'coronalisation' is an assimilation or spreading process, the spread of I triggers the delinking of the U particle. One reason for this might be that these two particles do not sit easily together. In many languages, such as English, there seems to be a general intolerance towards the coexistence of these two particles. This is exhibited by the marked status of front-round vowels. Kaye et al (1985) draw upon this general reluctance to permit the coexistence of I and U to propose that the back and round lines should be conflated in such languages. This means that only one element can
exist on the back/round line at any one time. It might be that this trend lies at the heart of why I spreading would provoke U delinking.

The question arises why does velar fronting usually not result in a palatal [c]? This is an interesting problem. Why is it that palatal stops and fricatives are highly marked? Why do languages in general prefer palato-alveolar to palatal place? Chomsky and Halle (1968) noted that in consonantal systems with four points of articulation: labial, dental, and velar, the fourth is usually the palato-alveolar affricate. In other words, if the palatal zone is a point of obstruent articulation the preferred choice of segment will be a palato-alveolar affricate.

Hume also calls on markedness considerations to make sure that in the unmarked case, the outcome of coronalisation is a palato-alveolar affricate rather than a palatal. (Notice that in her account, both palato-alveolars and palatals are [+coronal, -anterior]). Hume (1994: 145) argues that the acquisition of [+strident, +continuant] is needed to ensure that a palato-alveolar is not part of coronalisation. It is determined on a language specific basis. In other words it is determined by the fact that in the palatal zone, most languages prefer palato-alveolars to palatals. This does not, however, imply that they are both [+coronal].\(^\text{18}\) How then do we account for the change from /k/ to [tʃ]?

\(^\text{18}\) See 6.2.3 below where we will consider a language which has both palato-alveolar affricates and palatal stops.
The claim is that once the U particle has been delinked, this results in a highly marked structure: a palatal. In a language which rules out palatal stops/fricatives this would be uninterpretable. Consequently, some form of repair would be required. In the account being developed in this thesis, such a repair is available in the form of default A. If A was added the following repaired structure would result:

(24) C
    ↓
     .
    .
   .
  A  I
In other words, by adding A the resulting structure is a palato-alveolar.\(^{19}\)

As a consequence of the account proposed above, in languages which tolerate palatals, the result of velar fronting will be a palatal, since I under place will not form an illegal structure. Languages which do not tolerate palatal will undergo repair and this will result in a palato-alveolar consonant.\(^{20}\) Consequently we can say that it is the nature of the repair rather than the nature of the front vowel which is responsible for the outcome of velar fronting becoming a coronal.

This account can be readily applied to coronal place change \(/t/ \rightarrow [\text{t}]\). First of all, given the assumptions about the special status of coronals and underspecification the I particle would spread to fill the empty place node of the coronal \(/t/\) as in (25).

---

\(^{19}\) This is reminiscent of the SPE account. Hume would criticise this account because it does not treat velar fronting as a straightforward assimilation.

\(^{20}\) Lass (1994) comments that OE palatalisation did not take the form \(k \rightarrow \text{tf}\), but rather \(k \rightarrow c\). The point to notice is that OE had palatal fricatives. Once palatal ceased to be an obstruent place in English, velar fronting took the form of \(/k/ \rightarrow [\text{tf}]\).
The illegal structure would then be repaired by the addition of default A (as in (25b)).

We can now address Goad and Narasimhan’s criticism: that velar fronting is not as common as CPC, and that labial to palato-alveolar is at best rare. In the approach developed in this thesis, place in velars and alveolars is determined by U and A respectively which are the heads of the structure. Labials on the other hand are not place headed. Recall from chapter 4 that we assumed that labials are manner headed and the place component is a dependent. Therefore palatalisation processes affect segments which are place headed.\(^{21}\) Notice that this can only be achieved if we assume that CPC

\(^{21}\) In Eastern Czech it is claimed that labials become alveolars before front vowels:

\begin{align*}
\text{pivo} & \rightarrow \text{tivo} \quad \text{beer} \\
\text{t}\text{fepice} & \rightarrow \text{t}\text{fetice} \quad \text{cap} \\
\text{min} & \rightarrow \text{nin} \quad \text{less}
\end{align*}

(Jakobson and Waugh 1987:100)

In this case I would spread as a head and result in the place specification I

U

Consequently, we could say that I spreads but causes problems, therefore I, U combination is lost and A is supplied by default. Hence /p/ \(\rightarrow \) [t].

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and velar fronting are the same process. The difference is captured by the fact that CPC is a feature filling process, whereas velar fronting (as in SPE) requires restructuring.

In the following section, I shall consider the way in which Hume’s approach and the approach developed in this thesis can account for the palatalisation process exhibited in Chaha, a Semitic language spoken in Ethiopia. The palatalisation process in question affects not only consonants but also vowels. However, what is of particular interest to us here is the fact that alveolars become palato-alveolars whereas velars become palatals.

### 6.2.3. Chaha

Chaha’s consonantal inventory is set out in (26) below. Notice that Chaha exhibits alveolar, palatal and velar stops and palato-alveolar affricates.

<table>
<thead>
<tr>
<th>(26)</th>
<th>labial</th>
<th>labio-dental</th>
<th>dental</th>
<th>palato-alveolar</th>
<th>palatal</th>
<th>velar</th>
<th>laryngeal</th>
</tr>
</thead>
<tbody>
<tr>
<td>stops</td>
<td>p</td>
<td>p'</td>
<td>t</td>
<td>d</td>
<td>ʈʃ</td>
<td>c</td>
<td>k k'</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>b'</td>
<td>d</td>
<td>dʃ</td>
<td>Ʉ</td>
<td>j</td>
<td>g g'</td>
</tr>
<tr>
<td></td>
<td>p'</td>
<td></td>
<td>t'</td>
<td>tʃ</td>
<td>Ʉ'</td>
<td>c'</td>
<td>k'</td>
</tr>
<tr>
<td>fricis</td>
<td>f</td>
<td>f'</td>
<td>s</td>
<td>š</td>
<td>ŝ</td>
<td>ɴ</td>
<td>x x'</td>
</tr>
<tr>
<td></td>
<td>β</td>
<td></td>
<td>z</td>
<td>ž</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nasals</td>
<td>m</td>
<td>m'</td>
<td>n</td>
<td></td>
<td>ŋ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>liquids</td>
<td>l</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>flap/trill</td>
<td>r</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glide</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Ford undated: 10)
The Chaha vowel inventory is set out in (27) (Ford undated: 14).

(27) Front Central Central Back
     Unrounded         Unrounded      Rounded    Rounded
High Close i            i            u           
Half Close e            e            o           
Mid Close Open e^{23}    a^{22}       o^{24}      
Low Close Open e^{23}    a            o^{24}      

In Chaha the 2nd person feminine singular is representable as a floating palatalising component. This is illustrated by the following data.

(28) 2sg. imperfective forms.

<table>
<thead>
<tr>
<th></th>
<th>2m.sg</th>
<th>2f.sg</th>
</tr>
</thead>
<tbody>
<tr>
<td>you reign</td>
<td>tiräg[s]</td>
<td>tiräg[f]</td>
</tr>
<tr>
<td>you seize</td>
<td>titäβ[t']</td>
<td>tiitäβ[t'f']</td>
</tr>
<tr>
<td>you stretch out (sthg)</td>
<td>tizäm[d]</td>
<td>tizäm[dʒ]</td>
</tr>
<tr>
<td>you immerse (sthg)</td>
<td>tidäf[k']</td>
<td>tidäf[c']</td>
</tr>
<tr>
<td>you plaster (sthg)</td>
<td>timär[g]</td>
<td>timär[j]</td>
</tr>
<tr>
<td>you stab/pierce (sthg)</td>
<td>tisä[k:]</td>
<td>tisä[c:]</td>
</tr>
</tbody>
</table>

(Hayward and Hayward 1989: 188)

On the basis of the data above, we can see that final alveolars become palato-alveolar and final velars become palatals. Ford (undated: 65) notes "If the final consonant is not palatalisable and the penultimate consonant is velar, it will be palatalised. If the final

\[^{22}\] Ford comments that she uses /ä/ instead of schwa. See also Hayward and Hayward (1989) footnote 22.

\[^{23}\] This vowel is said to originate from the diphthong [aj] and is pronounced as such in many dialects, according to Ford (undated: 14).

\[^{24}\] Ford comments that this vowel has, like its front non-round counterpart, come from the diphthong [aw] and that it is still pronounced as a diphthong in many dialects.
consonant is not palatalisable and the penultimate consonant is not velar, the vowel following the penultimate consonant is palatalised." Ford illustrates this with the following data.

(29)

<table>
<thead>
<tr>
<th>Continuous Stem</th>
<th>2nd pfemsg</th>
</tr>
</thead>
<tbody>
<tr>
<td>xāda 'deny/disown'</td>
<td>tixādʒā</td>
</tr>
<tr>
<td>gāfa 'push'</td>
<td>tijāfā</td>
</tr>
<tr>
<td>tāfa 'spit'</td>
<td>titefā</td>
</tr>
<tr>
<td>k’aβa 'anoint'</td>
<td>tic’āβā</td>
</tr>
<tr>
<td>rādif 'sting'</td>
<td>tirādif</td>
</tr>
<tr>
<td>xābib 'surround'</td>
<td>tixābib</td>
</tr>
</tbody>
</table>

(Ford Undated:65)

The question arises how would the two coronal-vowel approaches account for the effects of the 2fsg marker docking onto velars and alveolars?

On Hume’s account, the floating feature would be [coronal, -anterior]. If it was simply [coronal] then we would expect the outcome to be [t] in both cases. The only way that Hume could achieve two non-anterior consonants is to assume that the suffix is specified as [-anterior]. (Recall that Hume claims that the assignment of [+strident, +continuant] was needed to ensure a palato-alveolar in coronalisation cases is not part of the coronalisation process, rather it is determined on a language-specific basis.) Since one output of palatalisation is a palato-alveolar, [+strident, +continuant] must be added. However, this would predict that the outcome of velar fronting should also be a palato-alveolar affricate. In sum, the coronal-front vowel approach cannot account for the effect
of the 2fsg on velar and alveolar consonants in Chaha in that it makes the wrong predictions about the outcome of velar fronting.

What can be said for Chaha palatalisation if we assume a coronal-A approach? The first point is that the 2fsg marker will be a floating I particle. It is not obvious that coronals in Chaha behave asymmetrically. The import of this is that there is no reason to assume that A is underlingly underspecified. Given this the structure for /t/ and /k/ underlingly will be:

\[
\begin{array}{c}
O \\
\mid x \\
\mid . \\
\mid . \\
A \\
/\text{t/} \\
\end{array}
\quad
\begin{array}{c}
O \\
\mid x \\
\mid . \\
\mid . \\
U \\
/\text{k/} \\
\end{array}
\]

Consequently when the floating I suffix is added the result will be a palato-alveolar, a permissible structure in Chaha (as in 31 a).
To derive a palatal from a velar, the result of I attaching to U will be to produce the impermissible structure (in 31b). In line with assumptions made above, U is therefore delinked as a repair strategy and the result is a palatal stop (as in 31c), which is permissible in Chaha. In this way we can account for the appearance of both palatal and palato-alveolar structures.

Finally, how do the two approaches account for the effect of the 2fmsg on vowels? Ford summarises the changes in the vowels as i → i; ā → e; and a → ā. Given Hume’s assumptions, if [coronal,-anterior] was added to /i/ then the result would be [i]. On Hume’s account we might also expect /a/ to be realised as [i], since schwa has no structure, it would be filled in as [i]. Finally there is no obvious way in which [ˈã] could be derived from /əl.

As for a particle approach, Schane (1995) assumes that /i/ is never specified.

Consequently when I is added the result will be [i]. When I is added to schwa it will front it producing its corresponding front vowel [e] and when I is added to /a/, the result

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would be the illegal [æ]. Since [æ] is impossible and since the suffix must be realised, the effect of I on the structure of /a/ in Chaha is to cancel out the dependent A producing a raising effect. When /a/ raises it becomes schwa. This is illustrated in (32).

(32)  

The significance of the Chaha data is twofold. First of all, it supports the particle account of palatalisation and secondly it highlights further problems with the coronal-front vowel approach of palatalisation.

To conclude. In this section we have considered the evidence initially put forward by Clements (1976) to support a natural class of coronal consonants and front vowels: velar fronting. In contemporary feature theory, the claim is that [coronal,-anterior] spreads from the vowel to the velar consonant. A [-anterior] specification is required to guarantee that the outcome of spreading is a palato-alveolar rather than an alveolar. I have argued that it is possible to provide a straightforward account of velar fronting if one assumes a coronal-A connection. The account which has been put forward shows
that the property of the front vowel which spreads into the velar produces a highly marked structure: a palatal. If the language does not permit palatals then this structure is repaired by adding A. This is then interpreted as coronal in the phonetic implementation. Consequently the front vowel is only very indirectly responsible for the acquisition of coronal. What is more, [anterior] plays no role in this account and so the problems encountered by Hume do not arise. There is no mismatch between the use of A in consonants and vowels such as that encountered by Hume and there is no need to explain why coronal consonants can be produced anywhere from the teeth to the hard palate or why the tip or blade in isolation cannot form vowels.

Hume (1994) devotes considerable attention to a case study of Maltese Arabic, and we might conclude that she regards this language as providing particularly clear and strong support for her claims about [coronal]. Therefore in the following section I will consider aspects of her discussion of Maltese and argue that far from providing overwhelming support for coronal-front vowel interaction, her case study supports the special status of coronals in Maltese.
6.3. Maltese Arabic

6.3.1. Introduction

According to Hume (1994) Maltese Arabic has the five vowel system set out in (33) and the phonemic consonantal inventory in (34).

(33) \[ i \quad u \]
\[ e \quad o \]
a

(Hume 1994: 156)

(34) labial Labio- Dental Palato- Velar Pharyngeal Laryngeal

dental alveolar

stops \[ p \quad b \quad t \quad d \quad k \quad g \quad ? \]
frics \[ f \quad v \quad s \quad z \quad ñ \quad [3]^* \quad h \]
affs \[ ts \quad dz^* \quad ñf \quad ñg \]
nasals \[ m \quad n \quad ñ \]
liquids \[ l, r \]

* dz occurs only in a few Italian/Sicilian loanwords
* [3] occurs only before voiced obstruents

(Hume 1994: 157).

Hume adopts a Contrastive Underspecification approach (following Steriade (1987) and Clements (1988)). Contrastive Underspecification requires that only features which are noncontrastive can be underlyingly underspecified. Consequently the underlying representation of Maltese vowels is given as follows:

(35) coronal dorsal labial pharyngeal high

\[ i \quad e \quad a \quad o \quad u \]

\[ + \quad + \quad + \quad + \quad + \]

(Hume 1994:156)
And the contrastively specified inventory as regards place in consonants is given as:

\[(36)\]

\[
\begin{array}{ccccccc}
\text{lab} & + & + & + & + \\
\text{cor} & + & + & + & + & + & + & + \\
\text{ant} & + & + & + & - & - & - & - \\
\text{dors} & + & + \\
\text{phar} & + & + \\
\end{array}
\]

Taken from Hume (1994:158)\(^{25}\)

Hume’s approach differs from that of Steriade and Clements in that she adopts a different type of default rule. She claims that default rules are independent of the underlying feature system of a given language. They may be available on a universal or language specific basis as a means of filling in unspecified segments. This position is adopted, because in addition to the 5 vowel system given in (33) Hume assumes that Maltese has a sixth totally unspecified vowel which receives the default values \([+\text{coronal}, + \text{high}]\). The motivation behind this claim is that since the epenthetic vowel is

\[25\] The fully specified vowel and consonant (place) representation is given below to illustrate Hume’s use of binary features in vowels versus their monovalent use in consonants.

<table>
<thead>
<tr>
<th>(a)</th>
<th>i</th>
<th>e</th>
<th>a</th>
<th>o</th>
<th>u</th>
</tr>
</thead>
<tbody>
<tr>
<td>coronal</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>dorsal</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>labial</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>pharyngeal</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>high</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(b) Place specification</th>
</tr>
</thead>
</table>
| \[
\begin{array}{ccccccc}
\text{lab} & + & + & + & + \\
\text{cor} & + & + & + & + & + & + & + & + \\
\text{ant} & + & + & + & + & + & - & - & - \\
\text{dors} & + & + \\
\text{phar} & + & + \\
\end{array}
\] |

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[i] in Maltese one approach might be to assume that [i] is underlyingly underspecified across the board. However, Hume argues that only prefix [i] is specified underlyingly. Similarly for consonants Hume argues that although [t] is the likeliest candidate for underspecification, stem [t] is fully specified. In what follows I shall set out to demonstrate that Hume's evidence does not support the underlying specification of [coronal] at least in coronals obstruents, and as we shall see this calls into question the putative coronal-front vowel relation.

6.3.2. The Effect of Coronal Consonants on the Prefix Vowel.

In her case study of Maltese Arabic, Hume considers the formation of the imperfective in strong triliteral verbs. Hume assumes that the imperfective is derived from a CVCVC form. The singular stem is CCVC. A CV prefix is added which signifies agreement. In addition, Hume assumes one underlying vocalism per stem. Hume claims that one example of coronal front vowel interaction is provided by triliteral strong verbs of the first measure where the prefix vowel is a copy of the stem vowel. This is illustrated in (37) below.

---

26 I do not intend to go into her justification here, as this would take us beyond the scope of the present discussion.
27 Hume attributes this claim to Berrendonner et al (1983).
(37)

<table>
<thead>
<tr>
<th>Perfective 3rd</th>
<th>Imperfective 3rd</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd p.m.sg</td>
<td>3rd p.m.sg</td>
</tr>
<tr>
<td>forok</td>
<td>jofrok</td>
</tr>
<tr>
<td>kotor</td>
<td>joktor</td>
</tr>
<tr>
<td>habat</td>
<td>jahbat</td>
</tr>
<tr>
<td>rōhos</td>
<td>jorōhos</td>
</tr>
<tr>
<td>ūnasam</td>
<td>jūnasam</td>
</tr>
<tr>
<td>ūnābad</td>
<td>jūnābad</td>
</tr>
</tbody>
</table>

(Hume 1994: 168)

However, if the stem initial consonant of a first measure verb is a coronal obstruent then the prefix vowel is [i]:

(38)

<table>
<thead>
<tr>
<th>Perfective 3rd</th>
<th>Imperfective 3rd</th>
</tr>
</thead>
<tbody>
<tr>
<td>p.m.sg</td>
<td>p.m.sg</td>
</tr>
<tr>
<td>daḥal</td>
<td>jidḥal</td>
</tr>
<tr>
<td>dālam</td>
<td>jidālam</td>
</tr>
<tr>
<td>talab</td>
<td>jītalab</td>
</tr>
<tr>
<td>tebaḥ</td>
<td>jītebaḥ</td>
</tr>
<tr>
<td>siket</td>
<td>jīsket</td>
</tr>
<tr>
<td>sēḥet</td>
<td>iṣḥet</td>
</tr>
<tr>
<td>zēlaʔ</td>
<td>jīzəlʔ</td>
</tr>
<tr>
<td>dʒ ḏabar</td>
<td>jidʒ ḏabar</td>
</tr>
<tr>
<td>jōroḥ</td>
<td>jīṣroḥ</td>
</tr>
</tbody>
</table>

(Hume 1994: 215)

The data given in (39) below show that cases with stem initial coronal sonorants do not pattern with coronal obstruents, rather the prefix vowel is, once again, a copy of the stem initial vowel.

---

28 MA differs in this respect from other dialects of Arabic. In Li ƅan Arabic (Tripolean accent) the prefix vowel is a copy of the stem vowel regardless of the quality of the stem initial consonant. (I am grateful to Hussein Al-Ageli for discussion of this data.)

29 I do not intend to discuss the way in which the single underlying stem vowel is manipulated. This would take us beyond the scope of the current discussion.
(39)  

<table>
<thead>
<tr>
<th>perfective</th>
<th>imperfective</th>
</tr>
</thead>
<tbody>
<tr>
<td>laʔat</td>
<td>jolʔot</td>
</tr>
<tr>
<td>lefaʔ</td>
<td>jolfoʔ</td>
</tr>
<tr>
<td>nefaʔ</td>
<td>jonfoʔ</td>
</tr>
</tbody>
</table>

(Hume 1994: 216)  

In all other measures the prefix vowel is [i] as illustrated in (40).

(40)  

<table>
<thead>
<tr>
<th>Measure</th>
<th>Perfective</th>
<th>Imperfective</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>?asam</td>
<td>jaʔsam</td>
</tr>
<tr>
<td>Fifth</td>
<td>tʔattel</td>
<td>jitʔattel</td>
</tr>
<tr>
<td>Sixth</td>
<td>tbierek</td>
<td>jitbierek</td>
</tr>
<tr>
<td>Seventh</td>
<td>(i)nʔabad</td>
<td>jinʔabad</td>
</tr>
<tr>
<td>Eighth</td>
<td>(i)rtabat</td>
<td>jirtabat</td>
</tr>
<tr>
<td>Ninth</td>
<td>hdaar</td>
<td>jihdaar</td>
</tr>
<tr>
<td>Tenth</td>
<td>stenbah</td>
<td>jistenbah</td>
</tr>
</tbody>
</table>

(Hume 1994:164)  

To account for the regular cases (i.e. all cases except verbs with stem initial coronal obstruents) Hume assumes that the prefix vowel was underlyingly the first vowel of the stem. She claims that syncope, given in (41) below, deletes all predictable information except the Vocalic node and the melody features, which remain floating.  

(41) Syncope (Hume 1994: 194):  

\[
\begin{array}{c}
\text{C} \quad \tilde{\text{V}} \\
\text{[ ] voc} \\
\end{array}
\quad \rightarrow 
\begin{array}{c}
\text{C} \quad \text{V} \\
\text{[ ] [ ] voc} \\
\end{array}
\begin{array}{c}
\text{C} \\
\text{[ ]} \\
\end{array}
\begin{array}{c}
\text{V} \\
\text{[ ]} \\
\end{array}
\]

30 In Hume’s approach, the vocalic node must remain since this node dominates stricture and place. Given Hume’s theoretical background, in the case of stem /o/, (i.e. [labial, -high], if place mapped onto the empty v-slot, and [high] was supplied by default, the result would be [u], since default is [+high]. To avoid this Hume requires the presence of the vocalic node.

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Hume says "Informally stated, the v-slot and noncontrastive features of an unstressed vowel in a non-final open syllable delete." She then assumes that a process of vocalic mapping formulated in (42) maps this vocalic node and melody onto the empty prefix vowel.\(^{31}\)

(42) Vocalic Mapping:

```
  V
 /\  
voc`
```

A floating vocalic melody maps onto an unspecified V-slot (where voc` indicates an unassociated vocalic melody and V an empty V-slot). (Hume 1994: 195).

A sample derivation illustrating the effect of both syncope and vocalic mapping is given in (43) below.

---

\(^{31}\) Hume claims that VM and syncope are independently motivated in Maltese Arabic. For instance both processes are at work in metathesis.
Output: [jofrok] he limps.
It is interesting that only coronal obstruents block vocalic mapping. After all, one of the advantages of this model is that vowel features can spread freely across intervening consonants as a class. Hume rules out the possibility that coronal obstruents have a vocalic node which blocks vocalic mapping since this would predict that coronal obstruents have some kind of secondary articulation and, as Hume points out, Maltese Arabic only has plain consonants.

Since the epenthetic segments in Maltese are [t] and [i] and the assumed default rules supply [coronal], [+high], perhaps the most straightforward solution is to assume that [i] is supplied by default. Hume anticipates this response and states at the outset that

"The most obvious means of accounting for the occurrence of [i] in the verbs...is to attribute the quality of the prefix vowel to default, given my claims that the default vowel in Maltese is [i]. However,...attributing the entire quality of the prefix vowel to default is problematic."

In order to achieve default assignment Vocalic Mapping would have to fail to apply - blocked by the occurrence of a coronal obstruent. But there is no reason why coronal obstruents should block Vocalic Mapping in Maltese because coronal consonants do not contain a vocalic node.

Since it is difficult to explain why coronal obstruents block Vocalic Mapping, Hume proposes that coronal obstruents spread their own place feature into the empty vowel
position. She calls this Vowel Coronal Assimilation (VCA), which is set out in (51) below.\(^{32}\)

\[(44)\]

\[
\begin{array}{c}
\text{V} \\
(\text{Root}) \\
(\text{Cons}) \\
(\text{place}) \\
(\text{Voc}) \\
(\text{place}) \\
\hline
\text{C} \\
(\text{Root}) \\
[-\text{son}] \\
\text{Cons} \\
\text{place} \\
[+\text{coronal}] \\
\end{array}
\]

(Hume 1994: 222)

[i] acquires its [+high] value from default assignment, which according to Hume is independently motivated as the default value for vowel height in Maltese.\(^{33}\) Since Hume

---

\(^{32}\) Although Hume does not discuss this, VCA clearly involves a constriction status change.

\(^{33}\) Hume points out a peculiar prediction of her vowel coronal assimilation. Once again, this peculiarity is centred on [anterior]. She notes that since [s] and [ʃ] contrast for [anterior], they will both be specified for it underlyingly. The problem is that if the V-slot picks up coronal from [s], it will also acquire [+anterior].

\[
\begin{array}{c}
\text{V} \\
[\text{coronal}] \\
[+\text{anterior}] \\
\hline
\text{C} \\
[\text{coronal}] \\
[-\text{anterior}] \\
\end{array}
\]

Hume (1994: 225)
now has two feature filling operations, VM and VCA, she invokes the Elsewhere Condition (repeated in (45) below for convenience).

(45) The Elsewhere Condition

Rules A, B in the same component apply disjointly if and only if
a. The input of A is a proper subset of the input of B.
b. The outputs of A and B are distinct.
[Archangeli 1984: 27 citing Kiparsky 1984: 3]

The effect of the EC is to guarantee that the more specific VCA applies before the general VM process. This is illustrated in (46).

As Hume points out, the instances of coronal are multiply linked so to attempt to alter the value of [anterior], which has spread from [s] would be problematic. Hume suggests that a solution is provided by 'cloning'. The effect of cloning is that the features [coronal, +anterior] replicate. [+anterior] is removed from the vowel structure and default [-anterior] completes the restructuring.
Output [jiʃrob] ‘he drinks’ (Hume 1994: 223)

So although Hume has provided an account of the data that fits her claim that coronals and front vowels form a natural class, she leaves what are perhaps the more interesting questions unanswered. Specifically, why are coronal obstruents different? Why do they spread their place features into the empty prefix vowel? Why don’t coronal sonorants also spread their place? Hume has to stipulate [-sonorant] in the VCA rule, but it is just that.\(^{34}\)

---

\(^{34}\) Hume equates this process with Guttural assimilation, but it is not a helpful comparison. Coronal obstruents target an empty v-slot whereas GA singles out /i/. If VCA and GA were like processes we might
There is an alternative approach and one which will allow us to account for the failure of coronal sonorants to spread their place value. However, before we can consider this alternative, we should first pursue the fact that the Maltese data strongly suggests the underspecification of [coronal] in obstruents. To do so, I will consider Hume’s attempt to tie the process of vowel coronal assimilation to a process affecting a consonantal affix. This second case lends support to the claim that certain coronals are underspecified for place in Maltese and that the processes used to support a coronal front vowel connection point instead to the special status of coronals i.e. to the underlying underspecification of [coronal].

6.3.3. The Special Status of Coronal Obstruents in Maltese

According to Hume, in the 2nd and 3rd fem sg imperfective form of the 5th -10th measure verbs, the prefix C is realised as [t] and is followed by the prefix vowel [i] as in

(47) (Hume 1994: 227)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Perfective</th>
<th>Imperfective</th>
</tr>
</thead>
<tbody>
<tr>
<td>5th</td>
<td>t?attel</td>
<td>tit?attel</td>
</tr>
<tr>
<td>6th</td>
<td>tbierek</td>
<td>titbierek</td>
</tr>
<tr>
<td>7th</td>
<td>in?atel</td>
<td>tin?atel</td>
</tr>
<tr>
<td>8th</td>
<td>irtabat</td>
<td>tirtabat</td>
</tr>
<tr>
<td>9th</td>
<td>hda:r</td>
<td>tihda:r</td>
</tr>
<tr>
<td>10th</td>
<td>stenbah</td>
<td>tistenbah</td>
</tr>
</tbody>
</table>

expect stem initial gutturals to spread their place features into the empty prefix vowel slot. As we have seen above this does not happen.
When these forms are compared with second and third measure forms, then we find that there is no prefix vowel and the prefix consonant surfaces as [t].

<table>
<thead>
<tr>
<th></th>
<th>perfective</th>
<th>imperfective</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd measure</td>
<td>na??as</td>
<td>tna??as</td>
<td>to lessen</td>
</tr>
<tr>
<td></td>
<td>kattar</td>
<td>tkattar</td>
<td>to multiply</td>
</tr>
<tr>
<td>3rd measure</td>
<td>bierek</td>
<td>tbierak</td>
<td>to bless</td>
</tr>
<tr>
<td></td>
<td>tha:res</td>
<td>tha:res</td>
<td>to observe</td>
</tr>
</tbody>
</table>

(Hume 1994: 227)

If the stem-initial consonant is a coronal obstruent, in such forms, then the prefix consonant undergoes total assimilation to that consonant. (Hume 1994: 228).

<table>
<thead>
<tr>
<th></th>
<th>perfective</th>
<th>imperfective</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd measure</td>
<td>dahhak</td>
<td>iddhahak</td>
<td>to amuse</td>
</tr>
<tr>
<td></td>
<td>sallab</td>
<td>issallab</td>
<td>to crucify</td>
</tr>
<tr>
<td></td>
<td>jemmef</td>
<td>jfeemmef</td>
<td>to sun</td>
</tr>
<tr>
<td></td>
<td>djeedd</td>
<td>iddjeedd</td>
<td>to renew</td>
</tr>
<tr>
<td>3rd measure</td>
<td>dierek</td>
<td>iddierek</td>
<td>to rise early</td>
</tr>
<tr>
<td></td>
<td>siefer</td>
<td>issiefer</td>
<td>to depart</td>
</tr>
<tr>
<td></td>
<td>djeele</td>
<td>iddjeele</td>
<td>to incite</td>
</tr>
</tbody>
</table>

The data in (50) is provided to show that this process of complete assimilation is not restricted to these imperfective verbs. Hume reports that it is also found in the perfective form of the 5th and 6th measures. These forms are the reflexive/passive forms of the corresponding 2nd and 3rd measure verbs. When the 2nd/3rd measure forms are compared with the 5th/6th measure forms it can be seen that the reflexive/passive is formed by the addition of a prefix /t/; the (b) cases illustrate that where there is a stem initial coronal obstruent the prefix consonant undergoes total assimilation.
The reflexive/passive prefix consonant also provides evidence for the direction of this process of total assimilation. The data in (51) compares first measure verbs with eighth measure forms which are their reflexive/passive forms. In such cases, the reflexive/passive marker is an infix. As the data in (51) shows this surfaces as a [t] regardless of the nature of the stem-initial consonant, which suggests that the direction of total assimilation is right to left.

### (51)

<table>
<thead>
<tr>
<th>First measure</th>
<th>8th measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>baram</td>
<td>btaram</td>
</tr>
<tr>
<td>nefaʔ</td>
<td>intefaʔ</td>
</tr>
<tr>
<td>sabar</td>
<td>stabar</td>
</tr>
<tr>
<td>ḥefet</td>
<td>ḥefet</td>
</tr>
</tbody>
</table>

(Hume 1994: 229)
Hume assumes that the affix is unspecified for features. As an infix it is assigned default features but as a prefix it undergoes total assimilation. She calls this process of total assimilation Consonant Coronal Assimilation (CCA) and defines it in the format set out below: (52) Consonant Coronal Assimilation (CCA)

(52)
operation: spread root node
trigger: [coronal,-sonorant]
target: C
direction: right to left

\[
\text{Root} \quad [-\text{son}] \quad \bullet \\
\text{Place} \quad [\text{coronal}] \\
\]

(Hume 1994: 230)

The question arises: why does C undergo total assimilation to a following coronal obstruent? Why doesn't C also undergo total assimilation to coronal sonorants, or rather to the class of obstruents? This discrepancy suggests that the target and trigger have something in common which they do not share with either coronal sonorants or with other obstruents. If the affix was really an empty C slot, then it would have just as much in common with [p, h, l, r] and so on, as it would with coronal obstruents. The behaviour of the affix suggests that C bears a strong resemblance to the coronal obstruents. Given what we know about coronals: that they behave asymmetrically, this suggests, contrary to Hume's arguments, that [coronal] (or [coronal] and place) is underlingly
underspecified in Maltese obstruents i.e. that coronal obstruents would have the structure in (53a) or (53b) depending on the degree of underspecification adopted.\(^{35}\)

\[(53a)\]
\[
\text{Root} \\
\cdot \\
\cdot \\
\cdot \\
\text{Cons}
\]

\[(53b)\]
\[
\text{Root} \\
\cdot \\
\cdot \\
\cdot \\
\text{Cons} \\
\text{place}
\]

On this account assimilation might take place because the C and the coronal obstruents have a lack of specification in common. Hume assumes that prefix C is just a C slot, but it could equally be the structure in (53a) or (53b) above. This would go someway towards explaining why the prefix doesn’t undergo total assimilation to any obstruent.

\[^{35}\text{(53a) would follow Paradis and Prunet’s (1989) assumptions about coronal and place underspecification and (53b) would be in line with Avery and Rice’s (1989) assumptions.}\]
Once again the evidence suggests that coronal sonorants are specified for [coronal] underlyingly.\textsuperscript{36}

The main point is that this supports the idea that coronals, or more precisely coronal obstruents, in Maltese have special status.\textsuperscript{37} If they have special status then this suggests that they are unspecified for [coronal]/place. If they are indeed unspecified for [coronal]/place this is not filled in prior to the processes that Hume is concerned with since her evidence is being used as support for this claim. If this is so, then it means that the source of [i] in the imperfective form of the triliteral strong verbs cannot be accounted for as the spread of [coronal] from the stem initial coronal obstruents, since such consonants lack an articulator node. Therefore the vowel must be supplied by some other means.

What is more we are now in a position to consider a potential solution to the appearance of [i] before coronal obstruents: a solution which assumes that the [i] is after all the result of default assignment. Consider once again the formulation of vocalic mapping, repeated in (54) below for convenience:

\textsuperscript{36} Since vowels and consonants contain a consonantal node and would both be specified [+son] in the root node, it is reasonable to assume that coronal sonorants would be specified for [coronal] in order to distinguish them from vowels.

\textsuperscript{37} There are two points to note. First of all, neither modified contrastive nor radical underspecification would include palato-alveolars as special and underspecified for coronal. This is due to the presence of the marked value for anterior: [-anterior]. Since palato-alveolars are [-anterior] both approaches assume that the coronal node must be underlyingly present, as [-anterior] is a dependent of [coronal]. However, the data support palato-alveolars as members of the special subset. Consequently we can conclude that this is a problem for the particular theory assumed. A theory which does not use the controversial feature [anterior] would not require coronal specification here.
(54) Vocalic Mapping:

\[ \text{A floating vocalic melody maps onto an unspecified V-slot (where voc'}\text{indicates an unassociated vocalic melody and V an empty V-slot). (Hume 1994: 195).} \]

But suppose VM is modified slightly (as in (55)) so that it maps onto an adjacent underspecified slot. (After all Voc nodes can be found in consonantal structure, as we saw in (4) above.) And, in addition, we assume that the process is not iterative.\(^{38}\) When the floating melody attempts to attach to the preceding placeless segment, it cannot do so, since this would result in a consonant with secondary articulation and would therefore trigger a structure preservation violation. Consequently, the VM fails to link and the prefix vowel is determined by default. The reason why coronal sonorants pattern with all other types is that like all other types they possess a place node and attached features. Consequently, when the floating vocalic melody features scan for an empty position they locate the empty prefix vowel slot. No structure preservation violation

\(\text{\footnotesize{\textsuperscript{(38)} Notice that this raises questions about its universal status. It’s perhaps best thought of as a language specific process which, as we have seen, is motivated elsewhere.}}\)

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occurs and so the melody attaches and the prefix vowel is a copy of the stem. This 
suggests that Hume’s VM might be reformulated as: 39

(55) $\emptyset$

\[ \text{voc} \]

A floating vocalic melody maps onto an underspecified slot (where voc` indicates an 
unassociated vocalic melody and $\emptyset$ an underspecified structure). The effect of this as 
regards the derivation is illustrated in (56) below.

(56) $j$ \[ v \] $j$ o r o b

\[
\begin{array}{cccc}
\cdot & & & \cdot \\
\cdot & & & \cdot \\
\text{cons} & \text{cons} & \text{place} & \text{place} \\
\text{place} & \text{voc} & \cdot & \cdot
\end{array}
\]

39 Using a different approach, FG or whatever, height features would be contained under place. For 
example [o] in a Sagey-type feature geometry would be [DORSAL, -high, +back]. On such an approach 
syncope would delete information down to the articulator node. However, notice that once again, we have 
to assume that the features spread to take up essentially a vocalic position. That is to say they spread 
without a constriction status change.
Output [jiʃrob] ‘he drinks’

As regards Hume’s objections to underspecification of [i] in Maltese Arabic stems, the behaviour of the unmarked vowel in Maltese has much in common with English in the way in which default vowel features and default consonant features are assigned. Recall from the discussion of default A assignment in English we claimed that in vowels it needed to be present at a much earlier stage in the derivation than in consonants, where it was required only at the very fringe of the phonology/phonetics interface. In Maltese Arabic we have seen that as far as consonants are concerned there is strong evidence to suggest that the underspecification of coronal is motivated, but clearly vowels are more
problematic. Hume claims that stem vowels are not underspecified; prefix vowels are. However, this position is indistinguishable from one in which all /i/ are underlyingly underspecified but stem /i/ is supplied at a very early stage in the derivation. When the morphology has supplied the prefixes however, it appears that the relevant default rules have been switched off, only to be switched on again at a later stage, much as would appear to be the case for English (see chapter 5).

In conclusion, the Maltese data do not provide strong support for coronals and front vowels forming a natural class. Rather, Maltese appears to be a language in which coronal obstruents are special and underspecified and in which the unmarked and underspecified vowel is [i].

In her account of Maltese Hume claims that she has united the unmarked vowel in Maltese, /i/, with the unmarked consonant /t/. To claim to reduce the unmarked consonant place in a language with the unmarked vowel place is a desirable move. However, the arguments set out above disputing Hume’s claims also undermine this aspect of her approach. But even if Maltese did support Hume’s view of [coronal], the linking of [t] and [i] is still problematic. The special default rules assumed by Hume give rise to rather different entities. The unmarked consonant is arguably the universally unmarked consonant (Avery and Rice 1989). /t/ in Maltese is certainly the unmarked consonant, as it is in English. However, although /i/ is the unmarked vowel in Maltese, it does not enjoy the same status universally that /t/ does. So to claim that the two can be
accounted for using the same feature requires Hume to explain why /i/ does not enjoy the same status as /u/.

In this thesis, I have claimed that in English I have connected the unmarked consonant place (coronal) with the unmarked vowel schwa with the unmarked particle A. Schwa certainly enjoys more in the way of unmarked status than /i/ does. However, one of the advantages of the system employed in this thesis is the amount of flexibility available in the interpretation of A. That is, in a three vowel system the A represents the vowel /a/. So schwa is being linked with this /a/-type vowels and consequently we can capture the unmarked option in far more cases, whereas Hume is limited to languages in which /i/ is the unmarked vowel.

Finally, although Hume does not specifically align herself with the special status of coronal exponents, she clearly follows them in assuming that coronals have unmarked status. (Her adherence to contrastive underspecification prevents her from assuming that /u/ in Maltese is for the most part underspecified, because it contrasts with [p] and [k].) Hume’s characterisation of coronals builds in an incompatibility between the unmarked status of coronals and the type of segments involved. If coronals are unmarked, then Hume has to explain the presence in this group of the highly marked palatal consonants. In the approach developed in this theory, no such incompatibility arises.
6.4. More Coronal Front Vowel Cases

So far, this thesis has demonstrated that when A is used to represent place in coronal segments, a considerable amount of explanation can be achieved. Specifically, we can provide a non-arbitrary account of r-sandhi in English; vowel lowering effects of apical *r*s; we have something insightful to say about the greater frequency of schwa/-a/ type vowels as the choice for underspecified vowel and we can reduce the question of why schwa and /t/ are unmarked in English to why A is unmarked. In this chapter we have seen that in addition to this we can account for much of the coronal-front vowel data in a more insightful way without recourse to a feature which embraces coronals and front vowels. However, there are data sets which do seem to support a coronal-front vowel connection. In this section I shall discuss three cases of vowel to consonant assimilation where vowels (and the labio-velar glide) are said to front under the influence of coronal consonants. I shall show why they provide support for the coronal-front vowel natural class and I shall propose a tentative solution which maintains A as the coronal place representative. I shall propose that the behaviour of the coronals in the languages considered suggests a place representation which is the same as that for the front vowel [ɛ]. In section 6.4.1 I shall consider once again Hyman’s account of Fe?fe? reduplication. 6.4.2. will consider Vago’s example of glide fronting in Baule and 6.4.3 will look at vowel fronting in Lhasa Tibetan.
6.4.1. Fe?fe? Bamileke

According to Hyman (1972) "The term "Bamileke" refers to a group of people speaking diverse dialects in the mountainous regions of Western Cameroon." Consequently Fe?fe? is described as a dialect of Bamileke. As we shall see below, Fe?fe? Bamileke itself has numerous dialects e.g. Banka, Bafang and Petit Deboo. In the general description that follows it is the Central FB dialect of Bafang that is the focus although other varieties are considered. The underlying consonantal inventory is set out in (57) below.

(57)

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>c</th>
<th>k</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>d</td>
<td>j</td>
<td>g</td>
</tr>
<tr>
<td>f</td>
<td>s</td>
<td>h</td>
<td></td>
</tr>
<tr>
<td>v</td>
<td>z</td>
<td></td>
<td></td>
</tr>
<tr>
<td>m</td>
<td>n</td>
<td>η</td>
<td></td>
</tr>
<tr>
<td>(w)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Hyman 1972: 30)

The full list of phonetic consonants found in Fe?fe? is given in (58):

(58)

<table>
<thead>
<tr>
<th>[+grave]</th>
<th>[-grave]</th>
<th>[-grave]</th>
<th>[+grave]</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>t</td>
<td>c</td>
<td>k</td>
</tr>
<tr>
<td>b</td>
<td>d</td>
<td>j</td>
<td>g</td>
</tr>
<tr>
<td>f</td>
<td>s</td>
<td>š</td>
<td>h</td>
</tr>
<tr>
<td>v</td>
<td>z</td>
<td>ž</td>
<td>γ</td>
</tr>
<tr>
<td>m</td>
<td>n</td>
<td>(n)</td>
<td>η</td>
</tr>
<tr>
<td>w</td>
<td>l</td>
<td>y</td>
<td>?</td>
</tr>
</tbody>
</table>

([+ant] [+ant] [-ant] [-ant])

(Hyman 1972:17)

---

40 Where /p, l, j, x/ and initial /w/ are derived from /b, d, j, g, gw/ respectively. /s/ and /z/ are derived from /š/ and /ž/.

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Hyman (1972: 32) gives the underlying vowel inventory of Fe?fe? as:

(59)  
\[
\begin{array}{ccc}
[-\text{grave}] & [+\text{grave}] & [+\text{grave}] \\
i & u' & u \\
e & o & \text{ (γ)} \\
(e) & \text{ (α)} & \text{ (α)} \\
a & a & a \\
[-\text{round}] & [-\text{round}] & [+\text{round}] \\
\end{array}
\]

As we saw in Chapter 1, certain varieties of Fe?fe? exhibit a process of reduplication whereby the stem-initial consonant is reduplicated and the nature of the reduplicated vowel depends to some extent on the stem initial consonant and the stem vowel.\(^{41}\)

Consider the data in (60) below. (I have repeated the data from (27) in chapter 1 for convenience.)

(60)

\[
\begin{array}{ccc}
\text{za} & \rightarrow & \text{zuza} \\
\text{to} & \rightarrow & \text{tuuto} \\
\text{sóh} & \rightarrow & \text{suisóh} \\
\end{array}
\]

\begin{itemize}
  \item to eat
  \item to punch
  \item to wash
\end{itemize}

On the basis of this data Hyman claimed that the reduplicated vowel is realised as [u] in careful speech and as [i] in rapid speech. However, he noted that if the stem vowel was [i] as in (61), then the reduplicated vowel would also be [i].

(61)

\[
\begin{array}{ccc}
\text{sii} & \rightarrow & \text{sisi} \\
\text{pii} & \rightarrow & \text{pipi} \\
\end{array}
\]

\begin{itemize}
  \item to spoil
  \item to profit
\end{itemize}

\(^{41}\) Hyman (1972: 32) states "The symbol /u/ is used for /I w/.

Hyman (1972) notes that the Banka dialect exhibits standard reduplication in which the stem initial consonant and vowel are reduplicated. Hence [za] becomes [zaza], [to] reduplicates to [toto].
If the vowel was a front vowel other than [i] then the reduplicated vowel would be [i] just so long as the intervening consonant was a coronal or palatal.

(62)  pëe  →  püpëe  to hate
       tee  →  titee  to remove
       yee  →  yiyyee to see
       këe  →  kukën to refuse
       pën  →  püpën to accept
       tën  →  titën to stand up
       čën  →  čičën to moan
       yën  →  yuryën to go
       pa? →  püpa? to commit suicide
       ta? →  tita? to bargain
       ča? →  čiča? to trample
       ka? →  kuka? to grill

Hyman’s approach to this data was to argue that if the feature [grave] was reintroduced into the feature system, vowel fronting could be accounted for as a process of assimilation. Hyman commented on the fact that [i] is more acute i.e. [-grave] than the other front vowels and so vowels which are less acute ([grave]) needed the support of an intervening acute consonant in order to effect the assimilation.

But this is just one variety of Fe?fe? and one manifestation of the reduplication process. Hyman (1973: 376) discusses data from Fe?fe? villages which differ in the distribution of [u] to [i]. In such varieties not only does [i] effect fronting but so does [e], without assistance from an intervening coronal ([e] and [a] behave as in the first variety). Hyman uses this variation data to support his claim that there are different degrees of [-grave]. However, to talk about degrees of a bivalent property is a contradiction.
A nonlinear account of Fe?fe? reduplication would presumably be that the stem-initial consonant maps onto the template, but what is interesting is that the stem initial vowel does not follow suit. The appearance of [i] in the reduplicated vowel position can be accounted for as the spread of particle I under certain circumstances. The appearance of [u] can be accounted for if we assume that it is the default vowel and is filled in if spreading does not occur.

On the approach adopted in this thesis, a number of Hyman’s points fall out. First of all, the grave/acute distinction is captured by the fact that the velars and labials are represented by a single particle: U. Secondly, the degree of ‘acuteness’ can be accounted for in a particle theory in terms of the contribution that the I particle makes to the overall structure of the vowel. Consider the following particle representation of front vowels.

(63)    /i/     I
        /e/     I
        /ɛ/     A
        /a/     A

In the vowel [i], I is the sole particle, and so in the first system it would seem that I spreads most readily into the empty vowel slot when it is the sole component. In systems where both stem [i] and [ɛ] give rise to [i] regardless of the nature of the intervening consonant, we can say that the I head is spreading. The reduced ability of the low front
vowels to give rise to [i] can be accounted for by the fact that in low front vowels I is present as a dependent.

However, what is interesting about this problem is why labials and velars should block the spread of the I particle under certain circumstances\(^{42}\), but coronals and palatals facilitate it. On the assumption that coronals are underspecified for place the reason I spreads is that it is not prevented from doing so by an intervening place node. The problem with this claim is that palatals also permit I spreading. On the basis of data provided by Hyman (1973) we find that the 'palatals' refer to the palatal glide [j], as in [yiyee] for example, and the palato-alveolar affricate [č], as in [čiča?] for example. The palatal glide, first of all, often patterns with front vowels in fronting and palatalization processes. Its place structure would contain I in isolation. Therefore, we could claim that the glide [j] rather than the vowel gives rise to [i]. In chapter 4 we discussed the structure of palato-alveolars and assumed that their place nodes consisted of A and I, so once again we could say that it is the I that is spreading from the palato-alveolar. So we could say that in Fe?fe? the alveolar coronals permit spreading because they have no place node, palato-alveolars and palatals permit spreading because they contain a I place particle. When we consider evidence from a third variety of Fe?fe?, however, this account becomes untenable.

\(^{42}\) The circumstances under which I spreads in the two varieties are:
System 1 I as sole particle spreads freely.
\(\uparrow\) I spreads freely if the intervening C is coronal/palatal.
System 2 I spreads freely if it is the head
\(\uparrow\) or if the intervening C is a coronal/palatal.
The variety in question is Petit De Boum (see Hyman 1972, Clements 1976). Consider the data in (64).

(64) za ziza 'to eat'
to tito 'to punch'
keen kikée 'to refuse'
ben pipen 'to accept'
kuum kukuu 'to carve'
ko kuko 'to take'
boh pupoh 'to be afraid'
siim sisii 'to spoil'
teen titee 'to remove'
cen cicen 'to moan'

(Clements 1976: 101)

On the basis of this data the claim is that the reduplicated vowel is rounded to [u] when the stem vowel is [u], or when the stem initial consonant is a "grave" consonant and the stem vowel a round vowel of any height. If, on the other hand, the stem vowel is [i] or if the stem consonant is an "acute" consonant and is followed by a front vowel, the reduplicated vowel is [i].

Petit De Boum would appear to have a more symmetrical system than those described so far in that both [i] and [u] spread freely. One of the data items: [tito] undermines the suggestion made above. When this item is compared with [titee], for example, we find that although I spreads freely across coronals, the spread of U is blocked. Presumably, if a I dependent can spread through /t/ because /t/ lacks a place node, then we would expect dependent U to be able to spread with equal ease in such a symmetrical system. The fact

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that it cannot suggests that we have to re-examine our assumptions about the structure of 
/t/ etc.

Suppose we assume that coronals are not special in Fe?fe?. This means that they will be
specified underlingly for the coronal representative A. However, if alveolar place is
simply A, as we assume for English, then the reason why /t/ etc patterns with the palatals
and palato-alveolars is entirely mysterious. The fact that /t/ e t c. pattern with palatals
and palato-alveolars suggests that the place specification shares something in common
with these other places. If we assume that Fe?fe? coronals have the place structure given
in (65) below, then it becomes apparent that the alveolars do indeed have something in
common with palatals and palato-alveolars: the presence of the \( I \) particle in some
capacity.

(65) \[
\begin{array}{c}
\text{C} \\
\text{\ldots} \\
\text{\ldots} \\
\text{\ldots} \\
\text{A} \\
\text{I}
\end{array}
\]

In chapter 4 we argued that such a structure represents place in dentals or 'fronted
alveolars'. In addition we noted that this particular place structure is identical to that for
the front vowel [e]. I am not claiming that /t/, /d/ etc in Fe\(2\)fe\(2\) must be dentals, although
they may well be, rather I am saying that on the basis of the evidence from Hyman and
Clements, alveolar coronals would appear to have a place structure like that proposed for dentals.\textsuperscript{43} If we assume this structure for Petit Deboum alveolars, this enables us to account for a number of aspects of the Fe?fe? case as they have been presented in Hyman (1973) and in Clements (1976). Firstly, we can account for the patterning of the consonants in that alveolars will pattern with palatals and palato-alveolars, since all three contain I in their place representations. Secondly, we can account for the failure of dependent U to spread through alveolar consonants and thirdly, we can account for the appearance of [i] when the stem consists of an alveolar and front vowel combination i.e. the presence of I does not block I spreading from the vowel in the same way that the presence of U in a labial or velar facilitates the spread of U in the Petit Deboum variety. An approach of this kind can also be used to account for the case of glide fronting in Baule.

6.4.2. Baule

Baule, a language spoken on the Ivory Coast, provides a second, distinct example of the alleged effect of coronals and palatals, this time on a non-front semi-vowel [w] (data

\textsuperscript{43} This would mean that alveolars, like uvulars, have two representations and the choice of representation for a language can be determined by the behaviour of this class. Since the coronal representative has a dependent particle this means that coronal will not show underspecification in such languages. In contrast, languages in which the coronal representative A only is present may or may not select to underspecify A. In other words, if a language does not exhibit asymmetrical behaviour of coronal this does not mean that the structure of alveolar place is AI. All it guarantees is that the coronal representative A is not underspecified. To determine that the structure is AI one must look for behaviour such as that found in Fe?fe?.

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taken from Vago 1976). According to Vago (1976 672) Baule has the following consonant and vowel inventories.

(66) a. Consonants

<table>
<thead>
<tr>
<th></th>
<th>Labial</th>
<th>Alveolar</th>
<th>Palatal</th>
<th>Velar</th>
<th>Labio-velar</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>t</td>
<td>c</td>
<td>k</td>
<td>kp</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>d</td>
<td>j</td>
<td>g</td>
<td>gb</td>
<td></td>
</tr>
<tr>
<td>f</td>
<td>s</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m</td>
<td>n</td>
<td>l</td>
<td>y</td>
<td>w</td>
<td></td>
</tr>
</tbody>
</table>

b. Vowels

- i
- u
- e
- o
- e
- o

Consider the data in (67a and b).

(67) a. 

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>twi</td>
<td>gun</td>
<td>ayicwe</td>
<td>tortoise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>swi</td>
<td>elephant</td>
<td>mucwe</td>
<td>eight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nzwe</td>
<td>water</td>
<td>ajwi</td>
<td>craft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>adwi</td>
<td>amulet</td>
<td>jwe</td>
<td>fish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lwí</td>
<td>fat</td>
<td>jwejwe</td>
<td>happy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bwi</td>
<td>back</td>
<td>kwe</td>
<td>fetus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bwe</td>
<td>nose</td>
<td>kwekwe</td>
<td>comb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bwe</td>
<td>half</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The claim is that whenever /w/ occurs between an alveolar, or palatal, consonant and a front vowel (as in 67 a above) it is fronted to [uí]. (67b) demonstrates that labial and velar consonants and front vowels do not have the same effect on /w/. (67 b) shows that it is not the front vowel alone which is fronting the labio-velar glide, a coronal/palatal must also be present. Given this the conclusion is that there must be a connection between coronals and palatal. Vago (1976) assumes that the connection is [-grave]. And he
argues that when [w], which is [+grave], is surrounded by [-grave] segments, it assimilates to these segments and becomes [-grave]. Labials and velars, on the other hand, being [+grave] have no effect. Vago presented the following SPE style rule to account for this assimilation process.

\[
(62) \quad [-\text{syl}l] \rightarrow [-\text{grave}] / [-\text{syl}l \quad [\text{+syl}l] / [-\text{grave}]
\]

But once again, this example is not conclusive evidence of a front vowel coronal connection.

Notice, once again, that the coronal consonants in Baule, as in Fe?fe?, are not the cause of fronting, but they do appear to play some kind of ‘supporting’ or ‘strengthening’ role in the fronting processes. It is arguable that in Baule the reason why fronting occurs in cases where [w] + front vowel is due to the requirement that the morpheme should share the property I. This is not possible in units which contain an initial labial or velar, since the U prevents the existence of I across the morpheme. But what of the role of the coronal consonants in this?

There are two potential answers to this question. First of all, if we assume coronal underspecification, the question arises why do zero-placed consonants pattern with I-placed consonants rather than U-placed? Alternatively, we could assume that Baule, like Fe?fe?, does not have special coronals and furthermore that Baule coronals have the place structure given in (65) above. Once we assume this structure for Baule coronals we
can maintain that I becomes a property of the whole morpheme, thereby resulting in glide fronting.

In sum, I have considered two of the original cases of alleged coronal front vowel connection which have been put forward as evidence that coronals and front vowels share the same features (be it [-grave] or [+coronal]). We have seen that in both cases coronal consonants are not the cause of fronting, rather they appear to play a supporting role assisting front vowels to promote fronting. I have argued that we might tentatively account for Fe?fe? reduplication and Baule fronting if we assume that the coronals in these languages have the place structure proposed in chapter 4 for dentals: AI. The behaviour of the coronals in these languages support this proposal. In this approach the coronals would indeed have much in common with front vowels since AI is not only the structure for dentals, but also for the vowel [e].

What this suggests is that a language where coronals have the structure AI may well appear to exhibit front vowel behaviour given the presence of I. In languages such as English, which has dentals and alveolars, the alveolars will not exhibit front vowel like behaviour. However, it is worth emphasising here that it is not the coronal (represented by A) that is primarily responsible for the appearance of [i] or for glide fronting, since the presence of a front vowel is always required.
Finally in this section I shall consider another of the original pieces of evidence for a coronal-front-vowel natural class: Lhasa Tibetan. This language would also appear to be a Fe?fe?-type language.

6.4.3. Lhasa Tibetan

According to Clements (1976) (drawing upon the work of Michailowsky 1975), when written Tibetan is compared with contemporary spoken Lhasa Tibetan it appears that non-front vowels have been fronted by a following coronal written as /d, n, l, s/, and that these coronal consonants have subsequently dropped out. (69) provides a comparison between Written Tibetan and Lhasa Tibetan (taken from Clements 1976: 101-2).

(69)  Written Tibetan       Lhasa Tibetan
      bgyad                 kéé       eight
      bod                  phöö       Tibet
      bdub                 tüüü       demon
      sman                mëëë       medicine
      ston                 töö       autumn
      bdun                 tüüü       seven
      bal                phëgg       wool
      thol                thööö       country
      ras                 rgëë       cloth
      chos                chööö       religion
      lus                 lüüü       body.

Clements (1976: 102) summarises the results of fronting as:

(70)  Written Tibetan       Lhasa Tibetan
      a                   ð                           
      o                   ðö                         
      u                   ðü                         

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Clements (1976) argued that, with a revised SPE definition of coronal, Tibetan vowel fronting could be characterised as an assimilation process. In other words, the back vowels assimilated to the following coronal consonants and were consequently fronted.

If Tibetan, like Fe?fe? and Baule, had coronals with the place structure given in (65), the cause of fronting would indeed lie within the coronal consonant, although, once again, it is not the coronal place representative itself which is responsible for the fronting.

Support for the adoption of the place structure in (65) can be found in Clements' footnote 9 (p 108). Here Clements comments that some scholars apparently claim that these vowel changes may have passed through a diphthongal phase and this is apparently supported by certain present-day dialects which exhibit diphthongs in these positions. It is interesting that Clements gives the example *od > *oi > ö:, or alternatively, *od > *oid > *oi > * ö: . This suggests that prior to coronal loss the coronal disintegrated, revealing its place makeup.

\[(\text{71})\]

\begin{align*}
\text{(a)} & \quad N \quad O \\
\text{(b)} & \quad N \quad O \\
\text{(c)} & \quad N \quad O \\
\text{(d)} & \quad N \quad O
\end{align*}

\begin{align*}
& \quad x \quad x \\
& \quad o \quad A \\
& \quad o \quad i \\
& \quad o \quad i
\end{align*}

\begin{align*}
& \quad x \quad x \\
& \quad o \quad i \\
& \quad o \quad i \\
& \quad o \quad i
\end{align*}

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(69a) represents the proposed original form *od. In (69b) the place node of d has split, but at this stage I is being read as [i] and A as [d]. In (69c), the [d] has been lost leaving the diphthong *oi and finally in (69d) the I has blended with the particle structure of [o] giving rise to a fronted vowel *ö.: 

Tibetan differs from Baule and Fe?fe? in that it would appear that the coronal consonants are responsible for the fronting process. However, we have argued that if we assume that alveolars are AI in such languages then it is the I particle that causes the fronting and the A particle, which we assume represents coronal in the phonology, is not implicated in the process at all.

In sum, in this thesis we have seen that if we assume that coronal place is represented in the phonology by A a number of interesting consequences follow. In this chapter we have considered in detail the evidence put forward for the coronal-front vowel connection and we have discussed at length the mainstream approach to this natural class. I have argued that in order to capture this group the model proposed by Clements and Hume encounters a number of problems. In addition, I have argued that much of the coronal-front vowel evidence can be accounted for just as easily with the coronal-A approach. In cases where there appears to be a true coronal-front vowel connection, I have argued, as a first approximation, that this might be captured by assuming the presence of the I particle in the representation rather than by assuming that it is the coronal place representative which establishes the connection.
Conclusion

The aim of this thesis has been to search for the best possible representation of coronal segments. Chapter 1 set the scene for this search. First of all, I set out the representational issues which would need to be addressed: the nature of the phonological prime - feature or particle; hierarchical organization or 2-dimensional structure; underspecification. Having set out these issues I discussed the way in which coronals have been represented in the literature over the past 25 years. I then looked at two specific debates which focus on coronals namely the 'unified place features' debate and the 'special status of coronals' debate. Within the unified place features debate coronals are equated with front vowels and this has a direct effect on the representation of coronal segments. The special status of coronals issue seeks to ensure that the unmarked and special status of coronals is reflected in the representation.

Chapter 2 presented Broadbent’s (1991) analysis of linking and intrusive r in English. Although this analysis established a nonarbitrary relationship between the appearance of r-sandhi and the preceding vowel the framework within which it was couched pointed to a solution but could not straightforwardly implement it. More precisely, this analysis suggested that r-sandhi is a glide formation process whereby some aspect of the final vowel spreads into a following empty onset. This ties the appearance of r-sandhi to the preceding vowel, making very precise predictions about which vowels can give rise to [j]. Glide Formation is a general process which equates the appearance of the r-glide with mid low and low vowels and relates the appearance of the r-glide to the appearance of [j] after high front vowels and of [w] after high back vowels. In
addition, I made the claim that just as [i] and [u] are related to [j] and [w] respectively, so [a] is the cognate vowel of [i]. Given this connection between [a] and [i] and the r-sandhi account a number of theories of subsegmental structure were then looked at to see if they could implement GF in a more straightforward manner than ET and in such a way that the schwa-coronal link could be maintained. DP, PP and one version of FG where considered. The FG model could implement GF, however, not in the straightforward manner that the GF process indicates. Furthermore, there was no connection established between schwa and [i]. DP likewise could not implement GF and maintain the nonarbitrary r-sandhi account. PP however, could a) maintain r-sandhi as GF and b) establish the schwa-r connection. Thus in particle terms GF is a process which spreads the head particle of the vowel into a following empty onset.

The claim was that I gave rise to [j], U gave rise to [w] and A to [i] Therefore in chapter 2 a new vowel-coronal link was suggested: schwa-r.

Furthermore, the subsegmental theory best suited to representing this was Schane’s particle phonology. The conclusion was that schwa and the coronal glide [i] were both represented by a single aperture particle A.

In chapter 3 I considered the possibility that A could be used to represent coronal in coronal segments more generally. In order to do this, I considered evidence relating schwa to consonantal r’s. Specifically, I argued that prior to r-loss the disintegrating /r/ gave up its place particle A and for this reason, so-called pre-schwa breaking/laxing occurred. I considered other examples of consonants disintegrating revealing their place particles to demonstrate that velars yield U, palatals I and coronals A. I then considered /t, d, s, z/ vocalisations to [r] and argued that in order to maintain the non-
arbitrary account of r-sandhi, and the schwa-coronal connection between /r/, /l/, and /n/ and schwa, /l/ etc. must also contain A. Any other account would result in the loss of the former connections. I then looked more closely at the A-coronal connection and argued that A is not itself coronal, but rather it represents coronal in the phonological component. I argued that when A is compared to I and U we find that I and U can be implemented phonetically without changing the basic instruction. However, when A requires some degree of consonantal closure, a problem arises: how to produce a closure and maintain a non-high tongue body configuration. The answer is that coronality is added in the phonetic implementation.

Chapter 4 set out to consider the representation of consonantal place more generally in an approach which assumes coronals are represented by A. This had a number of consequences for the adopted structure: although Schane does not recognise head/dependent relations, which other particle theories use, I argued that this would be a desirable step. Secondly, hierarchical structure was adopted. So, Particle theory was modified to reflect these changes.

Chapter 5 considered the special status of coronals. First of all, I looked at a number of examples from English which suggest that coronals behave asymmetrically with respect to other place types. In chapter 1 we had seen that asymmetrical behavior is captured by underspecification of coronal. I argued that underspecification was motivated, but that we were no longer considering the underspecificaiton of coronal, we were now concerned with the underspecification of particle A. Furthermore, since A represents the unmarked coronal place, the unmarked vowel: schwa-/a/-type vowel and the unmarked particle three unmarked entities were being collapsed into one. I
suggested that the reason for the unmarked status of A is that it is the position closest to ‘rest’. Movement away from rest is more marked. Languages such as English, which selects A-underspecification, are therefore selecting the unmarked option.

Finally, in chapter 6 I returned to the competing view that groups coronal consonants with front vowels. I considered some of the chief evidence put forward in support of this connection. Specifically palatalisation processes and certain processes in Maltese Arabic. In both cases I argued that they could be accounted for without recourse to a coronal front vowel connection.

In sum, in this thesis I have argued that coronals should be represented in the phonology by A, the actual coronality being assigned in the phonetic implementation. In so doing I have established a connection between 3 unmarked entities: schwa/a-type vowels, coronal place and A.
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