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**Single-valued features and the distinction  
 between [-F] and [ØF]**

In Ewen & van der Hulst (1985), a number of aspects of underspecification theory are considered, in relation to a system of phonological representation based on single-valued features. We concluded there that the distinction drawn by Archangeli (1984) between complement and default rules was not relevant in a single-valued approach, in that complement values do not exist for single-valued features: for a binary feature the complement value is simply the reverse, so that [+F], say, has the complement value [-F], while the same strategy applied to a single-valued feature [F] simply yields the absence of the feature in question, as in (1):

(1)	Binary	Single-valued
	Lexical value	[+F] [F]
	Complement value	[-F] —

Thus, in an underspecification approach, the only rules required to handle cases of the sort dealt with by Archangeli are default rules, which simply supply the redundant features which are not present in lexical representations.

The validity of single-valued approaches within an underspecification framework has been called into question in recent work by Steriade (e.g. 1986), in which various kinds of apparently non-local phonological processes are dealt with. One of Steriade's claims is that the distinctions which she is able to make rely crucially on the use of a binary feature system. If her arguments are correct, then, this would provide important evidence against a system based on single-valued features.

Let us first consider the most important aspects of Steriade's theory. Like Archangeli, she draws a distinction between complement and default values, as in (2):

- (2) a. *Complement value*  
 A non-underlying value of F within a segmental class where  
 F is distinctive
- b. *Default value*  
 A non-underlying value of F within a segmental class where  
 F is predictable

As well as complement value and default value, we will use the term lexical value for the value specified lexically for segments belonging to the class in which F is distinctive. The choice of which value for a particular feature is lexical and which the complement value depends in Archangeli's model on language particular factors such as alternations, economy, and, if these are not decisive, universal markedness.

Steriade (1986) provides a simple example involving the binary feature [voice] in Japanese, which has the lexical inventory in (3):

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 1962 A short reference grammar of Moroccan Arabic, Washington D.C., Georgetown University Press
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peal to complement values. This model will prove to be untenable, however. We then propose a more drastic alternative which has various empirical consequences. In both proposals we assume that all spreading involves adjacency. However, this does not mean that spreading necessarily involves adjacent segments. Rather, in terms of an autosegmental model like that of Clements (1985), adjacency refers to the class nodes to which a feature can associate. A segment can be skipped in a spreading process if it lacks the appropriate class node (cf. van der Hulst & Smith, this volume: §3).

Let us turn to the first proposal. Suppose we allow empty nodes to be generated in the course of the derivation. Underlyingly we find only those class nodes which bear features, which we will refer to as lexical nodes. In the same way as Steriade differentiates between complement and default values, so we can distinguish complement nodes and default nodes. Complement nodes can be detected by a principle analogous to that in (5), Steriade's Universal Complement Rule:

(14) *Universal complement node rule*

Given some feature F: find all pairs of segments (s<sub>1</sub>, s<sub>2</sub>) such that s<sub>1</sub> differs from s<sub>2</sub> only in that s<sub>1</sub> is F-specified and s<sub>2</sub> not. Assign to s<sub>2</sub> the class node which bears F.

This principle gives us a set of (empty) complement node generation rules. Finally, we can define a set of default node generation rules, which creates all nodes not otherwise specified, whether they are filled or empty.

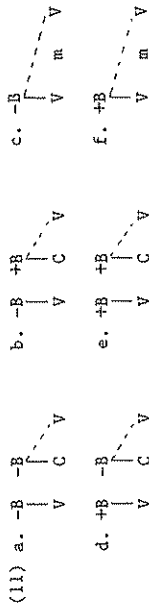
Given our assumption about adjacency of nodes, spreading will be blocked not by the presence of a particular feature-value, but by the presence of a particular class node. In demonstrating this, we will make use of the model of segmental representation proposed by Archangeli & Pulleyblank (1986) (cf. also Clements 1985), which incorporates a distinction between a place node, associated with consonantal place features, and a secondary place node (S-place node), associated with vocalic features. Palatalised consonants, however, also involve an S-place specification, as the secondary articulation involved is characterised by the tongue-body feature [back] (cf. also Clements' approach).

Spreading will be blocked if the spreading feature cannot associate with the S-place node under one of the conditions in (15):

(15) *Opacity Condition<sup>1</sup>*

- A segment S is opaque with respect to F iff:
  - a. S has the class node to which F associates and
  - b. F is prevented from associating to S by virtue of
    - i. a filter op<sup>2</sup>
    - ii. the SD of the spreading rule

For Barra Gaelic, then, we end up with the analysis in (16). Spreading of the frontness feature applies after C-node generation but before D-node generation:



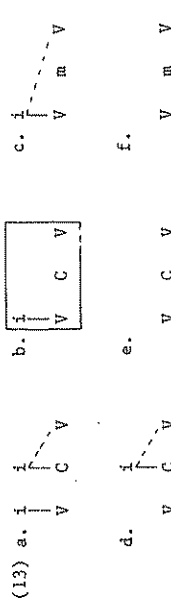
The first five of these possibilities are illustrated by the data in (12):

- (12) a. [ken'ep] 'hemp'
- b. [ʃerok] 'to fade'
- c. [t'imiɔdl] 'round about'
- d. [bul'ik] 'bellows', gen. sg.
- e. [balok] 'bellows'

The possibility in (11f) is not recorded in the data given by Borgström. However, its absence does not affect the point being made here.

Notice that in Steriade's model the distinctive non-palatalised consonants acquire [-back] by a C-rule (on the assumption that [+back] is the L-value), while the labials, which are non-distinctive for palatality, acquire their value from a D-rule. Thus the spreading rule is a C-rule: if it were an L-rule, distinctive non-palatalised consonants would be skipped, and if it were a D-rule, labials would not be skipped. Both these possibilities would of course be theoretically available in Steriade's theory.

An analysis of this problem in terms of single-valued features does indeed appear to raise problems, given that we are unable to make a distinction between [-F] and [ØF] in such a framework. Consider the single-valued equivalent of (11), given as (13):



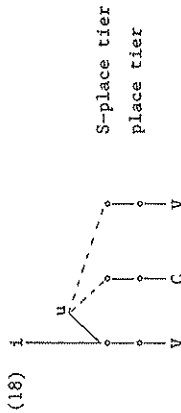
Here we incorporate a single-valued feature of frontness (cf. Anderson & Ewen 1987 and Goldsmith 1985, among others): this gives a more natural interpretation of the secondary articulation involved, in that palatalised consonants now have a property which the plain consonants lack, and also allows us to avoid having to specify labials as being phonetically back, which at best seems counterintuitive. However, it will be clear that we are now unable to account for the case enclosed in the box in (13): as the C is no longer associated with a feature, there appears to be nothing preventing spreading into the second vowel; there is no formal difference between (13b) and (13c). Moreover, given a single-valued feature system, it is unclear how the absence of F could block anything.

However, we will now show that a single-valued feature system can, contrary to the claim made by Steriade, provide an adequate analysis of the kind of phenomena we have been looking at. We proceed as follows. First we consider a model close to Steriade's, which employs 'empty nodes' in contexts where Steriade makes ap-

bear). We return to the second category of so-called L-rules in a moment. Let us first investigate the consequences of our alternative proposal in more detail.

There is another reason to prefer the second proposal, besides its greater restrictiveness. The first proposal is inconsistent in that we assumed that the presence of a class node, specifically an S-place node, blocks the spreading of all features which associate to this node if the segment bearing this class node does not constitute a target. Since, in the first proposal, *distinctive* non-palatalised consonants are provided with an (empty) S-place node, it is not clear how S-place features other than [i] can skip these consonants, as they must, since the consonants in question can determine only one feature of the epenthetic vowel, i.e. the presence or absence of [i]. Even if we do not provide distinctive non-palatalised consonants with an empty S-place node, the same point applies to distinctive palatalised consonants, which must have an S-node because they bear [i]. In short, non-labials in Barra Gaelic are not opaque with respect to S-place features other than [i], despite the fact that in our first proposal they have the relevant class node and do not belong to the target class of vowels.

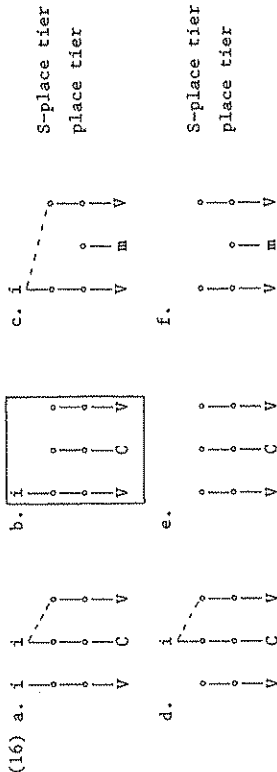
In terms of our second proposal, however, S-place features other than [i] can spread to and thus across distinctive non-palatalised consonants without problems. Consider (18), where we show the effect of potential spreading of [i] and [u] (the roundness feature) across a distinctive non-palatalised consonant:



Spreading of [i] to the intervening consonant is prevented because association of this feature with the S-place node would neutralise the opposition between palatalised and non-palatalised non-labial consonants, while our strict adjacency assumption prevents spreading to the vowel. However, there is nothing to stop the association of [u] with the consonant, as there is no pair of consonants which is distinguished merely by the presence or absence of this feature. If the intervening consonant had been a labial, then [i] could be associated with it in the same way: there is no distinctive opposition between palatalised and non-palatalised labials, and so there is no question of neutralisation in this case.

In this analysis, then, we assume that vocalic features may associate to the place node of the intervening consonant, which is either underlyingly present (distinctive palatalised consonants) or generated (distinctive non-palatalised consonants), as these features are not contrastively absent. Phonetically, these associated features are interpreted in terms of co-articulation. In this view, it is also no longer necessary to assume that labials are skipped. Rather, we can say that vowel features (including [i]) are associated to them, and that these associations will also be interpreted as co-articulatory effects. This is in accordance with the observations made by Borgström (1940: 18-19): 'labials, in the neighbourhood of front vowels or palatal consonants, are usually pronounced with the tongue in a somewhat palatal position, and possibly also with the lips more tightly drawn than in other positions'. The upshot of this move is that we have virtually eliminated skipping from the theory.

To conclude this paper, we consider two possible revisions of the framework



Intervening non-labials have an empty S-place node. If we assume that they can not act as targets *because the SD of the rule demands a vowel*, they will be opaque due to (15), in particular (15b.ii).

The second possibility which we would like to consider involves the proposal of a condition which rules out particular associations because they cause neutralisation, i.e. because they assign F to a segment which is distinctively non-F. We do not, of course, wish to eliminate neutralisation rules in general, but we can rule out the neutralisation of (non-target) intervening segments in spreading processes. Let us extend the Opacity Condition as in (17):

(17) Opacity Condition (revised)

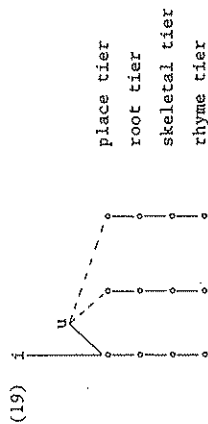
- A. segment S is opaque with respect to F iff:
  - a. S has the class node to which F associates and
  - b. F is prevented from associating to S by virtue of
    - i. a filter or
    - ii. the SD of the spreading rule or
    - iii. the fact that F is distinctively absent while S is not specified as being the target of an association

This approach has the advantage of not needing 'empty nodes'. More interestingly, however, it leads to a more restrictive theory. As opacity is no longer due to an empty node which is generated at some point in the course of the derivation without actually functioning as an anchor point, we can exclude the possibility of such empty nodes, thus eliminating a category of rules allowed under the previous account, i.e. the category of L-rules, which were crucially distinguished from C-rules by applying before the empty C-nodes were assigned.

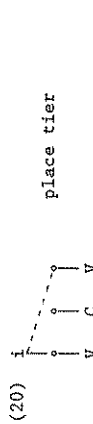
It does indeed seem that this category of rules is idiosyncratic. The examples provided by Steriade (1986) can be shown to be the result of the particular feature system which she adopts, while other conceivable cases are of a rather special type in the sense that they involve rules which refer *only* to vowels. The first category is exemplified by some varieties of Finnish palatal harmony, where /u/ and /ø/ are distinctively [-back], are skipped. On the assumption that [-back] is the spreading value and also the L-value, skipping of the two front rounded vowels provides an example of the top left-hand cell in (8). It is easy to see that different claims are made if the spreading value is taken to be [-back] or [+front], or indeed the single-valued frontness feature. Following van der Hulst & Smith (1986), we can characterise the vowels in such a case as transparent rather than skippable, in that they allow the spreading of a feature which is identical to the feature which they themselves bear (or will

proposed here. In the first place, our analysis of (18) is based on the assumption that although distinctive non-palatalised consonants are not provided with an empty S-place node by a C-rule, they do generate one. This is necessary, because otherwise (17) cannot be 'implemented'. We must assume then that the spreading rule cannot simply ignore consonants, even though they are not targets for a spreading rule which demands a vowel. This is not unreasonable, since consonants can be the source of a spreading [i].

Alternatively, we could abandon the idea that a distinction must be made between a place tier and an S-place tier (cf. Ewen 1986). In that case spreading vowel features simply associate to the place node, unless clause (iii) of the Opacity Condition is violated:

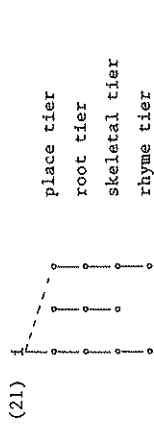


Our second revision relates to the category of C-rules mentioned above, i.e. rules, involving only vowels, in which F spreads across distinctive non-F. Such rules contradict the claim that segments which are distinctively non-F are necessarily opaque. Rules of this type are reported for certain dialects of Latvian (cf. Timberlake 1986), in which palatalisation takes place across intervening distinctive palatalised and non-palatalised consonants. We illustrate this type of situation in (20):



in which [i] spreads across C in spite of the presence of the relevant class node.

In our analysis of Barra Gaelic, we assumed that adjacency with respect to the spreading of a feature F is always defined in terms of F-bearing class nodes. Such an analysis is highly restrictive, but, given the evidence from Latvian, possibly over-restrictive. Perhaps, rather, adjacency is a parameter which is set differently for different processes, and, rather than being specified in terms of class nodes, makes reference to structural tiers. Consider situations like (16b) and (20) in terms of a model incorporating a rhyme tier and a skeletal tier (or macro tier - cf. again Archangeli & Pulleyblank 1986):

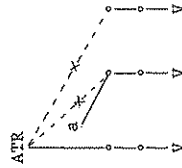


Here we have added two structural tiers (the rhyme and skeletal tiers). We ignore, however, further details of the representation of the internal structure of the segments. Why, then, does spreading across distinctive non-palatalised take place in Gaelic, but not in Latvian? We can associate this with the choice of the adjacency parameter: in Barra Gaelic, where both consonants and vowels are relevant to the process, the adjacency tier is the skeletal tier, where every segment has a representation, whereas in Latvian it is the rhyme tier, where only vowels are present.<sup>3</sup> Thus in Latvian the intervening distinctive non-palatalised consonant *caž* be skipped in the spreading process because it is not visible to the spreading element: it is not associated with a node on the rhyme tier. On the other hand, in Gaelic adjacency is defined on the skeletal tier. Here the distinctive non-palatalised consonant *čs* associated with an element on the adjacency tier, and so spreading is blocked.

Although our second proposal involves the introduction of a new element into our analysis to deal with a restricted class of 'L-rules', we have nevertheless maintained our central claim, i.e. that spreading is bound to adjacency, and that a feature cannot spread across a segment for which the absence of that (single-valued) feature is distinctive. However, this now only holds if that segment is visible to the feature in question, i.e. if it is associated with a node on the adjacency tier defined for the process in question.<sup>4</sup>

Notes

1. This approach to opacity derives essentially from Pulleyblank (1985), and is similar to that of Archangeli & Pulleyblank, although their framework differs in that features are binary and empty nodes are ruled out by stipulation.
2. Cases of this type involve for example opaque low vowels in ATR harmony systems (cf. Pulleyblank 1985; van der Hulst & Smith 1986; and note 4 below).
3. The distinction between adjacency being defined structurally in two ways is similar to the distinction made by Archangeli & Pulleyblank between maximal and minimal rules.
4. The question arises as to whether we still need empty D-nodes from the theory. In particular, is it possible for a segment which is non-distinctively non-F to be opaque? Such cases can indeed be found. However, they only appear to occur if the class node which bears F is implied by the presence of other features. This appears to be the case when a predictably [-ATR] low vowel is opaque to ATR-spreading, i.e. where it is non-distinctively non-F (cf. the discussion of Akan harmony in van der Hulst & Smith 1986). We assume here that the lowness and ATR features are associated with the same class node:



Cases of this type are discussed by van der Hulst & Smith (this volume).

