Position Neutralization and OCP-subsidiary features
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In this paper I discuss four environments in which certain stricture features are predictable. I give an argument that the contextually predictable features are absent in two cases but present in two other cases. The argument is built on the theory of OCP-subsidiary features from Yip (1989a), which crucially interacts with underspecification.

After introducing the phenomenon of Position Neutralization and the theory of OCP-subsidiary features, I discuss labial cooccurrence-restrictions in Cantonese, where PN affects the OCP-subsidiary feature continuancy. Then I turn to coronal cooccurrence-restrictions in English, where I argue that PN affects the OCP-subsidiary feature sonorancy in complex onsets. In each language there is also another case in which contextually predictable features are not absent.

In the last section I offer some speculations on how the difference between the features that are missing and the features that are present might be accommodated using the theory of Position Neutralization from Steriade (1994b).

Position Neutralization

In many languages a contrast between two features can surface in some positions of a word (or syllable), but not in others. In German, for example (see Rubach 1990) voicing is distinctive on obstruents in the onset as in the two dative noun-forms [ra.d-e] 'wheel-DAT' vs. [ra.t-e] 'council-DAT' but not in the coda: the nominative-forms /rad/ and /rat/ have the same pronunciation [rat]. As this example shows, Position Neutralization (PN) cannot be a property of underlying representations.

An interesting question is whether PN is just a fact about the (non-)pronunciation of contrasts in certain positions (i.e. PN might happen in the phonetics), or if the neutralized features are actually absent at some point during the phonology.

Rubach's discussion of final devoicing (i.e. PN of voicing in the coda) in German suggests that PN is phonological. As shown in (1), final devoicing applies postcyclically, after a cyclic rule of Sonorant Syllabification. Crucially, however, final devoicing applies before another postcyclic rule, Sonorant Resyllabification, which makes the two forms analogous in syllable structure on the surface.

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* I would like to thank Donca Steriade, Moira Yip, and the audience of The MOT Conference on Contrast in Phonology for helpful discussion and comments on my ideas.
(1) /handl/,/ung/ /hand/,/liç/ Sonorant Syllabification
han.dl - output cyclical phonology
han.dl.ung hand.liç PN (final devoicing)
- hant.liç Sonorant Resyllabification

Since PN here must happen before Sonorant Resyllabification, it must apply during the phonology. Would PN happen in the phonetics alone, it should treat Handlung and handlich alike.

Similarly Ao (1991) has provided an argument that the feature [+nasal], which is predictable on the first consonant of a cluster in Kikongo, is absent in a cluster during part of the phonology. Thus nasal assimilation turns the suffix - idi into - ini in (2)(i). However, a nasal in a cluster does not trigger nasal harmony, as in (2)(ii), or block harmony triggered by another nasal, as in (2)(iii).

(2) (i) /tu-nik-idi/ [tu-nik-ini] 'we-grind-PERF.ACTIVE'
(ii) /tu-bing-idi/ [tu-bing-idi] 'we-hunt-PERF.ACTIVE'
(iii) /tu-meng-idi/ [tu-meng-ini] 'we-hate-PERF.ACTIVE'

In this paper I would like to offer some support for the phonological view of PN from a different source.

Yip's theory of OCP-subsidiary features

I will be using the phenomenon of OCP-subsidiary features for my argument. Moira Yip (1989a) has argued that the OCP on articulator tiers is systematically sensitive to contrasts of the OCP-subsidiary features in (3). If there is a subsidiary contrast between two homorganic segments as in (4)(ii), no OCP-violation will ensue; if the subsidiary features are identical, there is no subsidiary contrast to save homorganic segments from the OCP, as in (4)(i). (see also Sager 1986 and Padgett 1991). Yip has furthermore argued that underspecification matters for subsidiary features: Only a fully specified subsidiary contrast as in (4)(ii) will prevent an OCP-violation; an underspecified contrast such as in (4)(iii) will not.

(3) OCP-subsidiary features for * Place α - Place α:
[±son], [±cont],
and dependents of articulators (not relevant here)

(4)(i) Art. Art. [+F] [+F] => OCP-violation
(iii) Art. Art. [+F] 0 => OCP-violation,
even if 0 -> [-F] on the surface
This phenomenon gives us a test for the presence vs. absence of OCP-subsidiary features in potentially neutralized positions. Thus assume that the second position in (4) is neutralized for the feature F, and that [-F] is the redundant surface-value in this position. Assume furthermore that there are two homorganic consonants, and that one of them is in the neutralized position. Then, if the OCP allows this cluster, as in (4)(ii), that would be evidence that [-F] is present in the phonological representation. If, on the other hand, the OCP rules this cluster out, as in (4)(iii), that would suggest that the surface-value [-F] is absent at the level of representation relevant for the OCP.

Cantonese labials: [-cont] on coda consonants

The first case I will be considering are labials in Cantonese. Cantonese morphemes are monosyllabic, of the shape CVX. The literature on Chinese usually distinguishes two positions in the coda, even though only one of them may be filled in a given syllable. The first of these positions, closer associated to the nucleus, can be filled only by a glide. The second position can be filled by an obstruent stop or a nasal.

(5)

\[
\begin{array}{cccc}
\sigma & \varepsilon & G & C \\
ext & [-\text{cons}] & [+\text{cons}] \\
 & [+\text{cont}] & [-\text{cont}] \\
\end{array}
\]

Glides and stops are the only segments that can occur in the coda in Cantonese. Many other segments, including fricatives and affricates, are only allowed in the onset, as shown in (6).

(6) allowed in the onset: allowed in the coda: not allowed in the coda:

<table>
<thead>
<tr>
<th>p</th>
<th>t</th>
<th>k</th>
<th>[-cont] on [+cons]</th>
</tr>
</thead>
<tbody>
<tr>
<td>m</td>
<td>n</td>
<td>ng</td>
<td>[-cont] on [+cons]</td>
</tr>
<tr>
<td>w</td>
<td>y</td>
<td></td>
<td>[+cont] on [-cons]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>p'</th>
<th>t'</th>
<th>k'</th>
<th>k',k''</th>
<th>not allowed in the coda:</th>
</tr>
</thead>
<tbody>
<tr>
<td>l</td>
<td></td>
<td></td>
<td></td>
<td>Lar. contrasts</td>
</tr>
<tr>
<td>f</td>
<td>s</td>
<td></td>
<td></td>
<td>secondary labial articulation</td>
</tr>
<tr>
<td>ts</td>
<td>ts'</td>
<td></td>
<td></td>
<td>[lateral]</td>
</tr>
</tbody>
</table>

[cont] contrasts on consonants
Since both values for continuancy are predictable in their respective coda positions in (5) (or from a given value of [+consonantal]), we now ask whether the surface values for continuancy is present in the phonological representation or not.

First, consider the labial glides in the coda in (7).

\[(7)(i)\] * \(f/w - V - w\)  \(\text{lab}\)  \(\text{lab}\)  \([+\text{cont}] - V - [+\text{cont}]\)

\[(7)(ii)\] ok:  \(p/p'/m - V - w\)  \(\text{lab}\)  \(\text{lab}\)  \([-\text{cont}] - V - [+\text{cont}]\)

\(\text{paw, p'aw, maw: 38}\)
\(\text{piw, p'iw, miw: 30}\)
\(\text{pow, p'ow, mow: 61}\)

As shown in \((7)(i)\), a [+cont] labial in the onset cannot cooccur with a labial glide in the coda. On the other hand, a [-cont] labial in the onset may very well cooccur with a [+cont] labial glide in the coda, as shown in \((7)(ii)\). This shows two things: (a) the labial cooccurrence-restrictions across onset and coda are sensitive to the subsidiary feature \([+\text{cont}]\); (b) [+cont], even though redundant, is present in the position for glides.

(Note that in languages with monosyllabic morphemes like Cantonese, all syllables that are allowed by the grammar are usually used in the lexicon, with differences in tones and a great amount of homophony, as the numbers in \((7)(ii)\), counted in Hashimoto 1972, indicate. Gaps in the occurrence of syllables are thus all the more significant.)

Consider then the position for consonants. Continuancy is neutralized in this position: no fricatives or stops may occur here. If [-cont] would nevertheless be present in the coda, as in \((8)(i)\), one would expect there to be no OCP-violation, analogously to \((7)(ii)\). If, on the other hand, [-cont] would be absent as shown in \((8)(ii)\), there should not be a contrast in continuancy, and the corresponding configurations should be ruled out.

\[(8)\] PN of \([\text{cont}]\)

\[(i)\] labial  labial  \(\Rightarrow\) no OCP-violation  
\([+\text{cont}]\)  \([-\text{cont}]\)

\[(ii)\] labial  labial  \(\Rightarrow\) OCP-violation  
\([+\text{cont}]\)  \(0\)  \((0 - [\text{cont}] \text{ on the surface})\)

\(^1\) There is one exception to this generalization: \([faw]\) is possible with lax \([a]\). No exceptions are found with tense \([a]\) or with non-low vowels or with \([w]\) in the onset (see Hashimoto 1972). I do not know how to accommodate this one exception.

\(^2\) the cooccurrence-restrictions on Labials are not, it appears, sensitive to contrasts in sonorancy.
The fact is that labials are in fact ruled out in this configuration. Thus none of the patterns in (9) are possible in Cantonese. There are no exceptions to this generalization according to the lists in Hashimoto 1972 (see also Fu 1990).

\[(9)\]
\[
\begin{align*}
* f - V - p & \quad \text{lab} & \quad \text{lab} \\
* f - V - m & \quad \text{[+cont]} & \quad V & \quad 0 \\
* w - V - p & \\
* w - V - m
\end{align*}
\]

The conclusion that I draw from this gap in the inventory of Cantonese syllables is that [-cont] is not present in the position for consonants in the coda at the relevant level of representation. If it were present, it would prevent an OCP-violation in (9) and these syllables should be attested. In this case, then, PN entails the absence of features at the relevant level of representation.

For completeness, let me add that other syllables with [f] or [w] in the onset, or with [p] or [m] in the coda are plentiful in Cantonese, so long as the cooccurrence-restrictions discussed here are not violated. Furthermore, syllables that have a [-cont] labial in the onset as well as in the coda are also not found, as one would expect. This is shown in (10).'

\[(10)\]
\[
\begin{align*}
* p/p'/m - V - p/m & \quad \text{lab} & \quad \text{lab} \\
[& \quad \text{[-cont]} & \quad V & \quad 0 ]
\end{align*}
\]

It seems, then, that the redundant feature [+cont] in the coda position for glides is present in the phonology, whereas the redundant feature [-cont] in the position for consonants is absent in the phonology. I will return to this difference below.

English coronals 1: [+son] in the position for liquids and glides

The next case that I want to consider is the prenuclear position of complex onsets in English, the position underlined in the onset-template in (11) (see Clements and Keyser 1983).

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\footnote{Rimes with a labial vowel plus [p] or [m] in the coda are likewise ruled out. This could be taken as additional evidence for neutralization of continuancy in the coda, as shown in (i).}

\[(i)\]
\[
\begin{align*}
* o/u/ö/ü - m/p & \quad \text{lab} & \quad \text{lab} \\
[& \quad \text{[+cont]} & \quad 0 ]
\end{align*}
\]

However, it appears to be a general pattern that adjacent labials are ruled out regardless of subsidiary contrasts (see Selkirk 1988). In Cantonese, this general pattern is reinforced at least partly by the ungrammaticality of labial front vowels following labial consonants as in (ii), where a subsidiary contrast in continuancy might otherwise be expected.

\[(ii)\]
\[
\begin{align*}
* p/m/f - ö/ü & \quad \text{[-cont]} & \quad \text{[+cont]} \\
\end{align*}
\]

It seems to be correct, therefore, to not take the pattern in (i) as evidence for the absence of continuancy in the coda.
\[(11) \quad s \ C_1 \ C_2 \ V\]

When there are two segments in the onset (apart from initial \([s]\)), sonority requires that the second one, in \(C_2\) in \((11)\), be either a liquid or a glide. Since liquids and glides are both \([+\text{son}]\), we now ask whether this (redundant) feature is present in \(C_2\), or not. Let us look at the coronal cooccurrence-restrictions to find out.

Consider first tautomorphic coronals clusters in the coda. Here \([+\text{son}]\) acts contrastively, as shown in \((12)\). \((13)\) shows that \([-\text{cont}]\) acts contrastively in examples in which there is no contrast in sonorancy. Adjacent identical coronals are ruled out by the OCP since there are no subsidiary contrasts, as in \((14)\).

(Note that voicing does not act contrastive for the OCP on articulator-tiers. The cooccurrence-restrictions are thus independent of voicing. In the following, I therefore only indicate the voiceless segments.)

\[(12) \quad \text{sonorancy:}\]
\[
\begin{align*}
  r/l \ s & \quad [+\text{son}] \ [-\text{son}] \quad \text{farce, false, ...} \\
  r/l \ t & \quad [+\text{son}] \ [-\text{son}] \quad \text{hard, halt, ...} \\
  r/l \ th & \quad [+\text{son}] \ [-\text{son}] \quad \text{forth, filth, ...} \\
  r/l \ sh & \quad [+\text{son}] \ [-\text{son}] \quad \text{harsh, Welsh (welch)} \\
  r/l \ ch & \quad [+\text{son}] \ [-\text{son}] \quad \text{march, indulge, ...} \\
\end{align*}
\]

\[(13) \quad \text{continuancy:}\]
\[
\begin{align*}
  s \ t & \quad [+\text{cont}] \ [-\text{cont}] \quad \text{fast, past, ...} \\
\end{align*}
\]

\[(14) \quad * \ t \ t \\
\text{... (other identical coronals)}\]

There are furthermore no clusters of dental or alveopalatal fricatives with other coronals in tautomorphic coda-clusters.

\[(15) \quad \text{continuancy underspecified:}\]
\[
\begin{align*}
  & (i) \quad * \ th,t \quad 0 \ [-\text{cont}] \\
  & \quad * \ th,s \quad 0 \ [+\text{cont}] \\
  & (ii) \quad * \ sh,s \quad 0 \ [+\text{cont}] \\
  & \quad * \ sh \ t \quad 0 \ [-\text{cont}] \quad \text{(borscht)} \\
\end{align*}
\]

Since non-coronal segments occur freely with \([s]\) and \([t]\) in the coda, the restrictions in \((15)\) are plausibly OCP-violations. This leads me to hypothesize that \([th]\) and \([sh]\) are underspecified for continuancy, as shown. If these features were specified, one would expect OCP-subsidiary contrasts in \((15)\) under Yip’s theory. The clusters in \((15)\) should then be allowed on a par with \([st]\) in \((13)\).

Finally, affricates do not cooccur with other coronals in the coda tautomorphemically as shown in \((16)\).
Lombardi 1990 has argued that affricates are [-cont] and [+cont], where these two values are unordered early in the derivation. It appears, then, that a segment that has both values of a feature does not establish an OCP-subsidiary contrast to another segment that has one value of that feature. This seems plausible.

Now we are equipped to consider the test-case for PN. Is [+son] present, i.e. contrastive, in C, in (11)? If it would be, as in (17)(i), there should be a sonorancy-contrast between adjacent coronals. If so, then any coronal obstruent should be allowed to precede [l] or [r]: the contrast in sonorancy would then save such clusters form the OCP. If, on the other hand, [+son] is not present in this position, as in (17)(ii), the OCP might rule out a sequence of a coronal obstruent and a liquid: sonorancy does not save these clusters from the OCP. More precisely, the OCP will rule out such sequences unless they are saved by other subsidiary contrasts.

(17) PN of [+son]?

\(\downarrow\)

(i)  cor  cor  V  \(\Rightarrow\) no OCP violation
     [-son]  [+son]

(ii) cor  cor  V  \(\Rightarrow\) OCP violation
     [-son]  0  (0 \(\Rightarrow\) [+son] on the surface)

The facts speak in favour of (17)(ii), not (17)(i). Consider (18).

(18) * t l  
    * th l  cor  cor
    * sh l  [-son]  0
    * ch l

Whereas non-coronal obstruents cooccur freely with [l], the coronal clusters in (18) are ungrammatical. I therefore take these to be OCP-violations. If [l] would be specified [+son] in C, these clusters should all be allowed by the OCP due to the contrast in sonorancy that saved analogous clusters in the coda in (12). What about the role of continuancy in (18)? Since continuancy acts contrastive in English coronal clusters (see (13)), why couldn't a contrast in continuancy save some of the clusters in (18)? Recall that (15) and (16) indicated that [th], [sh] and [ch] do not contrast for continuancy anyway. The only relevant case might then be *[t1]. Since [t] is specified for [-cont], it must be the case that [l] is either likewise [-cont], or that [l] is not specified for continuancy. Below I will suggest that the latter is correct: [l] lacks a value for continuancy at the relevant level of representation.
Clusters with [r] in the English onset are more tricky.

(19) (i) \[ t\ r \quad \text{tribe, truck, ...} \]

(19) (ii) \[ th\ r \quad \text{thrill, thrive, ...} \]

Rice and Avery (1991) suggest to account for the lack of otherwise expected cooccurrence-restrictions of [r] with the assumption that [r] is placeless (see also Mester and Ito 1989 for arguments that [r] is placeless in Japanese). In the clusters in (19) (i), then, there are no adjacent coronal nodes that might trigger an OCP-violation, and the clusters are therefore ok. For (19) (ii) I suggest in Truckenbrodt (1994) that [r], being specified [+cont], triggers an OCP-violation with the [+cont]-feature of the affricate. The OCP here rules out the configuration *[+cont][+cont]. In that theory a subsidiary contrast in sonorancy could still have saved the cluster in (19) (ii), as it saves the cluster [rch] in the coda, compare church, arch, etc. The reader is referred to that other paper for further discussion of cases of OCP-violations on stricture-tiers. Note that [thr] in (19) (i) does not trigger such an OCP-violation on the tier for [+cont], since [th], as seen above, is not specified for continuanncy.

Thus, while the clusters with [r] in (19) are harder to evaluate, the contrast between (12) and (18) suggests rather clearly that sonorancy is neutralized in C, in the English onset. It is then correctly predicted that these consonants can cooccur in any prosodic environment (halt., at.las, can.dl) except in the case where they both have to fit into a single onset, forcing [l] into the position C, that is neutralized for sonorancy: *[+.tl].

English coronals 2: the features of initial [s]

As a final case, let us consider the features of [s] in the English initial appendix. I think it is plausible to assign an additional position to word-initial [s] in English for the following reasons:

(a) Possible onsets are best characterized in terms of what can occur in C, and C, in (11) plus the assumption that [s] may precede these two positions, as Clements and Keyser 1983 as well as Goldsmith 1990 have argued.

(b) Initial [s] - unlike all other segments in the onset - does not obey sonority. Clements (1988) has suggested that initial [s] is not syllabified at the level at which sonority applies. If that is correct, then [s] should be in a position of its own.

(c) Goldsmith (1990, p.148f) observes that the coda of a morpheme allows at most one [s] to cooccur with another consonant; [s] may occur preceding a consonant as in task or following a consonant as in tax, but there will not be a morpheme like *tasks (Goldsmith's examples). Goldsmith suggests an account for this in terms of what features the coda of a syllable can license. It turns out, however, that initial [s] also shows cooccurrence-restrictions with final [s]. Consider the following patterns.
(20) (i)  
   s V s  
   s V Cs  
   s V sC  
   sC(C) V s  

   sass, sauce, souce  
   sense, sex, since, six, source  
   cyst  
   slice, sluice, splice, spruce, stress  

(21)  
   * sC(C) V(V) sC  
   * sC(C) V(V) Cs  
   * V(V) sCs  

   (from Goldsmith)  

(22) (i)  
   sponsor, stencil,  
   (ii) sparse (cf. spare); stance (cf. stand)  

(20) shows that [s] may cooccur with another consonant in the coda - (20)(ii) - or in the onset - (20)(iii) - in the same morpheme, also if there is an additional [s] around in that morpheme. However, as (21) shows, [s] may not both cooccur with a consonant in the onset and cooccur with a consonant in the coda within the same morpheme (and, as Goldsmith has shown, that there may not be two [s] cooccurring with a consonant in the coda).  
(22)(i) suggests that such configurations are ok with medial clusters, where the second [s] is the onset of a second syllable.  
(22)(ii) lists apparent exceptions, which are plausibly analysed as composed of more than one morpheme. The only other exception I found is sphinx, a name.  
This situation might best be characterized by (i) restricting the syllable in such a way that it does not allow for [s] plus another consonant in either onset or coda, and (ii) allowing one additional position for [s] per morpheme, either initial or final, and in the latter case either preceding or following another consonant. One can see this extrasyllabic [s] hike through a string in stack, task and tax, and in smack, mask and Max. However, there may not be two extrasyllabic [s] licensed by the same morpheme, as in *stask or *stax, or in Goldsmith's *tasks.  
If that is on the right track, then there is another argument that initial [s] in a cluster is in a separate position: it is in a position licensed by the morpheme.  
Since [s] is the only segment that can occur in this initial appendix, all its features are predictable in this position. Let us then use the test of OCP-effects and subsidiary features to see which of these predictable features are present. First, consider (23).  

(23) (i)  
   s t  
   [+cont] [-cont]  
   steak, steep, ...  

   (ii)  
   * s s  
   [+cont] [+cont]  
   * s th  
   [+cont] 0  
   * s sh  
   [+cont] 0  
   * s ch  
   [+cont] [-cont]/ [+cont]  

Here initial [s] shows a full range of coronal cooccurrence-restrictions in analogy to those in the coda in (13), (15) and (16). This means first of all that [s] in the initial appendix has a coronal node: this node triggers the OCP-violations in (23). Furthermore, [s] has the feature [+cont] in this position, for it
is this feature that establishes a subsidiary contrast in (23)(i)
but not in (23)(ii). Here, then, the test suggests that the
features that are predictable in the initial appendix position are
not underspecified there.

What, then, of the feature [-son], which is also predictable
on [s] in the initial appendix position? I think that is hard to
decide on the basis of English alone. Consider the patterns in
(24).

(24)(i)  
\[
\text{s 1} \quad \text{cor} \quad \text{cor} \\
\quad \text{[+cont]} \quad \text{[-cont]}? \quad \text{slow, sleep, …}
\]

(ii) \* s r

Halle and Vergnaud (1979) have suggested that [sr] is turned
into [shr] by a rule of assimilation. Given that there are also
other processes of palatalization in English, this seems plausible,
and the absence of *[sr] might thus not be very telling. [sl], on
the other hand, is grammatical, but since it is not clear whether
[1] is specified for [-cont], one cannot tell if there is a
subsidiary contrast in sonorancy or in continuity at work here.
A brief look at German and Spanish, however, turns out to be
helpful.

In German, the initial appendix position is reserved for a
sound similar to English [sh]'. Other than that, the onset-template
and the sonority-restrictions are similar to English. In particular
non-coronalts freely precede [l]. However, as (25) shows, coronal
clusters with [l] are not possible in C₁ and C₂ of the German onset.

(25)(i)  
\[
\text{* t 1} \quad [-\text{son}] \quad 0 \\
\quad [-\text{cont}] \quad 0
\]

(ii) \* ts l  
\[
\quad [-\text{son}] \quad 0 \\
\quad [-c][+c] \quad 0
\]

(iii) \* s l  
\[
\quad [-\text{son}] \quad 0 \\
\quad [+\text{cont}] \quad 0
\]

The cooccurrence-restrictions in (25)(i) and (ii) are familiar
from English: coronals do not precede [l] in the onset. The OCP
will correctly rule them out if there are no subsidiary contrasts
here. Since [lt], [lts] and [ls] are grammatical in the coda and
elsewhere in German (Wald, 'forest', Walzer, 'waltz', Hals,
'neck'), it seems correct to take over the explanation from English
above: sonorancy is neutralized and absent in C₁ in the onset, thus
not establishing a subsidiary contrast here. As far as continuity
is concerned, (25)(i) and (ii), like the English examples above,
only tell us that [l] does not have the feature [+cont]. But is [l]
[-cont] or unspecified for continuity? (25)(iii) now forces a

\* [s] and other consonants may occur in the appendix
exceptionally in non-native words ([ps]ychologie, [sn]ob etc.).
choice. It seems to be clear independently that [s] in German, as in English, is specified [+cont], since [st] clusters are grammatical in the code: Ast, 'branch', fast, 'almost' etc. Therefore, if [l] would be [-cont], the cluster in (25) (iv) should be grammatical with a subsidiary contrast in continuancy. Since it is not, I conclude that [l] is not specified for continuancy at the relevant level of representation.

Similarly in Spanish (see Harris 1983). The Spanish onset allows no initial appendix. There are two onset positions, of which the first can be filled by an obstruent if a liquid is in the second position. Non-coronal obstruents freely precede the liquids, but *[d1], *[ch1] and *[chr] are not found. Here again, then, sonorancy is not contrastive in the onset for coronal cooccurrence-restrictions. [s], for which there is no initial appendix in Spanish, is likewise ruled out with [l] and [r]. From the ungrammaticality of *[s1], I draw the same conclusion as from the German (25) (iv): [l] is not specified for continuancy. If it were, *[s1] should be saved from the OCP by a subsidiary contrast in continuancy.

Let us then come back to English. Assuming that [l] in English, like in German and Spanish, is not specified for continuancy, one can better evaluate the grammaticality of the cluster [s1].

(26)    cor    cor
        s 1  [+cont]  0 slow, sleep, ...
        [-son]  [+son]

If there is no subsidiary contrast in continuancy here, there must be a subsidiary contrast in sonorancy. Consider what follows from this. First, [l] can have the value [+son]. This would not be possible if [l] would be in the position C1 in (11), as seen earlier. Thus [l] must be in the position C1 in (26), where it may be specified [+son]. Second, if [l] is in C1, then [s] must be in the appendix in (26). Third, since there is a subsidiary contrast in sonorancy here, [s] must be specified [-son] in the initial appendix. Which is what we wanted to find out.

A few foreign words with [s1] are found, such as Slalom or Slavistik. As noted in footnote 4, [s] may exceptionally be in the appendix in foreign words. Here, then, [l] may be in the position C1 in the onset where it can be specified for sonorancy and thus contrast with the preceding [s] for that feature.

Note also that *[sr] and *[tsr] are impossible in German, whereas [tx] is fine. In Truckenbrodt (1994) I suggest that the former two clusters, but not the latter, are violations of *[+cont] [+cont].

[t,l], with dental [t], on the other hand, is ruled out in some dialects but not in others; this is unexplained under the present assumptions.
Why, then, does English permit [sl] whereas German and Spanish do not? English allows [s] in the appendix, whence [l] can be in C, and a subsidiary contrast in sonorancy is possible. In German and Spanish, [s] may not be in the appendix for independent reasons, hence [s] would have to be in C, and [l] in C, in an onset like *[sl]. Sonorancy is neutralized in C, so *[sl] is not saved by a subsidiary contrast in sonorancy in German and Spanish.

Thus, so far as one can tell by the cooccurrence-restrictions, all the features of [s] in the appendix are present there: coronal, [+cont], and, as just seen, [-son]. Here, then, features that are predictable in a certain position are not underspecified.

The four cases reviewed above are listed in (27).

(27) [+cont] on glides in the Cantonese coda: specified

[-cont] on consonants in the Cantonese coda: not specified

[+son] in C, in the English onset

(and in German and Spanish onsets): not specified

 coronal, [+cont], [-son]

in the English initial appendix: specified

Steriade's theory of Position Neutralization

Stanley (1967), Mohanan (1991) and Steriade (1994a) have extensively criticized theories of underspecification. One of the points they make is confirmed by the results above: Lexical Minimality, the idea that all features that can be omitted will be omitted, does not give the right results in many cases. Thus the Cantonese coda and the position C, in English suggest, in line with Ao's findings mentioned earlier, that contextual predictability may be connected to underspecification. However, if predictability would be the cause of underspecification, then at least some of the features in the English initial appendix should also be missing, which does not seem to be the case. What to make of this situation?

Donca Steriade (1994b) has convincingly argued for a theory of PN that can be summed up as follows: a language may (but need not) leave a feature F unspecified in a position P only if the contrast that F expresses is harder to perceive in P than in other positions in that language. In this theory, PN is the choice of a language to "not demand perceptual acuity in positions where cues are weakest" (Steriade 1994b) by not specifying a certain feature in a certain position altogether.

With this in mind, consider again the Cantonese coda. In the position for glides, there does not seem to be a reason to think that the [+cont] quality of glides would be less perceptible than elsewhere. It is thus expected that this feature is present here. What about the position for consonants? In Cantonese, obstruents in the coda are not released. As Steriade has pointed out to me, this property of the Cantonese syllable would make an affricate hard or impossible to distinguish from a stop, since the crucial difference, the fricative part of the affricate, can only be
perceived upon the release of the stop part of the affricate.

For the fricatives in the Cantonese coda, I offer the following speculation. The stops in the coda appear to be shorter than stops in the onset, due to their not being released. On the assumption that there is a general requirement on coda obstruents to be short in Cantonese, it would appear that a difference between stops and fricatives would be harder to perceive in the coda, since fricatives need duration to unfold their salient acoustic property of stridency. If this is correct, then it would seem plausible in Steriade's theory that PN has applied to coda consonants, eliminating the less perceptible contrasts in continuuity in this position.

(Note that nasals are long in the coda, but that need not be a problem for the assumption about shortness of obstruents in the coda: nasals in the coda appear to be moraic: syllables closed by a nasal can bear long tones and contour tones. Obstruents in the coda, on the other hand, appear not to be moraic: syllables closed by an obstruent only bear short flat tones.)

Contrast this then with the feature [+cont] on [s] in the English initial appendix. There appears to be no requirement for [s] to be pronounced short in this position, so [s] can unfold its hissing quality here. Similarly, there appears to be nothing that impedes the perception of its coronal place of articulation. It thus follows from Steriade's theory that neither the coronal node, nor the feature [+cont] should be absent in the English initial appendix - which is what the cooccurrence-restrictions have indicated in this case.

Let us then turn to the feature [sonorant] in C₁ of the English onset. What might the perceptual qualities of this feature be? Let me again offer a speculation. Rice and Avery (1989), Piggott (1992) and Rice (1993) have argued that the voicing of sonorants is not normally expressed by the feature [voice], which marks voicing in obstruents, but should be understood as an inherent property of their being [+sonorant]. [+sonorant] thus means, among other things, voiced. (These authors introduce the privative feature Sonorant Voice to express this claim. Note, however that the role of sonorancy as an OCP-subsidiary feature suggests that sonorancy is in fact a binary feature. I will therefore stick with the traditional name here.) If that claim is correct, then one can get a grip on the perceptual properties of sonorancy: voicing is indeed (at least partially) wiped out in C₁ of the English onset, albeit only after initial voiceless stops as in please, tree or [cy]ure. Thus it would make sense to say that [+sonorant] is hard to perceive after voiceless stops, since one of that feature's inherent acoustic properties, the voicing, is completely or partly gone.

From here, however, it is still a leap to saying that [+son] is always neutralized in C₁, i.e. even when it is preceded by a voiced stop or by a sequence of [sc] with voiceless C. What one would want, then, is that the theory of PN sais (a) that a possible position for PN is 'C₁', but not 'C₁ when preceded by a voiceless stop'; and (b) that it is sufficient for PN to apply if a feature is hard to perceive in a position in some, but not necessarily in all cases. Otherwise one would expect that *[t̪], for example,
would be ruled out, whereas *[dl] and *[stl] might be ok, since
[+son] might be allowed on [l] in the latter cases, where it can
be easily perceived and can thus establish a subsidiary contrast.
One might thus formulate the theory of PN along the following
lines: PN, conditioned by perceptibility, neutralizes contrast in
a phonologically defined set of cases that is slightly more
abstract and not necessarily fully identical to the set of cases
in which the feature in question is hard to perceive.

The facts about German PN of voicing on obstruents would
support that kind of theory: voicing is hard to perceive in the
coda in cases like Rad and Rat. German neutralized this less
perceivable contrast by dropping voice in the coda (apparently at
the word level). It will thus also neutralize voice in [hant-liç]
but not in [handl-ung], even though the surface syllabification of
these two examples is analogous such that there should not be a
difference in perceptibility of voicing in these particular forms.

Such a theory would also be required for the correct account
of continuancy on Cantonese coda consonants: Whereas it might be
the case that stops and fricatives are hard to distinguish in the
coda because of their shortness, nasals are long in the coda and
would not seem to lead to perceptual difficulties. Yet the
neutralization of continuancy on coda consonants extends to the
nasals, as the cooccurrence-restrictions above suggested:
continuancy is generally neutralized in the position for consonants
in the coda.

Compare then sonorancy in C, with sonorancy in the initial
appendix in English: [-son] would seem to be easy to perceive in
the appendix. There is no danger of initial [s] being perceived as
a sonorant (voiced) segment. In Steriade's theory there is thus no
reason to believe that [-son] should be unspecified in this
position, and the cooccurrence-restrictions indicated that that is
correct.

In summary, the cooccurrence-facts discussed here confirm that
PN in Steriade's sense (a contrast is dropped in connection with
low perceptibility) can be distinguished from other cases of
contextually restricted occurrences of features. It appears that
in cases of PN proper, the neutralized features are absent in the
phonology. In the other cases of contextually predictable
information, the redundant features are present.

References
Ao, B. 1991. Kikongo nasal harmony and context-sensitive
Clements, G.N. & S.J. Keyser. 1983. CV-Phonology. MIT Press,
Cambridge, Mass.
Clements. G.N. 1988. The role of the sonority cycle in core
syllabification. Ms. Cornell University.
Fu, J. 1990. Labial-labial cooccurrence-restrictions and syllable
structure. Ms., University of Massachusetts at Amherst.
Blackwell.
Sagey, E. 1986. The Representation of features and relations in nonlinear phonology. PhD Diss, MIT.