CHAPTER 4

PLACE GENERALIZATIONS

4.1 Introduction

The purpose of this chapter is twofold. Firstly, it further contributes to the understanding of phonotactic patterns by presenting place restrictions for obstruent clusters occurring in onset position. Across languages there is a strong preference for clusters consisting of a coronal fricative followed by a stop. I argue that the pattern observed can best be understood as place neutralization in a position of weak perceptibility. This chapter provides, therefore, further support to the idea that phonotactic patterns can be best understood and explained by reference to phonetic facts. The analysis I present draws on work by Beckman (1997), Padgett (1997) and Steriade (1993, 1994, 1995, 1997).

To support the model of grammar that I propose, I will present data from English, German, Delaware and Takelama. English and German represent two standard unmarked cases, in which only coronal fricatives are allowed in pre-obstruent position. The pattern shown by Delaware onset obstruent clusters is particularly interesting in illuminating the phonotactic patterns, since it shows a crucial asymmetry among the obstruents in the same phonological context. In particular, whereas fricatives are restricted to coronal place in pre-obstruent position, stops allow any place of articulation in the same position. Finally, Takelma is an example of a *harmonically incomplete* language. The two markedness dimensions relevant to obstruent clusters interact in such a way that more marked obstruent clusters surface at the expense of less marked clusters. In particular the requirement that both stops and fricatives in pre-obstruent position are coronal prevents SF clusters from surfacing, but not SS.

4.2 Onset Place Restrictions

In onset position, I have observed systematic place restrictions mostly for fricatives in pre-obstruent position. The restrictions are listed below:

(a) only /s/ is allowed as first member of the cluster.

(b) any coronal fricative is allowed as first member of the cluster.

(c) any fricative in the language is allowed as first member of the cluster.

This pattern holds regardless of the other types of obstruent clusters that occur in the language. In other words, there are languages, such as Modern Hebrew and Delaware, in which place restrictions hold for fricatives but not stops in the same phonological context. Whereas a fricative in pre-obstruent position, in these languages, must necessarily be a coronal, a stop in pre-obstruent position can have any place of articulation allowed in the language.

To account for the systematic restrictions on first member fricatives and the asymmetric behavior of stops in the same position, I propose a system of constraints which incorporates the notion of segmental *release*, following on work in the OT literature by Lombardi (1995), Padgett (1997) and Steriade (1997). The system is modeled upon Positional Faithfulness (Beckman 1998). Within this framework, I show that the place restrictions that hold in onset are indeed the result of place neutralization in a position in which place contrast would be hard to perceive due to the weakness of perceptual cues.

4.3 Release-sensitive Faithfulness and Place Neutralization

Segmental release, i.e. the burst that accompanies the offset phase of a consonantal constriction, has been known to provide important acoustic cues to place contrast and laryngeal features (Ohala (1990); Kingston (1990); Steriade (1993a-b), (1994), (1995a-b); Lombardi (1995); Padgett (1997)). As pointed out by Padgett (1997), release is "virtually phonetically inevitable" in presonorant position, whereas it can be masked by the presence of a following obstruent. This latter position is the environment in which consonants are less likely to be perceived because the perceptual cues are impoverished. Padgett (1997) proposes to implement the idea that features under release are perceptually more salient by release-sensitive faithfulness. His system for place features assumes that all consonants are released before a tautosyllabic sonorant, otherwise they are unreleased. The system consists of a special release-sensitive faithfulness constraint, $\text{FAITH}_{\text{REL}}$, and a general faithfulness constraint, FAITH[1], with the fixed ranking in (1) below:

(1) $\text{FAITH}_{\text{REL}}$ >> FAITH is universally fixed.

---

[1] In particular Padgett proposes release-sensitive Max and Dep constraints. I will use Ident constraints to be consistent with the other faithfulness constraints in the dissertation.

Following Padgett (1997), I propose that the pattern observed in onset obstruent clusters can be modeled on the basis of the constraints that follow:

(2) **Ident$_{Rel}$Place** : Released consonants and their input correspondents must agree in place feature.

This constraint requires that obstruents occurring in a release position, i.e. pre-sonorant, must maintain their input place of articulation. This constraint basically reflects the fact that segmental release contains the strongest cues and is therefore given a prominent status in the system.

The other constraint in the system is a general constraint that ranges over obstruents only, following on Padgett (1997). This constraint is given below:

(3) **Ident-Obstruent-Place**

Obstruent and their input correspondents must agree in place features.

The ranking between these two constraints is universally fixed on the basis of Padgett's model:

(4) **Ident$_{Rel}$Place >> Ident-Obstruent-Place**

Finally, I propose that the system contains another special faithfulness constraint, which ranges over stops only and is not universally ranked. This constraint is given in (5) below:

(5) **Ident-Stop-Place**

Stops must agree in place features with their output correspondent

The purpose of this constraint is to preserve input place features for stops regardless of the position in which they occur, whether in a release position or not. This constraint is crucial in the analysis of languages such as Modern Hebrew and Dakota, in which stops, but not fricatives, maintain place contrast in pre-obstruent position. The idea behind this constraint is that internal cues to obstruent place of articulation are stronger for stops than fricatives, unless the latter are sibilants (Wright 1996).

The strength of the stops' perceptual cues can be captured in the system by the existence of a special constraint that is relativized to stops only. On the contrary, the relative weakness of the fricatives' perceptual cues is captured by the non-existence of a special constraint, but rather in the fact that fricatives are subject to the general Ident-Obstruent-Place constraint.

From a purely phonological point of view, this constraint finds motivation in inventory considerations. Languages tend to maintain place contrast mostly among the stop series and to a lesser extent in their fricative series. Many languages restrict their fricative series to coronal fricatives only, but they never restrict their stop series to coronal place only. Moreover, there are no languages in which fricatives occur at different points of articulation, but there are only coronal stops in the system. In general the places of articulation for fricatives are a subset of the places of articulation at which stops occur in a language (Maddieson, 1984).

The factorial typology generated by the interaction of these constraints and the constraints that refer to each individual place feature (which I will indicate as *F for the moment) gives rise to three basic types of languages. Assuming the fixed ranking of (4), we get the following factorial typology:

(6) a. *F >> $\text{Ident}_{\text{Rel}}$Place >> Ident-Obstruent-Place >> Ident-Stop-Place

b. $\text{Ident}_{\text{Rel}}$Place >> Ident-Obstruent-Place >> Ident-Stop-Place >> *F

c. $\text{Ident}_{\text{Rel}}$Place >> Ident-Obstruent-Place >> *F >> Ident-Stop-Place

d. $\text{Ident}_{\text{Rel}}$Place >> *F >> Ident-Obstruent-Place >> Ident-Stop-Place

e. $\text{Ident}_{\text{Rel}}$Place >> *F >> Ident-Stop-Place >> Ident-Obstruent-Place

f. $\text{Ident}_{\text{Rel}}$Place >> Ident-Stop-Place >> *F >> Ident-Obstruent-Place

The ranking in (6a) is the least interesting because it corresponds to a language in which neither fricatives nor stops have the feature F, whether in a release position or not. The rankings in (6b) and (c) characterize a language in which both fricatives and stops occurring in pre-obstruent position allow the feature F. The fact that both rankings give rise to the same type of language is because in both cases Ident-Obstruent-Place, the general constraint, dominates the special Ident-Stop-Place. The rankings in (6d) and (e), instead, characterize a grammar in which neither a fricative nor a stop in pre-obstruent position maintains place contrast. In other words, this might correspond to a language in which both fricatives and stops occurring in pre-obstruent position only allow coronal place. This is actually the case of Takelma, which I will discuss later in the chapter.

Finally, the ranking in (6f) characterizes a language in which only stops but not fricatives can maintain place contrast in pre-obstruent position. This is the case of Delaware and Modern Hebrew.

In the remainder of this chapter I will first provide an analysis of the English and German obstruent cluster phonotactics and show how the restrictions observed for onset clusters can be accounted for with the constraints proposed here. Secondly, I discuss the phonotactics of Delaware, which provides crucial evidence for the proposal that stops are privileged segments over fricatives. I then discuss Takelma which exemplifies both a language in which stops and fricatives in pre-obstruent position are neutralized to coronal, as well as an example of a *harmonically incomplete* language. Finally, I discuss an alternative analysis based on a strict implementation of Steriade's Licensing-by-Cue model and show why, with place features, such a system proves to be problematic.

4.4 Case Study III: English

In terms of obstruent clusters, English represents what we could call the unmarked type of language. Obstruent clusters in English are limited to s+STOP. These clusters, within the present proposal, represent the best formed types of clusters because they are FS clusters, i.e. the unmarked type on the continuancy dimension. Moreover, on the place dimension, the only fricative that occurs in pre-obstruent position is /s/, which is the least marked coronal fricative.

4.4.1 The English Obstruent System

The English obstruent inventory is given in the chart below (O'Grady, Dobrovolsky and Aronoff 1997)

(7)

	Labial	Interdent.	Alveolar	Alveo-palatal	Velar	Glottal
Stops Simple	p b		t d		k g	ʔ
Fricatives Non-sibilant	f v	θ ð				
Sibilant			s z	ʃ ʒ		
Affricates Non-sibilant						
Sibilant				tʃ dʒ		

In English, the only obstruent clusters that are representative of the native phonotactics[2] consist of the form s+Stop, as the following examples show:

(8) [spɪl] spill

[stɪk] stick

[skay] sky

English is an example of a *Type 1* language in onset, i.e. a language that only admits FS clusters. On the continuancy dimension, the language is characterized by the following ranking:

(9) OCP[-cont], OCP[+cont], *SO >> Ident(continuant)

[2] Other clusters are also found in English, e.g. in sphere. These clusters are however only found in loans and are not considered representative of English phonotactics.

According to the ranking in (9) only FS clusters are allowed to surface. This was demonstrated in Section 2.2.6 for a *Type 1* language.

On the place dimension, it has been observed that only /s/ is allowed in pre-obstruent position. No other fricative occurring in the language is allowed in that position. I have argued in the previous section that this pattern is a pattern of place neutralization in a weak position for place contrast. I have argued that this type of neutralization results from the interaction of the release-sensitive constraint, $\text{Ident}_{\text{Rel}}$Place, the general constraint for obstruents, Ident-Obstruent-Place, and the place hierarchy of Prince and Smolensky (1993). The ranking that gives rise to the pattern observed for English obstruent clusters is given below:

(10) $\text{Ident}_{\text{Rel}}$Place >> *Dor, *Lab>> Ident-Obstruent-Place , *Cor[3]

Based on the constraint ranking in (10), a potential input of the form /ft/, cannot surface faithfully. On the contrary, the segment [f] will surface as a fricative at the least marked place of articulation, i.e. coronal. We can say therefore that a fricative in pre-obstruent position undergoes place neutralization. The tableau that follows, however, shows that the place hierarchy cannot chose between the three coronal fricatives [s], [ʃ] and [θ] present in the English inventory. This is shown

[3] Note that since *Cor is the least marked place in Prince and Smolensky, whether it is ranked above or below Ident-Place it will always surface. If, however, we adopt Lombardi's hierarchy (1995) , in which she proposes that *Phar is actually the least marked place, then we would expect [h] to be the preferred sound in that position. However, [h] would be poorly perceptible in that position since it lacks the frication noise typical of fricatives. So I assume that [ht] clusters are ruled out by a higher ranked constraint.

in the tableau by the fact that it contains three optimal candidates.

(11) Tableau illustrating the constraint ranking in (10)

/fpV/	$Ident_{Rel}$(Place)	*Lab	Ident-Obs-Place	*Cor
a. st	*!		**	**
b. fp		**!		*
c. ☞ sp		*	*	**
d. ☞ ʃp		*	*	**
e. ☞ θp		*	*	**

In the tableau, $Ident_{Rel}$Place ensures that the /p/ maintains its place of articulation when it occurs in a release position (candidate a). The cluster [fp] fatally violates *Lab because it contains a labial in pre-obstruent position and thus loses in the competition. Candidates (c), (d) and (f) are all optimal because they incur identical violations. In the case of English, however, candidate (c) should indeed be the optimal candidate.

To differentiate between these three coronal fricatives, and among the coronal fricatives in general, I propose that *Cor is indeed an encapsulated constraint which stands for the two independent sub-hierarchies in (12)[4]:

(12) a. *[-anterior] >> * [+anterior][5]

b. *[+distributed] >> *[-distributed]

The rankings in (11) are based on the assumption that /s/ is, indeed, the least marked of the coronal fricatives. As an example, the fact that [s] is less marked than [ʃ] is captured by the ranking in (12) and shown in the following tableau:

(13)

	*[+dist]	*[-anterior]	*[-dist]	* [+anterior]
a. s			*	*
b. ʃ	*	*		

The fricative [s] is shown to be less marked than [ʃ] because the latter violates higher ranked constraints. By the same token, the ranking in (12b) shows that

[4] It has been suggested to me that *Cor and the sub-hierarchies in (12) may indeed be independent constraints. Their independence of *Cor may allow them to dominate *Cor. If other constraints intervene, however, this hypothesis can give rise to a ranking that disallowed Coronal place in a language and allowed other places of articulation as below:

(i) *[-ant], *[+dist] >> *[+ant], [-dist] >> IdentPlace >> *Lab >> *Cor.

To the best of my knowledge, there are no languages that allow labial segments (or dorsal) but not coronal. This therefore discards the possibility that they are indeed separate constraints independent of *Cor.

[5] These are the features that depend on the Coronal node in Feature Geometry. A problem remains, however, with the typological predictions that follow from these two feature hierarchies. Whether they are ranked with respect to each other as in (a) or (b), or unranked as in (c), the prediction is that across languages the occurrence of [ʃ] implies the occurrence of both [s] and [θ]. This is not, however, an attested pattern because [θ] is more rare than [ʃ]. This prediction may represent a problem for segment typology. For the moment, I assume the ranking in (c).

(a) *[-ant] >> *[+ant] >> *[+dist] >> *[-dist]

(b) *[+dist] >> *[-dist] >> *[-ant] >> *[+ant]

(c) *[-ant], *[+dist] >> *[-dist], *[+ant]

[s] is less marked than the non-distributed coronal fricative, i.e. [θ] as in tableau below:

(14)

	*[+distributed]	* [-distributed]
a. s		*
b. θ	*	

Under the assumption that *Cor encapsulates the dependent feature hierarchies, the pattern of English obstruent clusters follows directly from the fact that [s] is the least marked coronal fricative. The analysis is shown in the following tableau:

(15)

/θpV/	*+dist	*-ant	Ident-Obs-Place	*-dist	*+ant
a. ☞ sp			*	*	*
b. ʃp	*!	*	*		
c. θp	*!				*

The tableau shows that with the dis-encapsulated *Cor, candidate (a), which contains a cluster consisting of s+STOP, surfaces as the optimal candidate. Candidates (b) and (c) both fail because of higher *[+distributed].

To conclude, I have shown how the system proposed so far can easily account for the pattern of English obstruent clusters. As I have argued previously, this is the most common pattern shown across languages. In the analysis I propose this is the preferred pattern cross-linguistically because s+STOP clusters are the best formed of all obstruent clusters with respect to both the continuancy dimension and the place dimension.

4.5 Case Study IV: German

German is also a case of an unmarked system because it only allows coronal fricatives in pre-obstruent position. However, unlike English, German presents the complication of a complementary distribution between [s] and [ʃ] in pre-obstruent position.

4.5.1 The Obstruent System

The German obstruent inventory is given in the chart below. The chart and all the data that follows is based on Hall (1992)

(16)

	Labial	Alveolar	Alveo-palatal	Velar	Glottal
Stops Simple	p b	t d		k g	ʔ
Fricatives Non-sibilant	f v			ç/x	
Sibilant		s z	ʃ ʒ		
Affricates Non-sibilant	pf				
Sibilant		ts	tʃ dʒ		

German analysts disagree on whether the sequences [ts], [tʃ] and [pf] are single phonemic units (James 1969; Wurzel 1980; Hall 1992) or consonant clusters (Moulton 1947; Moulton 1962; Heike 1972; Ungeheuer 1977; Benware 1986). Moulton, for example, argues that there is no reason why only [ts], [tʃ] and [pf], and not the other stop+fricative sequences of German, i.e. [ps], [pʃ] and [ks] should be analyzed as affricates. It must be noted, however, that whereas [ts], [tʃ] and [pf] fully contrast with the other phonemic units of the language, [ps], [pʃ] and [ks] instead only occur in word-final position or as initial sounds in rare words of foreign origin. Their distribution, therefore, strongly suggests that these two sets of sounds are inherently different. In the analysis that I present [t͡s], [t͡ʃ] and [p͡f] are treated as affricates, whereas [ps], [pʃ] and [ks] are treated as clusters.

4.5.2 Phonotactics of Onset Obstruent Clusters

In German, onset obstruent clusters are very limited. Of all the obstruent clusters[6]

---

[6] Note that other obstruent clusters occur in German onsets. Sequences of an obstruent followed by [v] as in [kvark] quark, or [tsvai] two, are quite common. I assume that these sequences examples of core clusters rather than obstruent clusters, since, as argued for a number of Germanic languages (König and van der Auwera 1994) the segment [v] is best classified as a sonorant.

In addition, a number of obstruent clusters are also found in words of foreign origin, e.g. [ptolomɛ:ʊs] Ptolomy; [ktenoi:t] ctenoid; [kse:ʀɔks] xerox; [pʃɔʀ] Pschorr (name); [spɛktʀʊm] spectrum; [sti:l] style; [sfɛ:ʀə] sphere; [stse:nə] scene. As for the reasons given in Chapter 2, these clusters will not be considered representative of the German phonotactics Their presence in the language can be explained following the model of lexicon stratification described for Modern Greek.

occurring in the language, the clusters that are considered representative of the native phonotactics are only the ones consisting of a coronal fricative and a stop, as in the following chart:

(17)

	p	t	k
s			+
ʃ	+	+	

Representative examples are given in (18) below

(18) a. ska:t skat

b. ʃpi:l game

c. ʃtant stand

The chart in (17) shows the distribution of the two coronal fricatives in pre-obstruent position. On the basis of the overall distribution of these two segments in the language, many authors (Trubetzkoy 1939; Wurzel 1970; Werner 1972; Scholz 1972; Hall 1992) have pointed out that in German [s] and [ʃ] are nearly in complementary distribution in pre-consonantal position. The generalization, according to these authors, is that [ʃ] occurs before all [-high] consonants[7] in syllable initial position, and [s] occurs elsewhere. The two segments, however, contrast in inter-vocalic and final position. The following chart from Hall (1992),

[7] [-high] consonants in German are: [p b t d v s z m n l r h]

summarizes the relevant facts. In the chart, the parentheses indicate that clusters are rare.

(19)

	syllable-initial	medial	syllable-final
sp	(+)	+	(+)
st	(+)	+	+
sk	+	+	(+)
sv			
ʃp	+		
ʃt	+		
ʃk			
ʃv	+		
sn	(+)	+	
sm	(+)	+	
sl			
sʀ			
ʃn	+		
ʃm	+		
ʃl	+		
ʃʀ	+		

On the basis of the patterns above, German can be classified as a *Type 1* language for onset obstruent clusters, i.e. a language that only allows FS clusters. Moreover, on the place dimension, the FS clusters are only limited to sequences of a coronal fricative followed by a stop.

4.5.3 Analysis of Onset Obstruent Clusters

German is an example of a *Type 1* language in onset, i.e. a language that only admits FS clusters. On the continuancy dimension, the language is characterized by the same ranking as English:

(20) OCP[-cont], OCP[+cont], *SO >> Ident(continuant)

On the place dimension, it has been observed that only the coronal fricatives in the language are allowed in pre-obstruent position. In particular, German shows a complementary distribution between [s] and [ʃ]. A number of researchers (Wurzel 1970; Scholz 1972; Standwell 1973; Hall 1992) have analyzed the distribution of [s] and [ʃ] in syllable-initial position by assuming that [s] is the underlying segment and [ʃ] is derived via some kind of phonological rule.

Following the intuition of these authors and under the assumption that [s] is the unmarked coronal fricative, I also account for the complementary distribution of [s] and [ʃ] in pre-consonantal position, by analyzing words containing [sk] as the normal default case, and words containing [ʃt] and [ʃp] as emerging under the effects of a higher ranked constraint that disqualifies [st] and [sp] as potentially optimal candidates. I propose that this constraint is a constraint that disallows a sequence consisting of an [s] followed by a [-high] in the onset. The constraint[8] is defined below:

(21) (*s[-high])^{onset} :
Disallow a sequence consisting of an [s] followed by a [-high] in the onset.

Tableau (22) below contains the relevant sub-hierarchy of *Cor. The tableau shows that an input of the type [ʃt] would automatically default into a cluster containing [s] because of the fact that [s] is less marked than [ʃ]. However this is a wrong result in German because it does not capture the complementary distribution between the two segments.

(22)

/ʃtV/	Ident-Obs-Place	*[-ant]	*[+ant]
a.☞ *st	*		**
b. ʃt	*	*!	*

[8] Note that although the use of the feature [high] for consonants is obsolete, this seems to be the best way of accounting for the complementarity. Note further that this constraint could not be a conjoined constraint of *s and *[-high] in the onset domain since it would equally fail [st], [sp] and [sk] because the latter would violate the constraint as well. As a matter of fact, although [k] is a [+high] segment, [s] is [-high]. So the [s] in an [sk] cluster would incur violation of the conjoined constraint as well because it is an [s] and it is [-high].Note also that an OCP on [-high] is not an option because it would otherwise rule out onset clusters such as [pl].

However, defaulting to a cluster whose initial member is [s] is prevented under duress of the constraint in (21), as shown in the tableau below:

(23)

/ftV/	*s[-high]	Ident-Obs-Place	*[-ant]	*[+ant]
a. st	*!	*		**
b. ☞ ʃt		*	*	*

By dis-encapsulating *Cor, the relative ranking of Ident-Obs-Place and the relevant sub-hierarchies must be reconsidered. The alternation provides evidence that Ident-Obs-Place must be dominated by at least *[-ant] in order to prevent an input of the form [ʃk] from surfacing faithfully due to the fact that Ident-Obs-Place dominates *[-ant]. This undesired result is illustrated in the following tableau:

(24)

/ʃkV/	*s[-high]	Ident-Obs-Place	*[-ant]	*[+ant]
a. ✝ sk		*!		*
b. ☛ ʃk			*	

This input shows that the right relative ranking of Ident-Obs-Place and the sub-hierarchy of *Cor must be the one shown in tableau (25) below:

(25)

/ʃkV/	*s[-high]	*[-ant]	Ident-Obs-Place	*[+ant]
a. ☞ sk			*	*
b. ʃk		*!		

With Ident-Obs-Place dominated by *[-ant][9], an input of the type in (25) correctly defaults to the least marked fricative. On the other hand, however, higher ranking of *s[-high] will determine that an input of the form [st] cannot make it to the surface, despite the fact that it contains the unmarked fricative. This is shown in tableau (26) below.

(26)

/stV/	*s[-high]	*[-ant]	Ident-Obs-Place	*[+ant]
a. st	*!			*
b. ☞ ʃt		*	*	

Finally, the analysis I propose in this dissertation also accounts for the fact that in medial or in syllable final positions an underlying [st] never surfaces as an [ʃt] cluster. It has been argued (Hall 1992) that in German, as in many Indo-European languages s+Obstruent clusters are syllabified heterosyllabically. In a

[9] Remember that the contrast in the inventory is maintained by high ranking $\text{Ident}_{\text{Rel}}\text{Place}$.

word such as “Minister”, then the medial [st] cluster would satisfy the constraint *s[-high]^{Onset} because this constraint has been relativized to the onset domain. If the cluster is not a tautosyllabic onset cluster, the constraint is vacuously satisfied.

In conclusion, I have shown that in onset position, German is a *Type 1* language, which allows a relatively marked phonotactics for the FS clusters. Moreover, I have argued that the allophonic variation between s/ʃ in pre-consonantal position can be explained by maintaining the unmarkedness of the fricative [s]. In other words, initial [sk] is not considered an exception to the more regular distribution [ʃt], [ʃp]. In those environments in which [s] is banned to surface due to high ranking of the sequential constraint, *s[-high]^{Onset}, the occurrence of [ʃ] is the next best choice.

4.6 Case Study V: Onset Place Asymmetries in Delaware

The Delaware language is spoken in Ontario, approximately fifty miles southwest of London, Ontario. The Delaware speaking people have migrated over 300 years from the Manhattan Island to various locations in the US and Canada. The importance of Delaware for the purpose of this typology is that it represents an asymmetric system for place in onset obstruent clusters. The language allows all types of obstruent clusters in the onset. However, whereas only coronal fricatives are allowed in pre-obstruent position, stops can occur at any place of articulation in the same position. This is not an isolated example of such a system; Modern

Hebrew is, indeed, another one.

The following chart of the Delaware obstruent system is based on O'Meara J. (1996)[10]

(27)

	Labial	Alveol	Alveo-Palatal	Velar
Stops Simple	p b	t d		k g
Fricatives Non-sibilant	(f v)			x
Sibilant		s z	ʃ ʒ	
Affricates Sibilant			č ž	

The parentheses around the labial fricatives indicate that these sounds are only found in English borrowings, and are therefore not considered part of the native inventory. The author, rather than distinguishing between voiceless/voiced sounds, uses "strong" and "weak" respectively. The weak member of each pair occurs only post-nasally. They never occur word-initially thus suggesting their allophonic status.

As for syllable structure, the language contains both core clusters and obstruent clusters. The onset obstruent cluster phonotactics is quite rich. A chart of two member initial clusters[11] is given below. All the clusters occur in monomorphemic words.

[10] The writing system used in this dictionary is intended to enable speakers of Delaware and non-native speakers to read and write Delaware.
[11] I have excluded [f] from the chart since it is not a native sound and never occurs in clusters.

(28) Two member initial clusters

	p	t	č	k	s	ʃ	x
p		pt		pk	ps	pʃ	px
t	tp						tx
č	čp			čk			
k	kp	kt	kč		ks	kʃ	kx
s	sp			sk			
ʃ	ʃp	ʃt					ʃx
x							

The chart shows that clusters whose initial member is a fricative can only contain one of the coronals. There are no clusters whose initial fricative is the velar [x]. On the other hand, there are plenty of clusters whose first member is a stop at places of articulation other than coronal. This asymmetry is explained in the system I propose by assuming the existence of the special faithfulness constraint relative to stops repeated below:

(29) Ident-Stop-Place

Stops must agree in place features with their output correspondent.

The asymmetric behavior of Delaware obstruent clusters then follows from the interaction of this special faithfulness constraint with the rest of the hierarchy. The ability of stops occurring in pre-consonantal position to maintain their input place of articulation is due to high ranking Ident-Stop-Place as shown in tableau that follows:

(30)

/kpV/	Ident-Stop-Place	*Dor	Ident-Obs-Place	*Cor
a. ☞ kpV		*		
b. tpV	*!		*	*

Candidate (b), in which the first stop of the cluster neutralizes to coronal place loses in the competition with the faithful candidate (a) because of its violation of Ident-Stop-Place, which requires that stops maintain their input place of articulation regardless of their position.

On the other hand, an input containing a velar fricative as first member of an obstruent cluster will undergo neutralization as shown below:

(31)

/xpV/	Ident-Stop-Place	*Dor	Ident-Obs-Place	*Cor
a. xpV		*!		
b. ☞ spV			*	*

Candidate (31a) loses because *Dor dominates the only faithfulness constraint that applies to a fricative in pre-obstruent position. Due to this domination relation, dorsal place is disallowed in pre-consonantal position unless the segment in that position is a stop, as shown in the previous tableau. Note that the presence of the Ident-Place-Stop is crucial because in its absence an input containing a dorsal stop in pre-obstruent position would undergo place neutralization as well, as shown in tableau (32) below:

(32)

/kpida/	Ident-Rel-Place	*Dor	Ident-Obs-Place	*Cor
a. Desired winner: ✝ kpV		*!		
b. Wrong winner: ☞ tpV			*	*

Candidate (a), in which place is maintained in both members of the clusters, loses in the competition with a candidate in which place is neutralized in the first member of the cluster. This is due to the violation of dominant *Dor.

4.7 Case Study VI: Takelma

Takelma is an extinct Penutian American Indian language. The main sources for the data are Sapir (1922) and Borim (1991). Takelma is interesting because it represents a language in which both fricatives and stops in pre-obstruent position are restricted to coronal place. Moreover, due to this place restriction, the language admits only FS and SS clusters, but not SF clusters. So, in other words, the language admits a more marked type of obstruent clusters, i.e. SS, but not a less marked type, i.e. SF. I argue that this surface pattern is the result of a conflict between the two markedness dimensions relevant to obstruent clusters. This conflict results in a *harmonically incomplete* system.

4.7.1 The Facts about Takelma

The obstruent system of the language is given in the chart below taken from Borim (1991):

(33)

		Labial	Coronal	Dorsal
Stops	Lenis	p	t	k k^w
	Fortis	p'	t'	k' k'^w
	Aspirated	p^h	t^h	k^h k^{wh}
Fricatives	Lenis		s	
	Fortis		ts'	

In Takelma, onset obstruent clusters are very restricted. According to Sapir (1922) common clusters are the ones in (34)[12]

(34) FS: sp sk sk^w

*SF

SS: t^hp t^hk t^hk^w

[12] [st] is extremely rare.

As the data in (34) shows, only FS and SS clusters are allowed. There are no SF clusters in the language. However, the initial segment in the obstruent cluster is always a coronal, never a labial or a dorsal. As I will show, this pattern is predicted by the constraint system proposed to capture the place generalizations. There are no clusters with two coronal place segments, or two segments with the same place of articulation. In other words, although its manner features are well-formed, any SF cluster would violate the place restrictions on obstruent clusters.

From the place point of view, the ranking that predicts the pattern of coronal place neutralization for both stops and fricatives in pre-obstruent position is given in (35) blow:

(35) $\text{Ident}_{\text{Rel}}$Place >> *Dor, *Lab >> Ident-Obs-Place, Ident-Stop-Place, *Cor

The tableau that follows shows how an input with a Dorsal is neutralized to coronal place, given the ranking in (35):

(36)

/k^hpV/	$\text{Ident}_{\text{Rel}}$Place	*Dor	Ident-Obs-Place	Ident-Stop-Pl	*Cor
a. k^hpV		*!			
b. ☞ t^hpV			*	*	*

Candidate (a) fails because the dorsal consonant is not in a release position and is not protected by high ranking $\text{Ident}_{\text{Rel}}$Place. Candidate (b) is the optimal form because the pre-obstruent stop has the least marked place of articulation, i.e. coronal place.

On the continuant dimension, the fact that SS clusters occur suggests that Takelma has the ranking that predicts that also SF clusters would surface. The relevant ranking is given in (37) below:

(37) OCP [+cont] >> Ident(cont) >> OCP[-cont], *SO

As argued in Chapter 2, this ranking entails that FS, SF and SS surface in the language. However, in the case of Takelma the place hierarchy has priority over the manner hierarchy and thus prevents SF clusters from occuring. The reason why SF cannot occur is that [dorsal] and [labial] are not allowed in pre-obstruent position. This requirement restricts the range of possible SF clusters. Given the pattern in (34), the only possible SF cluster would be [t^hs]. However, in Takelma, obstruent clusters are never allowed to share place of articulation. Due to high ranking OCP(Place) an input containing [t^hs] will surface as a cluster with two stops at different places of articulation as shown in the following tableau:

(38)

/t^hs/	OCP(Place)	$\text{Ident}_{\text{Rel}}$Place
a. t^hs	*!	
b. st	*!	
c.☞ t^hp		*

In conclusion, the interaction of the two markedness hierarchies and the fact that (35) has priority over (37), results in Takelma being *harmonically incomplete* . Although the constraint ranking in (37) allows for both SF and SS to surface, the former are prevented from occurring because of the fact that the place hierarchy has priority over the manner hierarchy.

4.7.1.1 An Additional Fact about Takelma

In addition to the fricative [s], Takelma also contains a sound which is transcribed as [x]. According to Sapir (1922), this segment is derived from original [ts’] and behaves phonologically like a coronal. In particular, [xt] and [st] clusters are extremely rare and I assume here that they are ill-formed. I assume that the absence of [xt] clusters is an accidental gap due to the fact that they would only have arisen from the ill-formed [coronal]-[coronal] sequence *[ts’t].

In the following section, I will discuss an alternative to the system I have just proposed. The alternative system is based on Steriade’s Licensing-by-Cue. I argue that in the case of place features the system presents a number of typological problems.

4.8 Licensing by Cue

Steriade (1997) proposes deriving alternations in sound patterns on the basis of a model of grammar that makes explicit reference to independently known facts about the perception and production of speech. In particular, she proposes that laryngeal features are neutralized in positions where perceptibility factors are impoverished, and on the contrary, maintained in positions where perceptual cues are strongest. She refers to this hypothesis as “Licensing by Cue”[13] and models it on the basis of alignment between constraint hierarchies and harmonic scales. Specifically, in the case of voicing, she assumes a perceptibility scale for voicing based on the contexts in which contrastive voicing is more or less likely to be identified. The scale is given in (39) below. The symbol ▸ indicates that voicing contrast in one phonological context is more perceptible than in the context to its right.

(39) Steriade’s scale of obstruent voicing perceptibility according to context.

V_[+son] ▸ V_# ▸ V_[-son] ▸ {[-son]_[-son], [-son]_#, #_[-son]}

The scale expresses the fact that perceptual cues to obstruent voicing are stronger when the obstruent occurs between a vowel and a sonorant and becomes increasingly weaker as we move to the right. In Steriade’s model perceptibility scales of the type in (39) project families of constraints that correspond to each context in the perceptibility scale. Such constraints are formulated as negative constraints banning the occurrence of a feature F in every individual context in the scale. Steriade’s constraints are, in other words, positional markedness constraints. In the case of obstruent voicing, Steriade proposes the family of

[13] As opposed to models that postulate a correlation between syllabic positions and sites of licensing or neutralization (Licensing by Prosody) (Ito 1986,1989, Goldsmith 1990, Rubach 1990, Lombardi 1991, 1995).

constraints in (40) that are universally ranked on the basis of the perceptibility scale in (39).

(40) *αvoice/ [-son]_[-son], [-son]_#, #_[-son]

|

*αvoice/V_[-son]

|

*αvoice/V_#

|

*αvoice/V_[+son]

Patterns of voice neutralizations are derived by the interaction of the fixed hierarchy in (40) with a faithfulness constraint that preserves input voice values, *Preserve [voice]*. If the faithfulness constraint only dominates the lowest ranked constraint *αvoice/V_[+son], then voice contrast is only preserved after vowels and before sonorants, i.e. the context in which cues to voicing are strongest. If *Preserve[voice]* dominates both *αvoice/V_# and *αvoice/V_[+son], then voice is licensed in the two corresponding environments, i.e. after vowels and before sonorants or word finally. With *Preserve[voice]* ranked above *αvoice/V_[-son] voice contrast is maintained also after vowels and before non-sonorant segments. Finally, when *Preserve[voice]* dominates the whole constraint hierarchy, voice contrast is preserved between non-sonorant segments and either preceding or following a non-sonorant, i.e. it is preserved in both strong and weak environments.

A strict implementation of Steriade's model can be carried out by reference to the so-called contextual or transitional cues. These cues are found in the brief transitional period between a consonant and an adjacent vowel, or a sonorant. Obstruents also have internal cues. Internal cues are found in the burst for stops and in the frication noise for fricatives. They have been shown to be weaker than contextual cues. Therefore, perception of obstruents occurring either before or, to a lesser extent, after a vowel is stronger because the listener has access to both types of cues, i.e. contextual and internal. On the other hand, perception of obstruents in the context of other obstruents is impoverished due to the fact that the listener can only rely on internal cues. For this reason, it is argued that pre-obstruent and post-obstruent positions are the weakest positions where place contrast can be maintained (Steriade 1997, Wright 1996 and references therein). Segments occurring in these positions are therefore more likely to undergo neutralization of place than obstruents occurring in positions adjacent to a vowel.

On the basis of these perceptual facts about obstruents, there are basically four main contexts that need to be identified and on the basis of which a perceptibility scale á la Steriade can be formulated. The contexts in question are:

(41) a. Pre-sonorant: _(S)V[14]

b. Post-sonorant: V(S)_

c. Pre-obstruent: _O

d. Post-obstruent: O_

These four contexts give rise to the following perceptibility scale:

(42) _(S)V ▸ V(S)_ ▸ {_O, O_}

The context of a following vowel represents the strongest cues to obstruent place due to the fact that two types of cues are accessible in this context, i.e. contextual and internal. The context of a preceding vowel, and precisely the transitional period between a vowel and a following obstruent, still makes both types of cues available, but they have been shown to be weaker than the ones in pre-vocalic position. Finally the weakest cues are found in contexts where vowel transitions are absent, i.e. in pre-obstruent and post-obstruent positions. Only internal cues are available in such positions. Although four different contexts are represented in the scale, the scale itself basically expresses the main fact that cues to obstruent place are stronger if the obstruent is adjacent to a vowel, because of the presence of vowel transitions, and weaker if the obstruent is adjacent to another obstruent, because vowel transitions are absent in this context.

In Steriade's model, perceptibility scales project families of markedness constraints that ban a certain feature in each individual context. However, by

[14] This is the same context given in Lombardi (1991).

projecting markedness constraints for place features, the system of constraints would grow considerably, as shown in (43) below:

(43) Positional Markedness Hierarchies:

(a) *Lab/{_O, O_} >> *Lab/V(S)_ >> *Lab/_(S)V

(b) *Dor/{_O, O_} >> *Dor/V(S)_ >> *Dor/_(S)V

(c) *Cor/{_O, O_} >> *Cor/V(S)_ >> *Cor/_(S)V

Under Prince and Smolensky's markedness hierarchy, place features are themselves ranked. This is shown below:

(44) *Lab, *Dor >> *Cor

In order to maintain this ranking, the individual hierarchies would need to be ranked accordingly. So in other words, we would have the following ranked hierarchy:

(45) *Lab/{_O, O_}, *Dor/{_O, O_}

|

*Lab/V(S)_ , *Dor/V(S)_

|

*Lab/_(S)V , *Dor/_(S)V

|

*Cor/{_O, O_}

|

*Cor/V(S)_

|

*Cor/_(S)V

This positional markedness hierarchy, with the interaction of a general faithfulness constraint that preserves place, e.g. *Preserve[Place]* has a number of problems. If *Preserve[place]* is ranked anywhere above the *Cor family, the system predicts that Coronal place is allowed in all three positions that have been identified, i.e. presonorant, coda and pre-obstruent position. Similarly, the system predicts that if [labial] is allowed in one context [dorsal] is also, and vice versa. So for example, with *Preserve[Place]* dominating *Lab/{_O, O_}, *Dor/{_O, O_} we are not only predicting that both [labial] and [dorsal] place are allowed in pre-obstruent position but also that both must necessarily occur in coda. Therefore, this system does not allow us to freely rerank *Dor/V(S)_ because the context is fixed in the hierarchy of contexts. This predicts a correlation between the patterns in clusters and in codas, but there is no evidence for such a correlation.

Similar problems arise if we assume that, rather than a single *Preserve[Place]*, the system consists of three different faithfulness constraints relativized to the different place features. The ranking among the three different faithfulness constraints would also be fixed on the basis of the hierarchy in (44):

(46) *Preserve[coronal] >> Preserve[labial], Preserve[dorsal]*

Interaction of (46) with (45) would also predict that if [labial] and [dorsal] place are allowed in pre-obstruent position, they would also necessarily occur in coda because of the fixed ranking among the faithfulness constraints.

Another possibility would be that (46) actually interacts with a hierarchy of the type in (47) below:

(47) *Place/{_O, O_} >> *Place/V(S)_ >> *Place/_(S)V

Also in this case, the system would predict that if [dorsal] or [labial] is allowed in pre-obstruent position, i.e. *Preserve[labial]* >> *Place/{_O, O_}, it must necessarily be allowed in coda position as well, because *Preserve[labial]* >> *Place/{_O, O_} implies *Preserve[labial]* >> *Place/V(S)_. Therefore, no matter how we implement Steriade's model, a correlation between place in pre-obstruent position and coda position is always predicted.