

## CHAPTER 1

### ASPECTS OF POSITIONAL FAITHFULNESS THEORY

#### 1.1 Introduction: Positional Privilege in Phonology

There is a small inventory of privileged linguistic positions which play a central role in the phonological systems of the world's languages. Privileged positions (1a) are those positions which enjoy some perceptual advantage in the processing system, via either psycholinguistic or phonetic prominence, over the complement of non-privileged positions (1b).

- |     |    |   |    |   |
|-----|----|---|----|---|
| (1) | a. | Privileged positions  | b. | Non-privileged positions  |
|     |    | <ul style="list-style-type: none"><li>• Root-initial syllables</li><li>• Stressed syllables</li><li>• Syllable onsets</li><li>• Roots</li><li>• Long vowels</li></ul> |    | <ul style="list-style-type: none"><li>• Non-initial syllables</li><li>• Unstressed syllables</li><li>• Syllable codas</li><li>• Affixes, clitics, function words</li><li>• Short vowels</li></ul> |

Positions which are psycholinguistically prominent are those which bear the heaviest burden of lexical storage, lexical access and retrieval, and processing: root-initial syllables, roots and, to some degree, final syllables (see Chapter 2 and Steriade 1993c for relevant discussion). By contrast, medial syllables and functional elements such as inflectional affixes, clitics and closed-class items, though important, play a lesser role in the organization of the lexicon. Phonetic prominence may be instantiated by many different physical cues, including increased duration or amplitude, pitch extrema, release bursts, etc. (See Kingston 1985, 1990; Steriade 1993c, 1995 and Kirchner 1996 for recent examinations of perceptual cues and their role in phonology.)

Positions of phonetic prominence include stressed syllables, syllable onsets, long vowels and possibly final syllables.

Positional privilege is not determined solely on perceptual grounds, however. While there is a functional unity to the class of privileged positions, there is also a phonological unity: positional privilege is manifested in three distinct, but closely related, patterns of phonological asymmetry (2).

- (2) Phonological asymmetries diagnostic of positional privilege
- Positional maintenance of contrasts which are neutralized elsewhere

- Positional triggering of phonological processes
- Positional resistance to processes which apply elsewhere

I will show, in this and subsequent chapters, that each of these phonological asymmetries arises from a single pattern of constraint interaction in an Optimality Theoretic grammar (Prince & Smolensky 1993, McCarthy & Prince 1993a,b) , one in which *positional faithfulness constraints* crucially dominate context-free faithfulness and markedness constraints. Before turning to the analysis, however, let me consider each of the diagnostic asymmetries in (2) in greater detail.

The first of these phenomena, typically discussed under the heading of positional neutralization, is the most familiar, documented in many languages for many different positions of privilege. (See, for example, Trubetzkoy 1939; Bach 1968; Haiman 1972; Ringen 1975; Kiparsky 1981, 1988; Goldsmith 1985, 1989, 1990; Kingston 1985, 1990; Itô 1986, 1989; Lombardi 1991; Steriade 1979, 1982, 1993c, 1995; and a host of others.) In cases of positional neutralization, some contrast or contrasts are maintained only in a prominent position. Outside of that position, the inventory is a less-marked subset of the full inventory attested in positions of privilege; the contrast in question is neutralized in favor of an unmarked value. The reverse pattern, in which the full inventory appears in a non-prominent position and an unmarked subset is restricted to the prominent position, is rarely, if ever, attested.

Positional neutralization is most obvious, perhaps, when it occurs in morphologically derived environments, where there are overt alternations to highlight the neutralization process; however, this positional restriction on the distribution of contrast is robustly documented in many languages. One example of positional neutralization can be found in the vowel height harmony system of Shona verbs. Shona, a Bantu language of Zimbabwe, has a common, five-vowel inventory: {i,e,u,o,a}. In verbs, vowel height is fully contrastive in root-initial syllables, as shown in (3); all five vowels occur freely. However, vowel height in non-initial syllables is severely restricted; non-initial mid vowels may surface only if preceded by an initial mid vowel (4).

(3) Initial syllable: Vowel height varies freely

pera	‘end’
tsveta	‘stick’
sona	‘sew’
ipa	‘be evil’
iuaa	‘come out’
bvuma	‘agree’
iata	‘hold’
shamba	‘wash’

(4) Non-initial syllables: Height is restricted

<i>Mid vowel in S<sub>1</sub></i>		<i>Non-mid vowel in S<sub>1</sub></i>	
tonhor-	‘be cold’	buruk-	‘dismount’
pember-	‘dance for joy’	simuk-	‘stand up’
bover-	‘collapse inwards’	turikir-	‘translate’
		charuk-	‘jump over/across’
		tandanis-	‘chase’

There are no Shona verb roots in which mid vowels follow either low or high vowels. Only the peripheral vowels *i*, *u* and *a* are contrastive in non-initial syllables. (For an analysis of the Shona facts, see Chapter 2.) This type of positional neutralization, displaying sensitivity to the root-initial syllable, is extremely common in languages which exhibit vowel harmony, being attested in a genetically diverse array of languages and language families including Bantu, Kwa, Uralic, Altaic, and Finno-Ugric. Not attested are languages in which a full array of vowels appear outside of the root-initial syllable, while only the peripheral vowels appear in initial syllables.

A second example of positional neutralization, also familiar, is that of unstressed vowel reduction. In languages which exhibit reduction of unstressed vowels, the full inventory is permitted to surface under stress. In the absence of stress, however, the vowel inventory is restricted to a set which is less marked on either the articulatory or acoustic dimension. English is one example of reduction in articulatory markedness; non-final unstressed vowels in English are restricted to [ɪ]<sup>1</sup> (Chomsky & Halle 1968, Bolinger 1981, Flemming 1993, Burzio 1994), a vowel which is arguably devoid of any place specifications or articulatory targets (Anderson 1982, Odden 1991, Browman & Goldstein 1992). An example of reduction to an inventory

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<sup>1</sup> In unstressed final syllables, [ij] and [oU] may occur. Some dialects permit unstressed [I] in both final and medial syllables.

which is arguably less marked acoustically may be found in Western Catalan (as well as a number of other regional Romance dialects) (Hualde 1992, Prieto 1992). In syllables which bear primary stress, Western Catalan exhibits the seven-vowel inventory shown in (5).

(5) Western Catalan vowels, stressed syllables

	<u>Front</u>	<u>Back</u>
High:	i	u
Mid: [+ATR]	e	o
Mid: [-ATR]	ɛ	ø
Low:		a

However, outside of the primary stress position, the vowel inventory of Western Catalan is limited to a triangular five-vowel system, with the [ATR] contrast among the mid vowels being lost. This inventory can be characterized as less marked than that of the stressed syllables, as it is composed of fewer vowels separated by greater perceptual distance (Liljencrants & Lindblom 1972, Lindblom 1986, Flemming 1995). Representative data are provided in (6), with alternating vowels in boldface.

(6) Unstressed vowel reduction, Western Catalan (Prieto 1992: 567–568)

r~íw	‘river’	r~iwét	‘river, dim.’
néw	‘snow’	newéta	‘snow, dim.’
p’s	‘weight’	pezét	‘weight, dim.’
pála	‘shovel’	paléta	‘shovel, dim.’
r~ø’?a	‘wheel’	r~ø’éta	‘wheel, dim.’
só”	‘sun’	solét	‘sun, dim.’
búr~o	‘dumb’	bur~ét	‘dumb, dim.’

Here, as in the Shona case, it is the position of perceptual prominence which is accorded phonological privilege, permitting a wider variety of vowels than the less prominent, unstressed syllables. (A full analysis of Catalan vowel reduction is provided in Chapter 3.) I know of no cases of “stressed vowel reduction”, in which the inventory in stressed syllables is a subset of that in the unstressed syllables. In circumstances of positional neutralization, it is always the perceptually non-prominent position which undergoes reduction, while the prominent positions preserve a full range of contrasts.

The second phonological diagnostic of positional privilege is the triggering of phonological processes. Segments which appear in privileged positions frequently serve as the

triggers of phonological processes such as vowel harmony, place assimilation, laryngeal feature assimilation, and dissimilation of various sorts. In the realm of vowel harmony, cases of positional triggering arise in languages which exhibit root-governed vowel harmony (in which the vowels of the root determine the vocalism of any affixes, whether prefixes or suffixes; Tangale (Hulst & Weijer 1995) is one such example), and in those which have initial-syllable governed harmony. In the latter class of examples, it is the vowel of the root-initial syllable which determines the vocalism of any subsequent root vowels, as well as that of affixal vowels, via progressive assimilation. Numerous vowel harmony systems fall into this category; they include the height harmony system of Shona and other Bantu languages, ATR harmonies in a variety of African and Tungusic languages, and the palatal and labial harmonies of the Uralic and Altaic languages. (See Hulst & Weijer 1995 and the extensive prior vowel harmony literature cited therein for additional details.)

Positional triggering is also robustly attested in clusters of consonants comprised of a coda and following onset; canonical cases include place assimilation (Steriade 1982, 1993c, 1995; Itô 1986, 1989; Padgett 1991, 1995b) and laryngeal assimilation (Kingston 1985, 1990; Cho 1990; Lombardi 1991, 1995a, 1996a,c) . One example occurs in Diola Fogy, a language of West Africa. In Diola Fogy, coda nasal consonants undergo assimilation in place to a following obstruent or nasal, as shown in (7).

(7) Place assimilation in Diola Fogy (Sapir 1965: 16; Itô 1986: 56)

a.	/ni-gam-gam/	∅	niga~gam	‘I judge’
	/pan-ji-maɲj/	∅	paɲjimaɲj	‘you (pl.) will know’
	/ku-bøñ-bøñ/	∅	kubømbøñ	‘they sent’
	/na-ti~ti~/	∅	nati:nti~	‘he cut (it) through’
b.	/na-mi:n-mi:n/	∅	nami:mni:n	‘he cut (with a knife)’
	/ni-ma~ma~/	∅	nimamma~	‘I want’
	/ni~an~an/	∅	nĩa~~an	‘I cried’

In these data, the segment which appears in onset position triggers the process of place assimilation; the features of the non-onset consonant are lost. This is true also of obstruent-obstruent clusters which exhibit voice assimilation (Lombardi 1991, 1995a, 1996a,c) and place assimilation or gemination (Mohan 1993) . Processes which are triggered exclusively by

elements in non-prominent positions (such as voice or place assimilation triggered only by coda consonants, or vowel harmony triggered only by affixes), without an overriding functional motivation, are virtually unattested.

The final phonological diagnostic of positional privilege is that of resistance to phonological processes, a phenomenon closely related to positional triggering of processes. Segments which appear in privileged positions such as onsets or stressed syllables often fail to undergo an otherwise regular phonological process, such as assimilation or dissimilation. In one class of cases, exemplified by the Diola Fogny data above, this failure of privileged positions to alternate appears almost unworthy of mention; given a process affecting two-member consonant clusters, one must be target and one must be trigger. If the onset segment is the trigger of assimilation, as seen above, it cannot also be the undergoer. This line of argumentation obscures an important generalization, however: segments in prominent positions very rarely undergo phonological processes, *even in cases in which they do not serve as triggers*.

One striking example of this latter variety of positional resistance can be found in Zulu, a Bantu language of South Africa. In morphologically complex Zulu forms in which a labial consonant + *w* sequence arises (the passive and the locative), there is a process of dissimilation which causes the affected labial consonant to surface as a palatal or palato-alveolar (Doke 1954, 1969; O'Bryan 1974; Ohala 1978; Khumalo 1987; Beckman 1994a).<sup>2</sup> The process is unbounded, affecting the rightmost labial, even if that labial is not syllable-adjacent to the triggering *w*. The affected labial consonants are themselves never the trigger of dissimilation. Some examples are given in (8).

<sup>2</sup> The outcome of dissimilation is affected by both the manner and the laryngeal specification of the targeted labial consonant, with the voiceless aspirate [p<sup>h</sup>] surfacing as a fricative [β], and the other oral stops appearing as affricates. There are no non-affricated oral palatal stops in the Zulu inventory.

(8)	Labial dissimilation in Zulu (Beckman 1994a)			
	iop <b>h</b> a	‘Tie!’	uyai <b>o</b> βiswa	‘he is being made to tie’
	°up <b>h</b> ek’a	‘Suffer!’	iyai <b>o</b> βelwa	‘it is being tied for someone’
	sei’nza	‘Work!’	k’u°u <b>β</b> ek’wa	‘it is being suffered’
	βumayela	‘Preach!’	iyase <b>e</b> ’nzwa	‘it is being worked’
	Tgob <b>o</b> za	‘Dip!’	iyab <b>u</b> uelelwa	‘it is being preached’
	kh <b>u</b> mula	‘Undress!’	iyat <b>g</b> o <b>e</b> ozwa	‘it is being dipped’
			uyakh <b>u</b> uelelwa	‘she is being undressed for’

The dissimilation process fails to apply in one circumstance, when the target labial is contained in the initial syllable of the root.<sup>3</sup> This is shown in (9).

(9)	Root-initial exceptionality (Beckman 1994a)			
	p <b>h</b> uza	‘Drink!’	iyap <b>h</b> uzwa	‘it is being drunk’
	b <b>a</b> la	‘Write!’	iyab <b>a</b> lwa	‘it is being written’
	i <b>u</b> ta	‘Collect!’	iyai <b>u</b> twa	‘it is being collected’

Another striking example of positional resistance occurs in the nasal harmony system of Guaraní (Tupí: Paraguay). In Guaraní, [nasal] spreads to the left from a stressed nasal vowel, or from the closure phase of a prenasal stop (which need not be in a stressed syllable). The process is unbounded, affecting all preceding unstressed syllables, as shown in (10). (Nasal harmony spans are underlined.)

(10)	Guaraní nasal harmony (Gregores & Suárez 1967)		
	/ro + mbo + pora~’]	∅	[ <u>r~o~mo~po~r~a~’</u> ]
	I-you + CAUS + nice		
	‘I embellished you’		
	/a+yìei+ ndupa~’/	∅	[ <u>a~n~e~înnu~pa~’</u> ]
	I + REFL + beat		
	‘I beat myself’		
	/ndo+ro+ndupa~’ + i/	∅	[ <u>no~r~o~nu~pa~’î</u> n]
	not+I-you + beat + NEG		
	‘I don’t beat you’		
	/ro + mbo + ©watá/	∅	[ <u>r~o~mbo</u> ©watá]
	I-you + CAUS + walk		
	‘I made you walk’		

<sup>3</sup> A small number of Zulu verb roots are of the form VC, rather than the canonical CVC. Dissimilation is blocked in these roots, though the root consonant is arguably not a member of the root-initial syllable. These facts merit further consideration, as they suggest that the root-initial syllable is initiated by the first consonant in the root, rather than the first segment in the root. Thanks to David Odden for reminding me of the relevant data.

However, nasal harmony is blocked by a preceding stressed syllable, even when the vowel in that syllable is oral; prominent positions resist the application of an otherwise regular phonological process.

- (11) Stressed syllables block the propagation of nasal harmony  
 /amba.apóro~reyʝú/                    Ø                    [÷a~mba÷apòro~re~yʝú]  
 ‘if I work you come’  
 /royʝotopapàmba~ro~roxóvara~/ Ø                    [royʝotopapàmba~r~o~ro~xòv~a~r~a~']  
 ‘if now we meet all of us, we’ll have to go’

Additional examples of positional resistance are discussed in Hume (1995) and Cole (1996), and in subsequent chapters of this dissertation.

The phonological asymmetries outlined above do not constitute a random collection of positional oddities, but rather a closely related constellation of facts which cluster around a single generalization: segments in prominent positions are resistant to alternation. The functional motivation for this resistance is clear; phonological contrasts are preferentially maintained in prominent positions because these positions are exactly those which take priority in perception and processing.

This functional motivation finds grammatical expression in the form of Optimality Theoretic *positional faithfulness* constraints (inspired by the positional PARSE(F) constraints of Selkirk 1994) which require segments in prominent positions to be preferentially *faithful* to the feature specifications of their underlying counterparts. Positional faithfulness constraints have the general form schematized in (12).

- (12) IDENT-Position(F)  
 Let  $\beta$  be an output segment in a privileged position P and  $\alpha$  the input correspondent of  $\beta$ . If  $\beta$  is [ $\gamma$ F], then  $\alpha$  must be [ $\gamma$ F].  
 “Correspondent segments in a privileged position must have identical specifications for [F].”

When (12) is spelled out with specific perceptually prominent positions, the result is a set of positional faithfulness constraint families (IDENT-ONSET(F), IDENT- $\sigma_1$ (F), IDENT- $\sigma'$ (F), and so on). Through interaction with the other constraints which are contained in the grammar, these



constraint families are responsible for the wide array of positional asymmetries summarized above.

In particular, there is a single pattern of constraint interaction which accounts for each of these asymmetries. This pattern is schematized in (13), where F represents any phonological feature and **C** any alternation-favoring constraint which crucially affects the distribution of F (\*LABIAL, \*VDOBSTR, ALIGN-R(ATR), etc.).

- (13) Ranking schema, positional phonological asymmetries  
 $\text{IDENT-Position}(F) \gg \mathbf{C} \gg \text{IDENT}(F)$

The ranking of **C** in the midst of the featural faithfulness constraint hierarchy (originally employed by Selkirk 1994 in an examination of positional  $\text{PARSE}(F)$  constraints), crucially above the context-free faithfulness constraint, is responsible for generating all three varieties of prominence-sensitive phonological asymmetry mentioned above: positional maintenance of contrasts neutralized elsewhere, positional triggering of phonological processes, and positional resistance to phonological alternation. This approach allows for the unification of a wide variety of related positional phenomena under a single analytic umbrella: positional faithfulness. Previous approaches, both derivational and constraint-based, have failed to recognize the unity of these positional phenomena, employing a mixed bag of constraints and stipulative restrictions in rule formalism to achieve the diverse effects of positional privilege, without explaining these effects.

The goal of this dissertation is to develop a theory of positional faithfulness which will both generate and explain the range of positional asymmetries attested in natural language phonology. I begin, in this chapter, with a demonstration of the workings of positional faithfulness theory in the familiar domain of onset/coda asymmetries, focusing on voice assimilation in Catalan. In Chapter 2, I examine positional privilege accorded to root-initial syllables, a position in which prominence derives largely from psycholinguistic (rather than phonetic) properties. Chapter 3 is devoted to the domain of stress, showing once again that positional faithfulness constraints unify and explain a wide range of phonological asymmetries associated with the presence or absence of stress. In Chapter 4, I turn to privilege effects which

are sensitive to the distinction between root and affix. Finally, in Chapter 5, a different type of positional effect, that of positional maximization, is analyzed.

## 1.2 Theoretical Background: Optimality and Correspondence

Optimality Theory (Prince & Smolensky 1993, McCarthy & Prince 1993b) is a framework in which the emphasis is not on a sequence of ordered rules by which an input is transformed into a surface form, but rather on the interaction of violable universal constraints which determine the well-formedness of output forms. The task of the analyst is therefore not to determine what rules apply and in what order in a given language, but instead to determine the ranking of constraints which will generate all and only the surface phonological patterns of a language.

The OT grammar consists of three components (Prince & Smolensky 1993) : *Gen*, *Con* and *Eval*. The first, *Gen*, is a function which associates an input string with a potentially infinite set of output candidates consistent with that string. Incorporated in *Gen* are the representational primitives of linguistic form (features and prosodic constituents, for example), as well as any inviolable constraints on linguistic structure. These inviolable constraints include the invariant properties of feature geometry and prosodic organization (for example, root nodes dominate features, syllables dominate moras, feet dominate syllables, etc.). Subject to these inviolable principles, *Gen* may improvise freely on the input string; possible phonological improvisations include the addition of structure (features, association lines, root nodes, syllabification, etc.), deletion of structure, and reordering of input segments.

Departing from earlier work in OT (Prince & Smolensky 1993; McCarthy & Prince 1993a,b) , I will adopt the Correspondence theory of faithfulness set out in McCarthy & Prince (1995) . McCarthy & Prince note that a wide range of parallels exist between requirements on base-reduplicant identity in reduplicative morphology on the one hand, and requirements of input-output faithfulness in phonology on the other. Generalizing over the two domains, McCarthy & Prince propose that candidate sets come from *Gen* with a correspondence

function expressing the dependency of the output on the input (or of the reduplicant on the base).<sup>4</sup>

(14) Correspondence (McCarthy & Prince 1995)

Given two related strings  $S_1$  and  $S_2$ , Correspondence is a relation  $\rightarrow$  from the elements of  $S_1$  to those of  $S_2$ . An element  $\alpha \in S_1$  and any element  $\beta \in S_2$  are referred to as *correspondents* of one another when  $\alpha \rightarrow \beta$ .

*Gen* is free to impose any correspondence relation, or none at all, on the elements of  $S_2$ . The choice among candidates which exhibit various  $S_1$ - $S_2$  correspondence relations will be determined by their satisfaction or violation of the constraints which make up the second component of the grammar, *Con*.

*Con* is a set of violable constraints, common to all languages, but ranked on a language-particular basis.<sup>5</sup> The constraints which comprise *Con* fall into three broad categories: markedness constraints, faithfulness constraints, and alignment constraints.<sup>6</sup> Markedness constraints assess the well-formedness of linguistic structure at a variety of levels, including featural, segmental and syllabic. Such constraints are ideally grounded (Archangeli & Pulleyblank 1994a), in the sense that they reflect the articulatory or acoustic (in)compatibility of various features, or the perceptual difficulties associated with certain configurations. Some examples of markedness constraints are given in (15).

(15) Markedness constraints

\*P<sub>L</sub>/Lab: \*[Labial]

“Consonants should not be labial.” (Prince & Smolensky 1993: chapter 9)

\*V<sub>D</sub>O<sub>B</sub>STR: \*[voice, –sonorant]

“Obstruents must not be voiced.” (Lombardi 1996a, Alderete 1997a, Itô & Mester 1997)

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<sup>4</sup> The correspondence relation is extended further, to pairs of output strings within a morphological paradigm in recent work by Benua (1995, 1997), Buckley (1995), McCarthy (1995), Kager (1995) and Burzio (1997). See also the discussions of paradigm uniformity in Burzio (1994), Orgun (1994), Flemming & Kenstowicz (1995), and Kenstowicz (1996).

<sup>5</sup> I assume here a strict dominance hierarchy, following Prince & Smolensky (1993). Work on variation in OT (Reynolds 1994; Zubritskaya 1994, 1997; Nagy & Reynolds 1997; Ringen 1997; Anttila, in preparation) suggests that the requirement of total ordering must ultimately be relaxed, with variable ranking being permitted.

<sup>6</sup> More constraint types may be necessary, and the classification of constraints is not always obvious. (For example, the NON-FINALITY constraint of Prince and Smolensky 1993 is a sort of anti-alignment constraint.)

ONSET: \*<sub>o</sub>[V  
“Every syllable has an onset.” (Prince & Smolensky 1993: 25)

Implicational relations which hold among more and less marked structure are encoded by means of markedness constraints and their relative rankings; structures which are more marked cross-linguistically are regulated by constraints which are higher-ranking than those which penalize relatively less marked elements.

Faithfulness constraints regulate the exactness of the correspondence between two strings (input and output, base and reduplicant, or output and output), penalizing deviations from the original string. The improvisational whims of *Gen* are reined in by the faithfulness constraints, which penalize a variety of changes including addition or deletion of features and segments, changes in the linear order of segments and fusion of segments. Representative Correspondence-based faithfulness constraints are shown in (16).<sup>7</sup> (A more extensive list is provided in McCarthy & Prince 1995.)

(16) A faithfulness constraint sampler

MAX  
Every segment in  $S_1$  has a correspondent in  $S_2$ . (Phonological deletion is not permitted.)

DEP  
Every segment in  $S_2$  has a correspondent in  $S_1$ . (Phonological insertion is not permitted.)

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<sup>7</sup> The constraints in (16) take the place of the faithfulness constraints employed in the earlier, representational approach to faithfulness (Prince & Smolensky 1993; McCarthy & Prince 1993a,b). In that theory, deleted segments were maintained in outputs forms as unprosodized material, violating PARSE-Segment. Epenthesized segments could be recognized as featureless prosodic nodes, violating FILL-Segment. Featural faithfulness was regulated by a variety of constraints including PARSE-Feature, FILL-Feature (Prince & Smolensky 1993), and constraints on the placement of association lines (see Pulleyblank 1993, 1994 and Itô, Mester & Padgett 1995 for examples). Some empirical differences between the two approaches to faithfulness are discussed in McCarthy & Prince (1995).

IDENT(F)

Correspondent segments in  $S_1$  and  $S_2$  have identical values for some feature [F].<sup>8</sup> (Features may not be changed.)

Faithfulness constraints, or their equivalent, are essential to any theory of phonology, for without them, all inputs would converge on a single unmarked output. (This is the “fallacy of perfection”, discussed in McCarthy & Prince 1994a and McCarthy 1997 .)

The final category of constraints which comprise *Con* is that of alignment constraints, which require the coincidence of edges of various phonological and/or morphological constituents (McCarthy & Prince 1993a). The constituents to be aligned may be drawn from the set of morphological or syntactic categories (affix, root, stem), prosodic categories (syllable, foot, prosodic word, etc.), or the set of distinctive features.<sup>9</sup>

(17) Alignment, general schema (McCarthy & Prince 1993a: 2)

$\text{ALIGN}(\text{Cat}_1, \text{Edge}_1, \text{Cat}_2, \text{Edge}_2) =_{\text{def}} \forall \text{Cat}_1 \exists \text{Cat}_2$  such that  $\text{Edge}_1$  of  $\text{Cat}_1$  and  $\text{Edge}_2$  of  $\text{Cat}_2$  coincide.

Where

$\text{Cat}_1, \text{Cat}_2 \quad \text{PCat} \approx \text{GCat}$   
 $\text{Edge}_1, \text{Edge}_2 \quad \{\text{Right, Left}\}$

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<sup>8</sup> I follow McCarthy & Prince (1995) in adopting the segmentally -mediated IDENT approach to featural faithfulness. As McCarthy & Prince themselves suggest (p. 265), it is possible that features, in addition to segments, are in correspondence. This featural correspondence approach to faithfulness has been advocated in a variety of recent works, including Lamontagne & Rice (1995), Lombardi (1995b), McCarthy (1995) . While featural correspondence may ultimately be required, I do not adopt it here, largely because positional faithfulness constraints can capture the effects outlined in §1.1 only if formulated in segmental terms. Consider the positional MAX(Place) of Padgett (1995b):

(i)  $\text{MAX}_{\text{REL}}(\text{Place})$ : Let  $S$  be a [+release] output segment. Then every place feature in the input correspondent of  $S$  has an output correspondent in  $S$ .

Without the intervention of the segmental unit  $S$ , the intended effect (output retention of the input place features of segments which are [+release]) is impossible to achieve with a MAX formulation, for it is the segmental anchor for the features which is crucial in establishing that *positional* faithfulness is at play. In the absence of the segmental mediator, the constraint in (i) will require simply that input features of a particular variety surface in a prominent position, as in (ii):

(ii)  $\text{MAX}_{\text{REL}}(\text{Place})$ : For all  $x, x \in \{\text{Coronal, Dorsal, Labial, Pharyngeal}\}$ , if  $x$  is present in the input, it must have an output correspondent on a segment which is [+release].

In many cases, such a constraint will lead to positional *unfaithfulness*, as it requires that input features be realized on a syllable onset in output, regardless of the input specification of the onset segment. As the segmental mediator of the features *must* be retained in (i) in order to account for the positional generalizations under discussion, I have chosen to retain the more direct segmental formulation of positional IDENT constraints.

<sup>9</sup> Featural alignment was originally suggested in Kirchner (1993) , and further developed in numerous works, including Pulleyblank (1993, 1994), Akinlabi (1994, 1995), Archangeli & Pulleyblank (1994b), Beckman (1994b), Itô & Mester (1994), Cole & Kisseberth (1995a,b,c), and Ringen & Vago (1995a,b).

The effects of alignment constraints proposed in the literature include the edgemoat placement of affixes (prefix vs. suffix; McCarthy & Prince 1993a), the placement of stress feet (McCarthy & Prince 1993a), iterative footing (McCarthy & Prince 1993a, citing personal communication from Robert Kirchner), directional syllabification (Mester & Padgett 1993) , and triggering of featural spreading processes, including vowel harmony (Kirchner 1993 and much subsequent work; see note 8).

Weighing the array of output candidates provided by *Gen* against the ranked constraint inventory *Con*, the final component of the grammar, *Eval*, will select that output which is optimal. *Eval* is a function which assesses output candidates and orders them according to how well they satisfy the constraint system of the language in question. The actually occurring output form is that candidate which best satisfies the constraint system, where best satisfaction is determined by minimal violation.

To illustrate what is meant by “minimal violation”, I will consider some canonical patterns of constraint violation. Assume a hypothetical *Con*, containing only two constraints, A and B, ranked such that A takes precedence over B ( $A \gg B$ ). For some (hypothetical) input  $/in_k/$ , *Gen* will provide a number of possible outputs, along with the correspondence relation which characterizes the mapping between output and input. Among these outputs will be the actual output associated with  $/in_k/$  (call this Candidate<sub>1</sub>) and at least one competitor (Candidate<sub>2</sub>). There are a number of violation patterns which may be associated with the selection of Candidate<sub>1</sub> as optimal. Perhaps the simplest is that of constraint conflict, illustrated in the constraint tableau in (18). In this and subsequent tableaux, the constraints are arrayed in the top row, with left-to-right order reflecting dominance relations. A solid line separating two constraint columns indicates a fixed ranking between the two constraints in question. (A dotted line is used when no fixed ranking can be established.) Candidate outputs appear in the left-hand column, underneath the input. Constraint violations are marked by “\*”.

(18) Constraint conflict

	/nk/	A	B
a. ☞	Cand <sub>1</sub>		*
b.	Cand <sub>2</sub>	*!	

In this scenario, Cand<sub>1</sub> is optimal (indicated by the “☞”) because its closest competitor violates a constraint (A) which Cand<sub>1</sub> itself does not violate, and that constraint is higher-ranking than the highest-ranked constraint (B) violated by Cand<sub>1</sub>. (The shading here emphasizes the irrelevance of the constraint B to the overall outcome; A is sufficient to rule out Cand<sub>2</sub>. A loser’s cells are shaded after the fatal confrontation; the winner’s, when there are no more competitors.) This is the pattern of violation which establishes that constraints conflict, and must be crucially ranked with respect to one another. Were the reverse ranking (B»A) to hold, Cand<sub>2</sub> would be selected as optimal.

Other patterns of constraint violation are possible, of course. Assuming the same hypothetical language, consider a second input, /inj/. *Gen* admits a set of output candidates, including the two shown in (19).

(19) Constraint tableau, A » B, but no constraint conflict

	/inj/	A	B
a. ☞	Cand <sub>1</sub>		
b.	Cand <sub>2</sub>		*!

Here, the optimal candidate actually violates neither A nor B, while its closest competitor violates B. Either ranking of A and B would result in Cand<sub>1</sub> being optimal; only the evidence of conflict from (18) provides conclusive evidence that the ranking is fixed at A»B. Another pattern of violation in which there is no evidence of ranking is demonstrated in (20), where both candidates violate the highest-ranked constraint, A.

(20) Constraint tableau, A » B; no constraint conflict

	/inj/	A	B
a. ☞	Cand <sub>1</sub>	*	
b.	Cand <sub>2</sub>	*	*!

The violations of A cancel one another out, effectively ruling A irrelevant in determining which of Cand<sub>1</sub> and Cand<sub>2</sub> will be optimal. The selection is therefore given over to the next constraint in

the hierarchy, B. As Cand<sub>2</sub> violates B and Cand<sub>1</sub> does not, Cand<sub>1</sub> is selected as optimal. Here, as before, Cand<sub>1</sub> is selected as optimal because it exhibits minimal violation; its nearest competitor, Cand<sub>2</sub>, violates some constraint which is ranked higher than that constraint uniquely violated by Cand<sub>1</sub>.

As a final example of minimal violation and candidate evaluation, consider the tableau in (21). Here a fourth input, /in<sub>h</sub>/, is assumed, along with the outputs Cand<sub>1</sub> and Cand<sub>2</sub>.

(21) Constraint tableau, A » B; no constraint conflict

	/in <sub>h</sub> /	A	B
a. ☞	Cand <sub>1</sub>	*	
b.	Cand <sub>2</sub>	**!	

As the shading indicates, constraint B is irrelevant in this scenario, as the choice between the candidates is made by higher-ranking A. Both candidates violate A, but the non-optimal Cand<sub>2</sub> incurs more violations than the optimal Cand<sub>1</sub>. One of Cand<sub>2</sub>'s violations of A is cancelled out by the A violation which Cand<sub>1</sub> incurs, but Cand<sub>2</sub> incurs an additional violation of A which is *not* matched by Cand<sub>1</sub>. This extra violation is fatal.<sup>10</sup>

The fundamental components of an Optimality Theoretic grammar, and their interaction, have now been described. There is one important corollary of Optimality Theory on which I will dwell before turning to the analysis of positional privilege effects in phonology; this is the principle of Richness of the Base (Prince & Smolensky 1993: 191). Richness of the Base is the claim that the set of inputs with which a grammar must contend is universal to all languages, and not restricted by language-specific limitations on possible underlying forms. This is because the constraints of *Con* are universal to all languages, and it is the different ranking permutations of these constraints which are the sole source of intra-linguistic variation. Different ranking permutations will converge on (potentially) different surface inventories of grammatical forms, filtering out all illformed patterns. On this view, “the lexicon of a language is a sample from the

<sup>10</sup> This pattern of violation, along with the three which precede it, falls under the purview of Prince & Smolensky's *harmonic ordering of forms*, which is formally defined and explicated in Prince & Smolensky (1993: 68–76).



inventory of possible inputs; all properties of the lexicon arise indirectly from the grammar, which delimits the inventory from which the lexicon is drawn” (Tesar & Smolensky 1996).

Richness of the Base follows from the strict output orientation of OT, but it has important ramifications for the elimination of redundancy in the phonological component of grammar. It has long been noted that phonological generalizations hold not only of morphologically complex forms, but also of underived lexical items. (See, for example, Halle 1959, 1964; Chomsky & Halle 1968; Kiparsky 1973, 1982; Lightner 1973; Shibatani 1973; Skousen 1973; Kaye 1974; Kenstowicz & Kisseberth 1977; Churma 1988; Myers 1991.) However, the characterization of restrictions on morpheme structure in a rule-based theory of phonology raises a variety of problems, as Kenstowicz & Kisseberth (1977) discuss. Among these is the Duplication Problem: if morpheme structure constraints are formally distinct from phonological rules, the grammar necessarily requires two separate mechanisms to account for a single set of phonological generalizations. (See Kenstowicz & Kisseberth 1977, and, for more extensive discussion, Ringen 1975.) OT avoids the Duplication Problem because, as discussed above, apparent restrictions on the structure of the underlying representations arise in the same way as restrictions on the structure of derived surface forms: from the interaction of output well-formedness constraints. This means that both static, morpheme-internal positional restrictions on the distribution of features (such as the requirement that non-initial vowels in Shona verb roots harmonize in height with the initial vowel) and active positional neutralizations (belied by phonological alternations, such as coda devoicing, place assimilation or reduction of unstressed vowels) derive from a single grammar, a single pattern of constraint interaction.

The notion of a universal set of inputs from which all languages must draw raises the question of what underlying forms are assumed by the learner of some specific language. Richness of the Base does not commit us to a universal set of underlying forms; there is a distinction to be made here between possible *input forms* and plausible *underlying representations* for actual lexical items. In general, many different inputs may converge on a particular output form, but only that input which diverges minimally from the output will be

selected by the language learner as the lexical representation.<sup>11</sup> In Optimality Theory, the principle of Lexicon Optimization (Prince & Smolensky 1993, Itô, Mester & Padgett 1995) is proposed as a means of determining the correct underlying representation.

(22) Lexicon Optimization (formulation from Itô, Mester & Padgett 1995)

Of several potential inputs whose outputs all converge on the same phonetic form, choose as the real input the one whose output is the most harmonic.

Given a choice of inputs which yield the same surface result, the language learner will select as the underlying representation that input which most closely resembles the output form.

With the basic tools of Optimality Theory in hand, I will now turn to an illustration of the ways in which the positional privilege effects outlined in §1.1 will be analyzed in such a grammar. For purposes of demonstration, I will concentrate here on coda/onset asymmetries in the occurrence of the feature [voice]. In subsequent chapters, positional privilege effects associated with root-initial syllables, stressed syllables and roots will be examined.

### 1.3 Coda/Onset Asymmetries in Phonology

The best documented, and since Itô's (1986) dissertation, the most extensively investigated, cases of positional privilege in phonology have been those involving syllable onsets. Onsets are the prototypical "strong licensors", to adopt the parlance of prosodic licensing theories of featural distribution (Kingston 1985, 1990; Itô 1986, Goldsmith 1989, Lombardi 1991, Wiltshire 1992); in many languages, they admit a more marked segmental inventory than do non-onset positions. By contrast, coda consonants in such languages exhibit a pervasive pattern of unfaithfulness to underlying structure, frequently undergoing neutralization to some type of default segment, or assimilating to a following onset.

Phonetically, consonants which appear in syllable onset position, preceding a sonorant, are perceptually privileged by virtue of their release (a point originally made, for laryngeal features, in Kingston 1985, 1990). Much of the acoustic information which signals the presence

<sup>11</sup> The degree of abstractness permissible in underlying representation has been extensively debated in the generative phonological literature. Kiparsky's (1968) Alternation Condition represents one well-known approach to abstractness; Kenstowicz & Kisseberth (1977) review the issue in some detail.

of contrastive consonantal features such as laryngeal state and place of articulation is carried in the segmental release burst. In coda position, and in the initial consonants of onset consonant clusters, positions which lack release bursts in many languages, reliable cues to phonological contrast are dramatically reduced.<sup>12</sup> In the positional faithfulness theory of contrast and neutralization (first applied to coda/onset asymmetries by Lombardi 1995a,b, for laryngeal features, and Jun 1995 and Padgett 1995b, for place features), the perceptual prominence of syllable onsets is cashed out in the form of enhanced phonological faithfulness, instantiated by the three aspects of positional privilege outlined in §1.1 above: licensing of contrasts, triggering of phonological processes, and resistance to phonological processes.<sup>13</sup>

Syllable onsets differ from syllable codas in permitting a broader range of phonological features and contrasts to surface. There are, for example, many languages in which the contrast between voiced and voiceless obstruents is instantiated only in onset position, with coda obstruents undergoing neutralization. German is a well-known case of this type; all coda obstruents in German must be voiceless, though onsets may be voiced or voiceless.

(23) German coda neutralization (data from Lombardi 1991)

<u>Voiced in onset</u>		<u>Voiceless in coda</u>	
run.[ <b>d</b> ]e	‘round (pl.)’	run[ <b>t</b> ]	‘round (sg.)’
Run.[ <b>d</b> ]ung	‘rounding, labialization’	Run[ <b>t</b> ].bau	‘rotunda’
lö.[ <b>z</b> ]en	‘to loosen’ lo[ <b>s</b> ].bar	‘solvable’	
Lö.[ <b>z</b> ]ung	‘solution’	Lö[ <b>s</b> ].lich	‘soluble’
We.[ <b>g</b> ]e	‘way (dat.)’	We[ <b>k</b> ]	‘way (nom.)’
We.[ <b>g</b> ]elager	‘highway robber’	We[ <b>k</b> ]bereiter	‘pioneer’

Coda neutralization of this type is robustly attested for laryngeal features (Lombardi 1991), and for consonantal place features as well (Steriade 1982; Prince 1984; Itô 1986, 1989; Goldsmith 1989; Wiltshire 1992; Itô & Mester 1993, 1994; Zec 1995). Languages which exhibit coda

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<sup>12</sup> Some languages are more permissive in their release possibilities, permitting either word-final consonants, or all consonants, to be released. French is one case in which all consonants, including those in coda position, are released (Selkirk 1982).

<sup>13</sup> Early acknowledgments of the importance of release in phonology may be found in McCawley (1967) and Selkirk (1982). More extensive recent work on the phonology of release appears in Steriade (1992, 1993a,b,c). For positional faithfulness analyses in which release is relevant, see Lombardi (1995a,b; 1996a) and Padgett (1995b).

neutralization of place features typically require a coda to be homorganic to the following onset consonant, or to belong to a default place of articulation. One such example is Lardil, which permits only coronal sonorants and nasals which share place of articulation with a following onset (Hale 1973, Itô 1986, Wilkinson 1988).

Onsets, in addition to permitting a broader range of contrasts than do codas, exhibit triggering of and resistance to phonological processes (two sides of a single positional privilege coin). Codas, on the other hand, are affected by phonological processes in many languages. This asymmetry of affectedness is perhaps best demonstrated by cases of voice and place assimilation. While there are many languages such as German which exhibit only coda neutralization of voicing or other laryngeal features, there are many which have both neutralization and assimilation within consonant clusters. For example, Polish displays syllable-final devoicing, and voice assimilation, as well. Underlyingly voiced obstruents must devoice in coda position, unless followed by a voiced obstruent (24a). Similarly, voiceless obstruents are necessarily voiced when followed by a voiced obstruent (24b).

(24) Polish neutralization and assimilation (Lombardi 1991: 57)

a.	z'a[b]a	'frog'	z'a[pk]a	'small frog'
	ró[zg]a	'rod'	ró[βêk]a	'small rod'
	wo[d]a	'water'	wo[tk]a	'vodka'
b.	pro[c']ic'	'request (v.)'	pro[z'b]a	'request (n.)'
	li[ê]yc'	'count'	li[dz'b]a	'numeral'
	wies[βê]yc'	'prophecy'	wie[z'dz'b]a	'prophecy'

Assimilation in these data, and in a host of comparable cases (including Dutch, Catalan, Yiddish, Sanskrit, and Romanian) is regressive, proceeding from onset consonants to the preceding codas.

The prevalence of regressive assimilation in heterosyllabic clusters is not limited to laryngeal features, but extends to place assimilation as well, affecting sonorant-obstruent, obstruent-obstruent and sonorant-sonorant clusters. For example, as we saw in (7) above (repeated in (25) below), nasal consonants in Diola Fongny assimilate in place of articulation to following obstruents and nasals:

(25) Place assimilation in Diola Fogy (Sapir 1965: 16; Itô 1986: 56)

a.	/ni-gam-gam/	∅	niga~gam	‘I judge’
	/pan-ji-maɲj/	∅	paɲjimaɲj	‘you (pl.) will know’
	/ku-bøñ-bøñ/	∅	kubømbøñ	‘they sent’
	/na-ti:~ti:~/	∅	nati:nti:~	‘he cut (it) through’
b.	/na-mi:n-mi:n/	∅	nami:mni:n	‘he cut (with a knife)’
	/ni-ma~ma~/	∅	nimanma~	‘I want’
	/ni~an~an/	∅	nĩ a~an	‘I cried’

Nasal stops frequently undergo place assimilation, particularly to contiguous stop consonants (and less frequently to fricatives and glides; (Padgett 1991, Mohanan 1993, Jun 1995)). Other consonant classes may undergo place assimilation, but none equal the crosslinguistically robust assimilatory behavior of the nasals (Mohanan 1993:72). The inherent susceptibility of nasals to place assimilation may be called upon to explain the onset triggering in (25a), but the data in (25b) make it clear that assimilation is not merely a matter of the nasal taking on the place features of a contiguous consonant. In (25b), where the onset and coda segments are both nasals, either progressive or regressive assimilation should be possible, yet only regressive assimilation occurs. This is true also of obstruent-obstruent clusters which exhibit voice assimilation (Lombardi 1991, 1995a, 1996a,c) (exemplified by the data in (24) above) and place assimilation or gemination (Mohanan 1993). In all of these cases, the features of the onset consonant are maintained, and those of the coda consonant are forfeited, a generalization that is not captured in directional theories which assume leftward spreading rules (or ALIGN-L constraints). Were a simple directionality parameter involved, we would expect find roughly equal numbers of progressive and regressive assimilation processes. However, aside from specialized circumstances such as post-nasal voicing (Itô, Mester & Padgett 1995; Lombardi 1995a, 1996c; Pater 1996), progressive assimilation in consonant clusters is virtually unattested, an asymmetry not explained in directional spreading theories.

While there are attested cases in which assimilation proceeds from non-privileged to privileged position, these cases are comparatively rare, and typically motivated by specific

phonetic considerations.<sup>14</sup> Processes which are triggered exclusively by elements in non-prominent positions (such as voice or place assimilation triggered only by coda consonants, or vowel harmony triggered only by affixes), without an overriding functional motivation, are virtually unattested.<sup>15</sup> In a positional faithfulness analysis, the absence of progressive assimilation processes is explained: assimilation is regressive in heterosyllabic clusters because onset features must be preserved, by virtue of high-ranking IDENT-ONSET(F) constraints. (This point is also made and discussed in Lombardi 1995a, 1996a,c and Padgett 1995b.)

These onset faithfulness constraints, initially proposed by Lombardi (1995a,b) and Padgett (1995b), require that [+release] segments adhere to their input feature specifications.<sup>16</sup> For example, the privileged status of onset voiced obstruents in German and Polish results from the positional constraint in (26).

(26) IDENT-ONSET(voice)

For all segments  $x$ ,  $y$ , where  $x$  Input,  $y$  Output and  $y$  is syllabified in onset position, if  $x \rightarrow y$ , then  $y$  is [voice] iff  $x$  is [voice].

“Onset segments and their input correspondents must agree in voicing.”

A violation of this constraint will be incurred by any onset segment which differs from its input correspondent in voicing; when high-ranking, IDENT-ONSET(voice) places a premium on

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<sup>14</sup> See Lombardi (1996c) for an examination, within positional faithfulness theory, of some circumstances in which progressive assimilation can arise. An additional example is presented in Chapter 4.

<sup>15</sup> One class of counterexamples can be found in regional Romance dialects which exhibit metaphony, a type of vowel harmony in which unstressed final high vowels trigger raising of stressed vowels—a case in which the non-prominent position is always the trigger. There is arguably a functional motivation behind this process, as well, for the final high vowels in question are inflectional affixes in a position which is often subject to lenition and deletion cross-linguistically. By triggering raising of stressed vowels, the features associated with these inflectional categories are rendered more perceptible. (See Kaun 1995 for this general approach to harmony.) Such cases may be analyzed as involving a type of positional maximization similar to that discussed in Chapter 5; see also Cole & Kisseberth (1995c), Zoll (1996a,b; 1997) for recent OT treatments of prominent phonological targets.

<sup>16</sup> In light of the discussion of consonantal release above, a constraint couched solely in terms of onset position is an oversimplification, as not all onset consonants have an equally privileged status. In onset clusters, it is the prenasal consonant which takes priority over other members of the cluster. To be precise, (26) should be formulated to refer to segments which are specified as [+release] in output forms. (For more on the importance of phonetic cues in determining the distribution of phonological contrast, see Kirchner 1996 and works cited therein.)

As the examples I will consider below do not involve complex onset clusters, I will retain the simpler onset formulation here. See Padgett (1995b) for examples of positional faithfulness analyses in which the more specific notion of release is crucial.

faithfulness in onset position. Through domination of constraints which penalize marked structures such as voiced obstruents, IDENT-ONSET(voice) will permit those marked structures to occur in onset position. By contrast, the context-free IDENT(voice) (the constraint which regulates faithfulness in codas), when subordinated to markedness constraints, will result in the elimination of marked structure in coda position. Exactly this pattern of constraint interaction is characteristic of languages such as German, Dutch and Catalan, in which codas and onsets exhibit asymmetries in the distribution of voiced obstruents. In the next section, I will analyze one such case, Catalan, in detail.

### 1.3.1 Case Study: Catalan Coda Neutralization

#### 1.3.1.1 Language Background

Catalan is a Romance language spoken in eastern Spain, the Balearic Islands (including Majorca and Minorca), southeastern France and in Sardinia (Hualde 1992). There is a contrast in the language between voiced and voiceless obstruents; this contrast is neutralized in word-final position, and more generally, in coda position. All obstruents are voiceless before a pause. This is demonstrated in (27) below, where the obstruents appear in onset position in the lefthand column, and in pre-pausal coda position on the right. While the voicing contrast is maintained in onset position, only voiceless obstruents appear in coda position. (Syllable boundaries are marked with “.”, and alternating stops appear in boldface. )

(27) Final devoicing in Catalan<sup>17</sup> (Hualde 1992)

/p/	típ\	'satiated (f.)'	típ	'satiated'
/b/	Oó.ʔ	'wolf (f.)'	Oó <b>p</b>	'wolf (m.)'
/t/	gá.t\	'cat (f.)'	gát	'cat (m.)'
/d/	\.sti.má.ʔ\	'beloved (f.)'	\.sti.má <b>t</b>	'beloved (m.)'
/k/	pø'.k\	'little (f.)'	pø'k	'little (m.)'
/g/	\.mí.©\	'friend (f.)'	\.mí <b>k</b>	'friend (m.)'
/ê/	\.ski.êá	'to splash'	\.skiê	'splash (m.)'
/Ê/	mí.Ê\	'half (f.)'	míê	'half (m.)'
/f/	bu.fá	'to blow'	búf	'puff of air (m.)'
/s/	gós.s\	'dog (f.)'	gós	'dog (m.)'
/z/	fr'n.s'z\	'French (f.)'	fr'n.s's	'French (m.)'
/β/	bá.β\	'low (f.)'	báb	'low (m.)'
/ʔ /	bø'.ʔ \	'mad (f.)'	bø'ê	'mad (m.)'

In addition to the coda neutralization process which is exhibited in the examples of devoicing above, there is a process of voice assimilation which applies in obstruent-obstruent clusters. Underlyingly voiceless obstruents surface as voiced when followed by a voiced obstruent; voiced obstruents devoice preceding a voiceless consonant. This is shown in (28), where surface variants which differ from their underlying counterparts in voicing appear in boldface.

(28) Voicing assimilation in Catalan clusters (Hualde 1992)

	<u>Singleton C</u>		<u>C + Voiceless C</u>		<u>C + Voiced C</u>	
/p/	káp	'no'	káp turó	'no hill'	<b>káb</b> dí\	'no day'
/b/	Oó.ʔ	'wolf (f.)'	Oó <b>pp</b> tít	'small wolf'	Oóbdulén	'bad wolf'
/t/	gát	'cat'	gátr\nkíl	'quiet cat'	<b>gá</b> ddulén	'bad cat'
/k/	pø'k	'little'	pø'ktéms	'little time'	pø' <b>gd</b> ú	'a little hard'
/g/	\.mí.©\	'friend (f.)'	\.mí <b>k</b> p\tít	'little friend'	\.mí <b>g</b> dulén	'bad friend'
/ê/	míê	'half'	míê pá	'half bread'	mí <b>Ê</b> ʔ\	'half day'
/f/	búf	'blow'	búf p\tít	'small blow'	búv ʔiári	'daily blow'
/s/	gós	'dog'	gós p\tít	'little dog'	<b>góz</b> lów	'blue dog'
/z/	gríz\	'gray (f.)'	grís p\tít	'pale gray'	gríz ʔ\ʔ~	'bluish gray'

Positional privilege effects are apparent in three aspects of the Catalan voicing system, highlighted in the data above. First, the contrast between voiced and voiceless obstruents is neutralized in syllable coda position, but not in onset position. Second, in cases of assimilation, it is the consonant in onset position which triggers spreading of laryngeal features. A third indicator of positional privilege, related to the second, is the fact that it is the coda consonants, rather than

<sup>17</sup> In Catalan, voiced stops undergo a lenition process between continuants, and the prepalatal /ʔ / affricates in word-final position. These changes are orthogonal to the voicing alternations in question.



those in onset position, which undergo assimilation. They surface with different voice values than their input correspondents, while those segments in onset position are always faithful.

These three patterns of positional privilege reflect the high-ranking positional faithfulness constraint, IDENT-ONSET(voice), repeated in (29) below.

- (29) IDENT-ONSET(voice)  
 For all segments  $x$ ,  $y$ , where  $x$  = Input,  $y$  = Output and  $y$  is syllabified in onset position, if  $x \rightarrow y$ , then  $y$  is [voice] iff  $x$  is [voice].  
 “Onset segments and their input correspondents must agree in voicing.”

An onset segment which differs from its input correspondent in voicing will violate (29); when high-ranking, IDENT-ONSET(voice) places a premium on faithfulness in onset position.

Merely ranking IDENT-ONSET(voice) near the top of the constraint hierarchy is insufficient to account for the coda/onset asymmetries in Catalan phonology, however. In order for positional voicing effects to be in evidence, featural faithfulness in positions other than the onset (regulated by the context-free IDENT(voice)) must be subordinated to some constraint or constraints which demand alternation. Positional effects thus arise when the ranking schema in (30) holds in the grammar:

- (30) Positional privilege ranking schema, Catalan  
 IDENT-ONSET(voice) » **C** » IDENT(voice)

Here **C** represents some constraint or constraints which regulate the distribution of the feature [voice]. These, through domination of IDENT(voice), will lead to voicing alternations in positions other than the syllable onset.

In Catalan, there are two such constraints which compel voicing alternations. The first is a segmental markedness constraint, \*VDOBSTR, which penalizes the combination of [–sonorant] and [voice]. This constraint reflects the cross-linguistic markedness of voiced obstruents, relative to their voiceless counterparts. \*VDOBSTR, by domination of IDENT(voice), will prevent voiced obstruents from occurring contrastively in coda position. However, because the markedness constraint is dominated by the positional constraint, IDENT-ONSET(voice), obstruents in onset position will be unaffected. Coda neutralization is the end result of this ranking, shown in (31).

- (31) Coda neutralization ranking  
 IDENT-ONSET(voice) » \*VDOBSTR » IDENT(voice)

The second constraint which instantiates **C** in (30) is the assimilation-favoring AGREE(voice) (Lombardi 1996a; see Padgett 1995b for discussion of the related SPREAD(Place)).

- (32) AGREE(voice)  
 Let  $x$  and  $y$  range over contiguous [–sonorant] segments. For all  $x, y$ , if  $x$  is [voice], then  $y$  must be [voice].  
 “Obstruents in a cluster must agree in voicing.”<sup>18</sup>

Via domination of IDENT(voice), AGREE(voice) will compel coda obstruents to be unfaithful to their input values of [voice] if followed by obstruents with which they do not agree in voicing. IDENT-ONSET(voice), being ranked higher than IDENT(voice), will prevent onset consonants from undergoing any alternation.

- (33) Voice assimilation subhierarchy  
 IDENT-ONSET(voice), AGREE(voice) » IDENT(voice)

Voice assimilation, triggered by onset consonants, is the result of the ranking in (33). The combination of this ranking with the coda neutralization subhierarchy of (31) will generate the full complement of positional voicing effects in Catalan, as I shall shortly demonstrate. I will begin with an examination of the distribution of voiced and voiceless obstruents in segmental inventories, both in Catalan and in other languages of the world.

#### 1.3.1.2 The Distribution of Obstruents

Before proceeding with the analysis of Catalan coda neutralization, it is important to understand the ways in which marked elements may be distributed in entire inventories, and the

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<sup>18</sup> This constraint is formulated with reference to clusters in order to prevent [voice] assimilation from occurring between obstruents and sonorants. As Lombardi (1995a) notes, voice assimilation between obstruents appears to be restricted to clusters; voice assimilation never crosses intervening vowels, suggesting that the spreading imperative is local. Obstruent-sonorant voicing interactions tend to arise only between words (as in Sanskrit; Lombardi 1991) or in highly specific circumstances, such as postnasal voicing (Itô, Mester & Padgett 1995, Pater 1996), where the phonetic motivation for assimilation is similarly specialized. The constraints and constraint interactions which generate such assimilations are likely to differ from those which result in assimilation in obstruent clusters. While the formulation in (32) would benefit from further refinement, it will be sufficient for my purposes. See Itô, Mester and Padgett (1995), Lombardi (1995a, 1996a) and Pater (1996) for discussion of voicing interactions among segments of different major classes.

ways in which constraint interaction will derive these patterns. Cross-linguistic surveys such as Maddieson (1984) have shown that voiced obstruents are less common than voiceless obstruents. Languages which include voiced obstruents in the inventory invariably also have a series of plain or aspirated voiceless obstruents, but the reverse is not true. Voiced obstruents imply voiceless ones, but a language may contain only voiceless obstruents without being ill-formed.

In an OT grammar, this type of implicational markedness relationship among segments can be reflected directly, by means of constraints and constraint ranking. For example, Prince & Smolensky (1993) argue that the phenomenon of coronal unmarkedness (Paradis & Prunet 1988, 1989, 1991; McCarthy & Taub 1992; Kaun 1993; Smolensky 1993; McCarthy 1994, *inter alios*) reflects a universally fixed ranking of place markedness constraints, as in (34).

- (34) Place markedness subhierarchy  
\*DORSAL \*LABIAL » \*CORONAL

Under such a ranking, coronal consonants will be favored over both velars and labials because the markedness constraint which is violated by a coronal is lowest in the hierarchy. In circumstances such as epenthesis, in which faithfulness to underlying feature specification is irrelevant, coronal consonants will be selected as optimal, as shown in (35). In this grammar, the syllable structure constraint  $O_{\text{NSET}}$  dominates the anti-epenthesis constraint  $D_{\text{EP}}$ , requiring a consonant to be inserted in the onset of a vowel-initial syllable. The relative ranking of the place markedness constraints ensures that it is a coronal consonant which will be epenthesized, as in (35c).<sup>19</sup>

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<sup>19</sup> Lombardi (1997) gives a recent analysis of consonantal epenthesis and place markedness in OT.

(35) Coronals are least marked

	/a/	ONSET	*DORSAL	*LABIAL	*CORONAL	DEP
a.	ka		*!			*
b.	pa			*!		*
c.	ta				*	*
d.	a	*!				

In this theory, segments which are more marked in the classical Praguean sense are literally more marked in the grammar (Smolensky 1993), as they incur violations of higher-ranking constraints than do less marked elements (or more violations of the same constraints).

The fixed ranking schema is one means by which featural or segmental markedness relationships are encoded in an OT grammar. However, the relative markedness of voiced and voiceless obstruents is arguably captured in a different manner, due to the nature of the feature in question, [voice]. If [voice] is a privative, rather than equipollent, feature (as suggested by Mester & Itô 1989 and Cho 1990 and argued extensively by Lombardi 1991), there can be no markedness constraint which penalizes voiceless obstruents. Not surprisingly, it is impossible to formulate constraints which make direct reference to the markedness of voiceless obstruents if there is no [-voice] specification to penalize. Under the privative [voice] hypothesis, the only markedness constraint which can regulate voicing in obstruents is \*V<sub>D</sub>O<sub>BSTR</sub> :

(36) \*V<sub>D</sub>O<sub>BSTR</sub><sup>20</sup>  
\*[-son, voice]

Given such a constraint, voiced obstruents will always be more marked, formally, than voiceless obstruents; only the voiced obstruents can violate a markedness constraint which regulates the distribution of [voice].

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<sup>20</sup> Recent analyses which retain equipollent [voice] include Rubach (1990,1996), Rubach & Booij (1990), and Lombardi (1996b), who argues that binarity is necessary in the postlexical phonology. Should binary voicing prove to be necessary, the implicational relationship between voiced and voiceless obstruents could be encoded in the grammar by means of a fixed ranking of markedness constraints parallel to the place hierarchy in (34): \*[-son, +voice] » \*[-son, -voice]. I will assume privative [voice] throughout the subsequent discussion, but the analysis of Catalan which appears below will not be adversely affected if equipollent [voice] is adopted.

It is the relationship of markedness constraints to faithfulness constraints which will ultimately determine the character of a language's phonological inventory. The relevant faithfulness constraint here is that which regulates the mapping between input [voice] and output [voice]. Faithfulness constraints reflect the intuition that phonological alternations are costly, occurring only under duress (that is, under compulsion by a higher-ranking constraint). (Derivational generative phonology captures the same intuition by means of the convention on rule formulation and application: anything which is not explicitly mentioned in a phonological rule remains unchanged by the application of that rule. Faithfulness is the norm, rather than the exception.)

- (37) IDENT(voice)  
 For all segments  $x$ ,  $y$ , where  $x$  Input and  $y$  Output, if  $x \leftarrow y$ , then  $y$  is [voice] iff  $x$  is [voice].  
 "Correspondent segments must agree in voicing."

This constraint will be violated by any deviation from the input specification, whether the deviation involves the addition or subtraction of a [voice] specification. Complete identity of specification between input and output is the only configuration which will satisfy (37).<sup>21</sup> The grammar also contains IDENT-ONSET(voice), a positional faithfulness constraint which regulates the occurrence of [voice] :

- (38) IDENT-ONSET(voice)  
 For all segments  $x$ ,  $y$ , where  $x$  Input,  $y$  Output and  $y$  is syllabified in onset position, if  $x \rightarrow y$ , then  $y$  is [voice] iff  $x$  is [voice].  
 "Onset segments and their input correspondents must agree in voicing."

This more specific faithfulness constraint is violated only if a segment in onset position differs in voicing from its input correspondent; featural divergences in coda consonants do not incur violations of (38).

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<sup>21</sup> Compare this symmetrical IDENT formulation with the PARSE/FILL featural faithfulness of Kirchner (1993) and Prince & Smolensky (1993), and the correspondence-based MAX/DEP model of featural faithfulness mentioned in McCarthy & Prince (1995) and explored in numerous subsequent works. See also the alternative, asymmetrical formulations of segmentally mediated featural faithfulness constraints proposed in Orgun (1995) and Pater (1996).

To demonstrate how the interaction of markedness and faithfulness constraints will generate various obstruent inventories, including that of Catalan, I will work through each of the logically possible ranking interactions of (36), (37), and (38). There are six ranking permutations in all; they are listed in (39).

- (39) Possible permutations of IDENT(voice), IDENT-ONSET(voice) and \*VDOBSTR
- a. \*VDOBSTR » IDENT-ONSET(voice) » IDENT(voice)
  - b. \*VDOBSTR » IDENT(voice) » IDENT-ONSET(voice)
  - c. IDENT-ONSET(voice) » IDENT(voice) » \*VDOBSTR
  - d. IDENT(voice) » IDENT-ONSET(voice) » \*VDOBSTR
  - e. IDENT(voice) \*VDOBSTR » IDENT-ONSET(voice)
  - f. IDENT-ONSET(voice) » \*VDOBSTR » IDENT(voice)

Though there are six permutations of the three constraints under consideration, they yield only three distinct patterns of contrastive voicing in obstruents: a complete absence of voiced obstruents in any position (39a,b), completely free distribution of voiced obstruents in all positions (39c,d,e), and voiced obstruents only in onset position (39f).

Consider first a language which does not permit voiced obstruents to occur at all, regardless of syllabic position. Hawaiian is such a case; the only obstruents in the Hawaiian inventory are voiceless. This gap reflects a grammar in which voice markedness constraints are given top priority; marked structure is avoided at all costs.<sup>22</sup> The combination of [voice, –son] is simply not permitted to appear in surface forms of Hawaiian, regardless of how the segments may be specified underlyingly. It is impossible to be faithful to [voice] in the context of a [–sonorant] segment, no matter where in the syllable it occurs. Such a prohibition on marked structure reflects a constraint ranking in which all relevant faithfulness constraints are dominated by the pertinent markedness constraints. One such ranking is that of (39a): \*VDOBSTR » IDENT-ONSET(voice) » IDENT(voice). Under this ranking, input voiceless obstruents are rendered faithfully in the output, as in (40).

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<sup>22</sup> Marked structure in the dimension of obstruent voicing, that is. There are many dimensions of phonological markedness, and these dimensions may be assessed independently of one another. The avoidance of markedness in one dimension does not imply that marked structure of all sorts must be similarly penalized.

(40) Voiceless obstruents are faithful

	/ka/	*V <sub>D</sub> O <sub>B</sub> STR	IDENT-ONSET(voice)	IDENT(voice)
a.	ka			
b.	ga	*!	*	*

In the case of a voiceless input consonant, unfaithfulness serves no purpose, as it results in more marked structure which is garnered without motivation. By comparison, the fully faithful (40b) incurs neither markedness nor faithfulness violations.

By contrast, if the input contains a voiced obstruent, this grammar will not only permit, but in fact require, unfaithfulness. This is true even if the voiced obstruent in question is syllabified in onset position, as shown in (41).

(41) No voiced obstruents in inventory

	/ga/	*V <sub>D</sub> O <sub>B</sub> STR	IDENT-ONSET(voice)	IDENT(voice)
a.	ga	*!		
b.	ka		*	*

The top-ranked markedness constraint \*V<sub>D</sub>O<sub>B</sub>STR compels unfaithfulness in voicing—under this constraint ranking it is impossible to arrive at a surface inventory which includes voiced obstruents.<sup>23</sup> Language learners will not posit underlying voiced obstruents, as the grammar will never allow them to surface. This is Prince & Smolensky’s (1993) principle of Lexicon Optimization, discussed in §1.2: in the absence of paradigmatic alternations, if two (or more) inputs converge on the same output form, the underlying form selected by the learner will be that with the most harmonic mapping from input to output. This is shown in the “tableau des tableaux” in (42).

(42) Evaluating outputs of possible input forms

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<sup>23</sup> Outcomes other than (41b) are possible, depending upon the relative ranking of other faithfulness constraints. For example, if IDENT(sonorant) and IDENT(nasal) are ranked below IDENT(voice), the optimal output would contain a voiced nasal sonorant, rather than a voiceless obstruent. The crucial point remains: the ranking of markedness over some relevant faithfulness constraint or constraints results in the omission of marked structure from the surface inventory.

Input	Output	*V <sub>D</sub> OBSTR	IDENT-ONSET(voice)	IDENT(voice)
a. /ka/	ka			
b. /ga/	ka		*!	*

Full faithfulness is maintained when input (42a) is selected as the underlying form. By contrast, if (42b) is chosen, a less harmonic input-output mapping is required, with violations of both IDENT-ONSET(voice) and IDENT(voice). Input (42a) is therefore the preferred underlying form.

Exactly the same result, a prohibition on voiced obstruents, obtains from the constraint ranking in (39b): \*V<sub>D</sub>OBSTR » IDENT(voice) » IDENT-ONSET(voice). Whenever a markedness constraint dominates all relevant faithfulness constraints, the contrastive occurrence of marked structure is prohibited; the relative ranking of the positional and context-free constraints is utterly irrelevant in this circumstance.<sup>24</sup>

(43) No voiced obstruents in inventory

	/ga/	*V <sub>D</sub> OBSTR	IDENT(voice)	IDENT-ONSET(voice)
a.	ga	*!		
b.	ka		*	*

Just as in (41), voiced obstruents are prevented from surfacing by the ranking of markedness over faithfulness constraints.

From the languages in which a complete prohibition on marked structure is enforced, I turn to the opposite type of language, one in which marked structure is freely distributed. English is one example of a language which permits a contrast between voiced and voiceless obstruents in both onset and coda position.<sup>25</sup> Unrestricted, contrastive distribution of marked structure implicates a grammar in which faithfulness constraints are of paramount importance. Retention of input specifications takes precedence, under such a ranking, over considerations of markedness.

<sup>24</sup> However, under pressure from a higher-ranking constraint, allophonic distributions of marked structure can be forced. For example, if a constraint requiring intervocalic voicing were to dominate \*V<sub>D</sub>OBSTR in either (39a) or (39b), voiced obstruents would occur predictably between vowels.

<sup>25</sup> English does exhibit restrictions on voicing within onset and coda clusters; one well-known case is the required voicing assimilation in plural, past tense and third person singular present endings. There is an extensive literature addressing this assimilation; relevant works include Harms (1973), Greenberg (1978), Mester & Itô (1989), Cho (1990) and Lombardi (1991, 1996b). This restriction on voicing in tautosyllabic clusters does not vitiate the contrastive status of voicing in English obstruents in general.




There are three ranking permutations which yield free contrastive distribution of [voice]; they are (39c,d,e), repeated in (44a,b,c) below.

- (44) Free occurrence of [voice] on obstruents  
 a. IDENT-ONSET(voice) » IDENT(voice) » \*V<sub>D</sub>OBSTR  
 b. IDENT(voice) » IDENT-ONSET(voice) » \*V<sub>D</sub>OBSTR  
 c. IDENT(voice) \*V<sub>D</sub>OBSTR » IDENT-ONSET(voice)

Because the context-free constraint IDENT(voice) dominates \*V<sub>D</sub>OBSTR in all three rankings, faithfulness to input voicing must be respected in every syllabic position—even though greater segmental markedness will result. Here, as in the Hawaiian case above, the relative ranking of IDENT(voice) and IDENT-ONSET(voice) will have no impact on the possible outcomes of the grammar.


Consider first the ranking in (44a). As shown in (45) and (46), this constraint hierarchy will require full faithfulness in voicing for all obstruents.

- (45) Voiceless obstruents in inventory

	/kot/	IDENT-ONSET(voice)	IDENT(voice)	*V <sub>D</sub> OBSTR
a. 	kot			
b.	got	*!	*	*
c.	god	*!	**	**

Here, as before, voicing of underlyingly voiceless obstruents serves no purpose; marked structure is gratuitously generated in (45b,c) at the expense of higher-ranking faithfulness constraints. The fully faithful (45a) is optimal. Full faithfulness is also optimal in the case of an input containing voiced obstruents, as in (46).

- (46) Voiced obstruents occur freely

	/god/	IDENT-ONSET(voice)	IDENT(voice)	*V <sub>D</sub> OBSTR
a.	kot	*!	*	
b.	got		*!	*
c.	kod	*!	*	*
d. 	god			**

In this case, fidelity is required by the grammar. No devoicing is possible in any position, for, although such devoicing yields better satisfaction of \*V<sub>D</sub>OBSTR, that constraint is dominated by

both [voice] faithfulness constraints. Violation of these higher-ranking constraints, as in (46a,b,c), is fatal. All else being equal, input voicing specifications must always be preserved in this grammar.

The same state of affairs holds for both of the remaining ranking permutations shown in (44).

(47) Contrastive voiced obstruents;  $I_D(\text{voice}) \gg I_{D-\text{ONSET}}(\text{voice}) \gg *V_{D\text{OBSTR}}$

	/god/	$I_{\text{IDENT}}(\text{voice})$	$I_{\text{IDENT-ONSET}}(\text{voice})$	$*V_{D\text{OBSTR}}$
a.	kot	*!	*	
b.	got	*!		*
c.	kod	*!	*	*
d. ☞	god			**

(48) Contrastive voiced obstruents;  $I_D(\text{voice}) *V_{D\text{OBSTR}} \gg I_{D-\text{ONSET}}(\text{voice})$

	/god/	$I_{\text{IDENT}}(\text{voice})$	$*V_{D\text{OBSTR}}$	$I_{\text{IDENT-ONSET}}(\text{voice})$
a.	kot	*!		*
b.	got	*!	*	
c.	kod	*!	*	*
d. ☞	god		**	

Under each of these rankings, faithfulness to input voicing is of paramount importance; syllabic affiliation is irrelevant. Voiced obstruents are therefore contrastive in both onset and coda position. This result obtains, as a comparison of (46), (47) and (48) demonstrates, regardless of the relative ranking of  $I_{\text{IDENT}}(\text{voice})$  and  $I_{\text{IDENT-ONSET}}(\text{voice})$ . All that is necessary is that the context-free constraint dominate  $*V_{D\text{OBSTR}}$ ; this will ensure that contrastive voiced obstruents are freely permitted.

This class of cases, and the preceding permutations which yield the complete absence of voiced obstruents, demonstrate that, while the addition of a positional faithfulness constraint does increase the number of possible ranking permutations (in this case, from two (2!) to six (3!)), the set of optimal outcomes is not correspondingly increased. The five ranking permutations in (39a-e) yield only two distinct outcomes: a complete absence of contrastive voiced obstruents, or free occurrence of voiced obstruents. All of the rankings in which the general  $I_{\text{IDENT}}(\text{voice})$  dominates the specific  $I_{\text{IDENT-ONSET}}(\text{voice})$  converge on optimal output

candidates which can be generated by a different, specific » general ranking. Given this non-distinctness of results, there is no reason to assume free ranking of positional and context-free constraints; further, if the ranking is fixed in Universal Grammar as in (49), the problem of learning constraint rankings in the acquisition process will be considerably simplified.

(49) IDENT-POSITION(F) » IDENT(F)

As a working hypothesis, I will henceforth assume that this specific » general ranking schema is held constant in UG; further investigation may, of course, reveal a need for free rerankability of positional and context-free constraints.<sup>26</sup>

Only one additional permutation of the three constraints now remains to be examined, namely the permutation in which the markedness constraint \*V<sub>D</sub>OBSTR intervenes between the two faithfulness constraints, as in (39f), repeated in (50).

(50) Positional neutralization ranking  
IDENT-ONSET(voice) » \*V<sub>D</sub>OBSTR » IDENT(voice)

Under this ranking, the distribution of [voice] on obstruents is free only in the syllable onset. Outside of the privileged onset position, the more marked voiced obstruents are disfavored; instead, voiceless obstruents are preferred. This is a canonical pattern of positional neutralization, instantiated by coda devoicing in Catalan; the ranking in (50) generates this pattern without incident.

In Catalan, both voiceless and voiced obstruents are permitted to occur in onset position without alteration of their input specifications. This is demonstrated in tableaux (51) and (52) below.

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<sup>26</sup> Lombardi (1996a) argues that the facts of voice assimilation in Swedish require such a ranking reversal, and suggests that (49) is the default ranking in UG, but may be subject to reranking.

(51) Contrastive voiceless obstruents in onset

/gos-a/ 'dog (f.)'	IDENT-ONSET(voice)	*VDOBSTR	IDENT(voice)
a. gó.z\	*!	**	*
b. gó.s\		*	

Voicing of the underlying /s/, as in (51a), serves no purpose. No high-ranking constraint compels the change from voiceless to voiced, and the resulting violation of IDENT-ONSET(voice) is fatal. The fully faithful (51b) is optimal. Parallel results obtain in the case of an input voiced obstruent, as in (52).

(52) Contrastive voiced obstruents in onset

/griz-a/ 'gray (f.)'	IDENT-ONSET(voice)	*VDOBSTR	IDENT(voice)
a. grí.z\		**	
b. grí.s\	*!	*	*

Here, when the normal syllabification algorithm of the language yields onset syllabification of the underlying voiced obstruent, fidelity to input voicing is essential.<sup>27</sup> The preceding tableaux show that, in onset position, the distribution of [voice] on obstruents is identical to that of English—reasonably so, as the ranking which determines onset distribution in Catalan is entirely parallel to that of English: faithfulness » markedness. The difference between the two cases lies in the ranking of the context-free constraint IDENT(voice). Because it is dominated in the Catalan grammar by \*VDOBSTR, a crucial difference emerges: voiced obstruents are not contrastive outside of the onset in Catalan.

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<sup>27</sup> Catalan obeys the Onset First Principle of Clements & Keyser (1983) (also known as the CV-rule or the Maximal Onset principle; see Kahn 1976, Steriade 1982, Itô 1986 and Blevins 1995) favoring onset (rather than coda) syllabification of a single intervocalic consonant. In OT terms, this result is accomplished by the constraints ONSET and NOCODA, which prohibit coda syllabification of such consonants. (See Prince & Smolensky 1993, Ch. 6 for extensive discussion and motivation of these constraints.) Both constraints must dominate \*VDOBSTR in order to prevent [grí.s\] from being selected as optimal. This specific case seems to reflect a more general tendency, namely that violation of constraints which affect syllabification and higher-level prosodic structure is not often compelled by strictly featural constraints such as \*VDOBSTR. Prosodic reorganization (such as a deviation from the default syllabification scheme) is not typically motivated by the spectre of featural markedness or faithfulness violations, suggesting that constraints on prosodic structure such as NOCODA and ONSET (usually) dominate constraints on subsegmental organization. Thanks to Rolf Noyer and John McCarthy for raising and discussing this issue with me.

(53) Obstruents in coda position must neutralize

/griz/ 'gray (m.)'	IDENT-ONSET(voice)	*VDOBSTR	IDENT(voice)
a. gríz		**!	
b. grís		*	*

In this case, highest-ranking IDENT-ONSET(voice) is simply not relevant, as the obstruent in question is syllabified in coda position. Both candidates satisfy IDENT-ONSET(voice), pushing the decision down to the markedness constraint, \*VDOBSTR. It is here that (53a) is fatally eliminated; the candidate which contains two voiced obstruents is more marked than the devoicing candidate. Without the protection of IDENT-ONSET(voice), the coda obstruent must devoice, as in the optimal (53b).<sup>28</sup> Obstruents which are voiceless in the input, of course, remain voiceless in coda position.

As the preceding examples have shown, the positional constraint IDENT-ONSET(voice) accounts, via constraint interaction, for the syllabification-based laryngeal neutralization pattern of Catalan (and numerous other languages which exhibit the same effects). The ranking of IDENT-ONSET(voice) over \*VDOBSTR results in the presence of contrastive [voice] on obstruents in syllable onset position. Conversely, the dominance of \*VDOBSTR over IDENT(voice) prevents the occurrence of voiced obstruents outside of the onset position; the less marked voiceless obstruents are favored. The resulting pattern is a canonical case of positional neutralization: marked phonological elements are permitted if and only if they appear in a favored position, the syllable onset. While the specific case at hand is one of coda

<sup>28</sup> Here, as in (52) above, there is an alternative candidate which is not considered, namely one in which a vowel is epenthesized in final position in order to yield onset syllabification of the root-final obstruent, and to preserve the input voicing of that obstruent: [grí.z]. Such a candidate can never be the optimal form for the masculine form, indicating that one or more of the constraints violated by the epenthesis candidate must dominate \*VDOBSTR. Minimally, the epenthesis candidate violates DEP; this constraint is consequently ranked above \*VDOBSTR in (i) below. Under this ranking, coda syllabification of the root-final consonant, and devoicing of that obstruent, will be optimal.

(i) Root-final obstruents are not “rescued” by epenthesis

/griz/ 'gray (m.)'	DEP	ID-ONSET(voice)	*VDOBSTR	ID(voice)
a. gríz			**!	
b. grís			*	*
c. grí.z	*!		**	

neutralization, the same general ranking schema produces parallel results for other prominent positions such as root-initial syllables and stressed syllables, as subsequent chapters will show.

### 1.3.1.3 Voicing in Obstruent Clusters

Coda devoicing is not the only phenomenon in Catalan which exhibits evidence for the privileged status of syllable onsets. In heterosyllabic obstruent clusters, there is a process of voicing assimilation which renders coda consonants identical in laryngeal specification to the following onset consonant. Illustrative data are repeated in (54); it is important to note that the process applies to both voiced and voiceless obstruents. Crucially, it affects only those obstruents which appear in coda position; onset segments are not altered. Interestingly, when a voiced coda consonant is followed by a voiced onset, both consonants retain their voicing in the output form—coda voicing is faithfully preserved in just this circumstance.

(54) Voicing assimilation in Catalan clusters

	<u>Singleton C</u>		<u>C + Voiceless C</u>		<u>C + Voiced C</u>	
/p/	káp	‘no’	káp turó	‘no hill’	ká <b>b</b> dí\	‘no day’
/b/	Óóʔ	‘wolf (f.)’	Óó <b>pp</b> \tít	‘small wolf’	Óóbdulén	‘bad wolf’
/t/	gát	‘cat’	gá <b>tt</b> r\nkíl	‘quiet cat’	gá <b>dd</b> ulén	‘bad cat’
/k/	pø'k	‘little’	pø'ktéms	‘little time’	pø' <b>gd</b> ú	‘a little hard’
/g/	\mí©\	‘friend (f.)’	\mí <b>k</b> p\tít	‘little friend’	\míg dulén	‘bad friend’
/ê/	mîê	‘half’	mîê pá	‘half bread’	mî <b>É</b> ?Á\	‘half day’
/f/	búf	‘blow’	búf p\tít	‘small blow’	bú <b>v</b> ?iári	‘daily blow’
/s/	gós	‘dog’	gós p\tít	‘little dog’	gó <b>z</b> l'áw	‘blue dog’
/z/	gríz\	‘gray (f.)’	grís p\tít	‘pale gray’	gríz \l'É~	‘bluish gray’

In all of the above clusters, the coda consonant takes on the voicing of the following onset, regardless of whether that onset is voiced or voiceless. In the case of a voiceless-voiced input sequence, the assimilation process is actually adding marked structure, and adding it in the non-privileged coda position. Without the involvement of AGREE(voice) (32), ranked above \*VDOBSTR, spreading of [voice] cannot be optimal, as shown in (55). (“●\*” marks an incorrect optimal candidate, one which is not an actual output form.)



Both strategies are employed in Catalan voice assimilation, but it is  $\text{IDENT-ONSET}(\text{voice})$  which determines which of the two will apply in a particular instance.  $\text{IDENT-ONSET}(\text{voice})$  requires faithfulness to input voicing in onset position, as we have already seen. In cluster situations, where agreement in voicing is also required, high-ranking  $\text{IDENT-ONSET}$  still favors faithfulness to the onset's voicing specification. The full hierarchy is given in (59). ( $\text{IDENT-ONSET}(\text{voice})$  and  $\text{AGREE}(\text{voice})$  are never violated by an optimal candidate, as we will see, and therefore cannot be ranked with respect to one another.)

(59) Onset privilege ranking, Catalan

$\text{IDENT-ONSET}(\text{voice}), \text{AGREE}(\text{voice}) \gg *V_{\text{D}}\text{OBSTR} \gg \text{IDENT}(\text{voice})$

The end result is regressive assimilation, triggered by the obstruent in onset position, regardless of whether that obstruent is voiceless or voiced.

Let us consider the effects of the hierarchy in (59) in some detail, beginning with a disharmonic voiced-voiceless input sequence. One such example appears in the tableau in (60) below.

(60) Voiced-voiceless input sequence; voiceless cluster is optimal

/griz p\ʔit/ 'pale gray'	$\text{AGREE}(\text{voice})$	$\text{ID-ONSET}(\text{voice})$	$*V_{\text{D}}\text{OBSTR}$	$\text{ID}(\text{voice})$
a. gríz p\ʔit	*!		**	
b. grís p\ʔit			*	*
c. gríz ʔit		*!	***	*

Because  $\text{AGREE}(\text{voice})$  is high-ranking, the optimal output must contain a consonant cluster which is uniformly voiced or voiceless; complete faithfulness to the input, as in (60a), is impossible. The voiceless cluster in (60b) is optimal because  $*V_{\text{D}}\text{OBSTR} \gg \text{IDENT}(\text{voice})$ , and because the input /z/ is not protected by  $\text{IDENT-ONSET}(\text{voice})$ . The alternative, (60c), does satisfy  $\text{AGREE}(\text{voice})$ , but does so at the expense of  $\text{IDENT-ONSET}(\text{voice})$ . The interaction of



AGREE(voice) and IDENT-ONSET(voice) with the remaining constraints thus converges on the candidate in which the coda consonant is devoiced.<sup>30</sup>

The next combination of interest is that of a voiced-voiced input sequence. Clusters of this type are permitted by the grammar to surface intact, again due to the effects of IDENT-ONSET and AGREE. This is shown in (61).

(61) Voiced-voiced input sequence; voiced cluster is optimal

/Ōob dulen/ ‘bad wolf’	AGREE(voice)	IDENT-ONSET(voice)	*VDOBSTR	ID(voice)
a. Ōóp dulén	*!		*	*
b. Ōób dulén			**	
c. Ōóp tulén		*!		**

Full faithfulness is compulsory, given this input; voicing must be retained on both the coda and the onset consonant in the cluster. It is not necessary to assume that a single [voice] specification is shared by both voiced consonants in (61b); merely that both consonants in the cluster agree, and that the onset consonant determines the laryngeal state of the entire cluster.

Finally, consider the outcome of the grammar in the event of a disharmonic voiceless-voiced consonant sequence, as in (62).

(62) Voiceless-voiced input sequence; voiced cluster is optimal

/gos blaw/ ‘blue dog’	AGREE(voice)	IDENT-ONSET(voice)	*VDOBSTR	ID(voice)
a. gós ʎáw	*!		**	
b. góz ʎáw			***	*
c. gós pláw		*!	*	*

Because AGREE(voice) is dominant over IDENT(voice), the fully faithful (62a) is doomed in this grammar. Assimilation must occur; the only question is in which direction it will proceed.

Markedness considerations alone would favor (62c), in which the cluster is composed of only voiceless obstruents, yet this candidate is not the actual output. High-ranking IDENT-ONSET(voice) ensures that assimilation is regressive, as in (62b); the voicing specification of the

<sup>30</sup> The neutralization of the coda consonant before a voiceless onset gives the effect of regressive spreading of [-voice], without actually requiring a [-voice] specification to be present. This is exactly the result obtained in Mester & Itô (1989), Cho (1990), Lombardi (1991) and subsequent works which combine privative [voice] with either positional licensing or positional faithfulness. See §1.3.2 below for further discussion.

onset obstruent must be identical to that of its input correspondent. The result is a voiced obstruent in non-privileged coda position, seemingly in conflict with the generalization that devoicing is required in the non-privileged coda position. Yet it is precisely the non-privileged status of the coda, reflected in lowest-ranked IDENT(voice), which yields this result, as well as the other coda/onset asymmetries attested in Catalan clusters.

In consonant clusters, [voice] specifications must agree, even at the expense of faithfulness to the input, because AGREE(voice) dominates IDENT(voice). There are three different means of achieving this required agreement when the input contains a voiced obstruent:

(63) Mechanisms by which AGREE(voice) is satisfied, Catalan obstruent clusters

Input C <sub>1</sub> C <sub>2</sub>	Output C <sub>1</sub> C <sub>2</sub>	Change	Violation
Vd, Vls	Both Vls	Deletion of [voice] from C <sub>1</sub>	IDENT(voice)
Vd, Vd	Both Vd	Full faithfulness to input	—
Vls, Vd	Both Vd	Regressive spread of [voice] from C <sub>2</sub>	IDENT(voice)

In the event that unfaithfulness is required to satisfy AGREE(voice), it is always the coda obstruent, rather than the onset, which is unfaithful. This is because IDENT-ONSET(voice) » IDENT(voice); under this ranking, coda consonants will always be more susceptible to alternation (all else being equal). Crucially, the positional faithfulness analysis does not specify that voiced obstruents in coda position are impossible; it simply says that onsets are held to higher standards of faithfulness than are codas. When voicing is required by some high-ranking constraint such as AGREE(voice), codas are free to be voiced. What is not possible in this analysis is the displacement of the onset's features. This is an important point of departure from previous, licensing-based analyses of the coda/onset asymmetry, a point I will discuss in the next section.

### 1.3.2 Previous Analyses: Positional Licensing

In the literature, the prevailing alternative to the positional faithfulness analysis of coda/onset asymmetries is that of positional *licensing* (Itô 1986, 1989; Goldsmith 1989, 1990; Lombardi 1991; Wiltshire 1992; Bosch & Wiltshire 1992; Itô & Mester 1993, 1994, 1997; Flemming 1993; Steriade 1995; Zoll 1996a,b, 1997). The positional licensing approach

assumes that all phonological features must be licensed by virtue of association to some prosodic position which is a legitimate licenser. In the case of onset/coda asymmetries, the onset is the position of licensing; marked feature specifications are prohibited or severely restricted in coda position.

There are two basic implementations of positional licensing theory. The first, proposed in Itô (1986, 1989), is a negative constraint which prohibits some marked feature specification or specifications from appearing in the coda. This is the Coda Condition shown in (64), where the proscribed feature is [voice].

(64) Coda Condition (CODACOND)

In Itô's (1986, 1989) application of the Coda Condition, a feature which is linked to both coda and onset is exempt from the constraint, by virtue of Hayes' (1986b) Linking Condition. Under the Linking Condition, association lines in the structural description of a rule or constraint must be interpreted as exhaustive. Thus, if the Coda Condition is formulated with a single association line, as in (64), structures in which the prohibited feature is multiply linked will not constitute a violation; only a [voice] specification which is exhaustively linked to a coda consonant will incur a violation of the Coda Condition. A [voice] specification which is shared between a coda and the following onset does not constitute a fatal violation of the Coda Condition, on this interpretation.

A more recent OT interpretation of the Coda Condition appears in Itô & Mester (1997), where it is proposed that CODACOND is actually the conjunction of two primitive constraints, NOCODA and \*VD0BSTR. (See Smolensky 1995 for development of the formal mechanism of constraint conjunction.) The resulting conjoined constraint, a separate entity ranked above both component constraints, is violated only if the two component constraints are both violated by some candidate. This approach derives the Linking Condition effect, exempting multiply-linked features from violation, by formulating NOCODA as a feature-to-syllable left-alignment constraint, where the onset affiliation of the multiply-linked place or laryngeal

specification satisfies a requirement for alignment of consonantal features at the left edge of a syllable (Itô & Mester 1994).<sup>31</sup>

An alternative to the negative formulation of CODACOND can be found in the positive licensing constraint of Lombardi (1991).<sup>32</sup> Rather than prohibiting the combination of coda and [voice], Lombardi's Voice Constraint requires that any [voice] feature which is present be licensed by association to a pre-sonorant onset consonant, as in (65):

(65) Licensing configuration for [voice]

Only [voice] specifications which appear in this configuration will be successfully licensed. Crucially, a [voice] specification which is multiply-linked between a coda and the following onset, as in (66), is licensed; the [voice] feature in question is linked to an onset consonant which precedes a tautosyllabic sonorant, and is therefore *parasitically* licensed (Lombardi 1991:43).

(66) Multiple linking satisfies licensing requirement

In this approach, a feature need only be licensed, through association, by *some* element in the prosodic structure; the feature need not be licensed by *every* segment to which it is associated. Association to an onset is sufficient to license a [voice] specification which is shared with a preceding coda, though the coda itself cannot independently license [voice].

Abstracting away from the various formal differences between the negative licensing formulation of CODACOND and the positive statement of the Voice Constraint, the core notion in both approaches is the same: certain marked features, such as [voice], are not permitted to

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<sup>31</sup> NOCODA is satisfied by features shared between a coda and a following onset because alignment need not be *crisp*, according to Itô & Mester (1994). The affiliation of the features to an onset consonant, which is leftmost in a syllable, is sufficient to satisfy the left-alignment constraint, even though the same features are affiliated with a coda consonant which is rightmost in a syllable. See Itô & Mester (1994) for a careful examination of crisp and non-crisp alignment.

<sup>32</sup> A positive licensing theory, one employing full prosodic templates with both rich and impoverished licensing capabilities spelled out for various prosodic positions, is developed in Goldsmith (1989, 1990), Wiltshire (1992) and Bosch & Wiltshire (1992). The effects of this templatic approach are essentially identical to those of Lombardi (1991), who differs in not employing explicit syllabification templates.

stand alone in coda position. My chief concern here is with an OT implementation of positional licensing, whether the relevant constraints are formulated in positive or negative terms. For demonstration purposes, I will adopt the positive formulation in the subsequent discussion. However, the problems exhibited by licensing analyses are not unique to the positive constraint formulation; they affect the negative CODACOND as well, as I will show in Chapter 2.

Crucially, neither variety of licensing can account for the pervasive regressive direction of assimilation in consonant clusters; both the positive and negative licensing formulations require only that a [voice] feature be associated to some onset position. The origin of the [voice] specification in question is irrelevant in licensing theory; either progressive or regressive assimilation will result in a well-formed structure, satisfying both the licensing requirement and the assimilation constraint. The choice between progressive and regressive assimilation candidates is thus remanded to the markedness constraint \*VDOBSTR, which will always favor a voiceless outcome—a result not consistent with the actual facts of Catalan. By contrast, the positional faithfulness analysis predicts that spreading will regress from onset to coda, because the features of the onset are preferentially maintained, due to high-ranking IDENT-ONSET(voice). Both voiced and voiceless clusters are permitted, with voicing crucially determined by the voicing of the onset.

Assuming an OT adaptation of Lombardi's Voice Constraint, let us consider how the facts of Catalan will be analyzed. A working formulation is given in (67).

(67) VOCCON

For all  $x$ ,  $x = [\text{voice}]$  and all  $y$ ,  $y$  a  $[-\text{son}]$  segment such that  $x$  is associated to  $y$ ,  $x$  must be licensed.  $x$  is licensed if  $y$  precedes a tautosyllabic sonorant.

The neutralization of voicing contrasts in coda position arises because [voice] cannot be licensed on coda consonants. In constraint ranking terms, VOCCON must dominate IDENT(voice); proper licensing of [voice] takes priority over faithfulness. The result of this ranking is shown in (68).

(68) Coda devoicing, positional licensing theory

/griz/ 'gray (m.)'	VOC <sub>CON</sub>	ID <sub>ENT</sub> (voice)	*V <sub>D</sub> OB <sub>STR</sub>
a. gríz	*!		**
b. grís		*	*
c. krís		**!	

High-ranking VOC<sub>CON</sub> requires that the coda [voice] specification, which is not in a licensed configuration, be deleted, as in the optimal (68b). Neutralization at all positions, as in (68c), is ruled out by the ranking of ID<sub>ENT</sub>(voice) over \*V<sub>D</sub>OB<sub>STR</sub>. Without the positional ID<sub>ENT</sub>-ON<sub>SET</sub>(voice) in the grammar, this ranking is essential; with the reverse ranking, no voiced obstruents would be permitted at all—devoicing would be required even in the onset position. The ranking in (68) does not force this outcome, and therefore derives the same pattern of results as the positional faithfulness analysis developed in the preceding section.

Differences in the two theories emerge when the focus is shifted from simple positional neutralization to cases of voice assimilation. Here, as above, it will be necessary to assume high-ranking AG<sub>REE</sub>(voice), compelling assimilation. Crucially, AG<sub>REE</sub>(voice) must dominate ID<sub>ENT</sub>(voice) (and by transitivity of ranking, \*V<sub>D</sub>OB<sub>STR</sub>), as in (69).

(69) Positional licensing grammar, Catalan

VOC<sub>CON</sub>, AG<sub>REE</sub>(voice) » ID<sub>ENT</sub>(voice) » \*V<sub>D</sub>OB<sub>STR</sub>

This ranking will indeed compel voice assimilation in obstruent clusters, but it cannot accurately predict the direction of assimilation. It will, in fact, predict that all disharmonic clusters surface as uniformly voiceless. This is, of course, the desired result in the case of an input voiced-voiceless sequence.

(70) Voiced-voiceless input; voiceless cluster results

/griz p\́tít/ 'pale gray'	AG <sub>REE</sub> (voice)	VOC <sub>CON</sub>	ID <sub>ENT</sub> (voice)	*V <sub>D</sub> OB <sub>STR</sub>
a. gríz p\́tít	*!	*!		**
b. grís p\́tít			*	*
c. gríz \́tít			*	**!*

The fully faithful candidate (70a) fatally violates AG<sub>REE</sub>(voice), as it contains a disharmonic cluster. Of the remaining two candidates, the one containing a voiceless cluster (70b) is selected

as optimal by lowest-ranking \*V<sub>D</sub>OBSTR; (70b) and (70c) tie on all other constraints of relevance.

Allowing the segmental markedness constraint to determine the outcome of assimilation bears no bad fruit in the case above, but it has disastrous consequences when the other logically possible disharmonic input is considered. This is the case of a voiceless-voiced input sequence. The actual Catalan output is one in which the cluster is uniformly voiced, but this grammar is incapable of deriving the correct result, as shown in (71).

(71) Voiceless-voiced input; incorrect candidate is optimal

/gos blaw/ 'blue dog'	AGREE(voice)	VOC CON	IDENT(voice)	*V <sub>D</sub> OBSTR
a. gós ʎáw	*!			**
b. góz ʎáw			*	**!*
c. gós pláw			*	*

With only these constraints, the positional licensing analysis is doomed to failure, as the candidate with the fewest \*V<sub>D</sub>OBSTR will always be optimal in cases in which voice assimilation is required.

One obvious solution to the problem posed above is a modification of the assimilation constraint, abandoning AGREE(voice) in favor of a directional constraint, as in (72).

(72) ALIGN([voice], L, PWd, L)

For all  $x$ ,  $x = [\text{voice}]$ , there exists a  $y$ ,  $y$  a PWd, such that the left edge of  $x$  and the left edge of  $y$  coincide.

Via interaction with constraints demanding locality of spreading, and prohibiting the multiple linking of [voice] between obstruents and vowels (see Itô, Mester & Padgett 1995 for one proposal), ALIGN-L will presumably generate the correct results. However, this approach misses the key generalization concerning consonantal assimilation patterns: onset features are preserved and spread in assimilation contexts. A parametrized spreading constraint as in (72) does not explain why assimilation in consonant clusters is almost exclusively regressive; it merely stipulates the direction of spread. Positional licensing, augmented with ALIGN-L, must explain why the corresponding ALIGN-R constraint (73) is rarely, if ever, attested in natural language.

- (73)  $\text{ALIGN}([\text{voice}], \text{R}, \text{PWd}, \text{R})$   
 For all  $x$ ,  $x = [\text{voice}]$ , there exists a  $y$ ,  $y$  a PWd, such that the right edge of  $x$  and the right edge of  $y$  coincide.

This question does not arise in positional faithfulness theory: there is neither  $\text{ALIGN-R}(\text{voice})$  nor  $\text{ALIGN-L}(\text{voice})$ . Regressive assimilation follows straightforwardly from the presence of  $\text{IDENT-ONSET}(\text{voice})$  in the grammar.

### 1.3.3 Conclusions

Western Catalan, like many of the world's languages, exhibits a positional restriction on the occurrence of voiced obstruents: they are contrastive only in syllable onset position. In coda position, the voicing of obstruents is entirely predictable. In the positional faithfulness analysis presented in §1.3.1, this asymmetry between coda and onset positions follows from the interaction of the positional and context-free faithfulness constraints with the markedness constraints which disfavor voiced obstruents and disharmonic obstruent clusters, as summarized in (74).

- (74) Summary: Constraint interactions governing Catalan obstruents

Ranking	Result
$*\text{VDOBSTR} \gg \text{IDENT}(\text{voice})$	Free-standing coda obstruents must be voiceless.
$\text{IDENT-ONSET}(\text{voice}) \gg * \text{VDOBSTR}$	Onset obstruents may be voiced or voiceless.
$\text{AGREE}(\text{voice}) \gg * \text{VDOBSTR}$	Clusters agree in voicing, even if voiced obstruents are derived from underlying voiceless segments.
$\text{AGREE}(\text{voice}) \gg \text{IDENT}(\text{voice})$	Clusters agree in voicing, even if deviations from the underlying [voice] specifications are required.
$\text{IDENT-ONSET}(\text{voice}) \gg \text{IDENT}(\text{voice})$	When unfaithfulness is compelled, coda obstruents, rather than onsets, will be unfaithful.

The subordination of context-free faithfulness to all other constraints in the relevant constraint subhierarchy forces coda obstruents to undergo neutralization (when isolated) or assimilation (when in a cluster). By contrast, high-ranking  $\text{IDENT-ONSET}(\text{voice})$  protects obstruents in onset position from undergoing either neutralization (thereby permitting the full range of voicing contrasts in onset position) or assimilation (thus generating invariant regressive assimilation). As we have seen, no other pattern of positional asymmetry is possible with such a grammar—and, contrary to the predictions of the positional licensing approach considered in §1.3.2, other



patterns of positional asymmetry are rarely, if ever, attested. In Chapter 2, I turn to cases of privilege which key on root-initial syllables, demonstrating both the advantages of positional faithfulness theory and the shortcomings of positional licensing.