Chapter 1

AGAINST THE SYLLABIC APPROACH TO DELETION AND EPENTHESIS

The aim of this chapter is twofold: 1) it introduces the syllabic approach to deletion and epenthesis and evaluates its empirical coverage, and 2) it presents a number of empirical generalizations concerning these processes, which the framework developed in chapters 3-5 is meant to account for.

Deletion and epenthesis are standardly assumed to follow from the principle of prosodic licensing, and specifically the requirement of exhaustive syllabification, whose application is conditioned by syllable well-formedness conditions. I argue against this approach, on the basis that it is:

- -*insufficient*: It cannot account for all cases of deletion and epenthesis and must be supplemented by independent principles;
- -*inadequate*: Several cases for which a syllabic account has been proposed turn out to be incompatible with a non-circular definition of the syllable;
- -*unnecessary*: In syllable-based analyses that are not empirically problematic, it appears that the syllabic level is unnecessary, as an equally simple sequential analysis is available.

The bulk of the discussion is devoted to the inadequacy problem. I present five cases of consonant deletion, vowel epenthesis, and vowel deletion which are standardly analyzed in syllabic terms, and show that this approach does not hold upon close examination of the facts. These patterns are consonant deletion in Hungarian, Attic Greek, English, and Icelandic, and vowel epenthesis and deletion in French. Given the complexity of the latter case, it is discussed in the following chapter, entirely devoted to the French schwa.

While showing the inadequacy of syllable-based analyses, these patterns also reveal generalizations and tendencies in the application of deletion and epenthesis which constitute the main empirical achievement of the dissertation. The discussion thus integrates critical analysis and constructive propositions. These generalizations are sequential in nature, a property that will be crucially reflected in the analysis I develop in the following chapters.

1.1. The syllabic approach: elements

> It is a strange thing that the existence of the syllable in languages is generally evident but linguists are at a loss as to its role in the language (...) (Krámský 1971: 45)

1.1.1. From SPE to Prosodic Phonology

In generative phonology, the *Sound Pattern of English* (Chomsky & Halle 1968) initiated a research program that did not recognize the syllable as a basic concept of the theory. The main argument that was given against incorporating the syllable into the theory has to do with conceptual economy. On the one hand, syllables seem not to be descriptively necessary (see e.g. Kohler 1966[1]). Morpheme-internal syllable boundaries never appear to be contrastive: a given language cannot have two morphemes /ap.la/ and /a.pla/ that differ only in the location of the syllable boundary (Hyman 1975).[2] It follows that syllable boundaries can always be derived by universal and language-specific principles governing segment sequences. Likewise, phonological processes that are expressed with reference to the syllable can always be reformulated in sequential terms. Conceptual economy, that seeks to minimize the set of primitive notions, would therefore argue against the syllable as a basic unit in phonology.[3]

But this line of research was soon challenged by a number of studies, such as Hoard (1971), Hooper (1972), and Vennemann (1972) (in the framework of Natural Generative Phonology), which argued for incorporating the syllable into the theory. Their arguments focus on the explanatory and unifying power of the syllable, and the simplicity of syllable-based accounts (see also van der Hulst & Ritter 1999). It was proposed that the syllable, although it added to the conceptual apparatus of the theory and made representations more complex, allowed for a simplification of the grammar. Syllable-formation rules are stated only once and need not be repeated for all the processes that refer to the syllable, whereas in the SPE approach syllabic

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[1]Note that Kohler (1966) argues that the syllable is not only "unnecessary" but also "impossible" and "harmful".

[2]Barra Gaelic has been viewed as an exception to this generalization; Kenstowicz & Kisseberth (1979) propose that in this language morphemes contain at least some pre-specified syllable structure in their underlying representation. But Clements (1986), followed by, among others, Bosch (1991), Nî Chiosáin (1994) and Smith (1999), has reanalyzed the Barra Gaelic facts without contrastive syllabification.

[3]The argument of conceptual economy is not explicitely expressed in SPE, but was at the heart of Chomsky and Halle's decision to do away with the syllable (Anderson 1985: 347).

contexts were segmentally expressed in each rule. The power of the syllable is forcefully expressed by its "ability to simultaneously generate predictions in three distinct empirical domains: intuitions of string division, rhythmic phenomena like stress and constraints on permissible segment sequences" (Steriade 1999a: 3). Reference to syllable structure thus makes the analysis of certain processes more enlightening. The following quote from Vennemann (1972: 2) illustrates this position well:

> I will advocate here the incorporation of syllable boundaries and syllables in phonological descriptions. I will not say, however, that the incorporation of these concepts into the theory of grammar is "necessary". All phonological processes which can be stated in a general way with the use of syllable boundaries can also be stated without them, simply by including the environments of the syllabification rules in the formula. My contention is rather that in numerous cases such a formulation would miss the point, would obscure the motivation of the process rather than reveal it.

Ultimately, the syllable has secured its place in the theory, and its explanatory potential has been greatly exploited in the last decades, particularly within what has been called Prosodic Phonology. A survey article on the syllable in phonological theory can then safely conclude that "the role of the syllable in phonological theory has become more significant with each passing decade" (Blevins 1995: 206), phonological processes being now typically accounted for with reference to syllabic structure.

The most basic principle of Prosodic Phonology is that of Prosodic Licensing, given in (1) in Itô's (1986: 2) formulation:

(1) PROSODIC LICENSING:
All phonological units must be prosodically licensed, i.e., belong to higher prosodic structure (modulo extraprosodicity).

The phonological units I am concerned with are segments, the higher prosodic structure to which they must belong is the syllable. Segments – and the features that compose them – must be incorporated into syllables to surface. In other words, strings of segments must be exhaustively syllabified. Processes such as consonant deletion have been proposed to fall out directly from Prosodic Licensing through the general convention of Stray Erasure (Steriade 1982; Itô 1986, 1989), which automatically deletes at the end of a cycle consonants that cannot be included into

well-formed syllables. Consonant deletion rules can then be eliminated from the grammar. The introduction of universal principles and conventions which allow for the elimination of a number of language-specific rules or constraints has pushed the simplification of the grammar one step further. This unifying approach is attractive, even though its implementation in specific cases may give rise to quite complex adjustments.

To avoid deletion, consonants may be syllabified before the application of Stray Erasure by epenthesis (Stray Epenthesis) or feature-changing rules, which provide an additional nucleus or alter the featural content of the consonant in a way that makes it compatible with the syllable well-formedness conditions. Laryngeal neutralization processes have been typically analyzed in those terms, on the idea that laryngeal features tend to be disallowed in certain syllabic positions, notably the coda (e.g. Rubach 1990; Lombardi 1991, 1995, 1999). I will only focus, however, on deletion and epenthesis processes, a large number of which have been analyzed as motivated by the requirement of exhaustive syllabification.

1.1.2. SYLLABLE WELL-FORMEDNESS CONDITIONS

Syllable well-formedness conditions mainly fall into three groups: 1) those that govern the complexity of the different syllabic constituents (nucleus, onset, and coda), 2) those concerned with the specific features that can or cannot be licensed in certain syllabic positions, and 3) those related to the sonority profile of the syllable. The first condition may be expressed by syllable templates, which give the maximal syllable allowed in a language (e.g. Itô 1986).[4] For example, a CVC template indicates that only one consonant may appear in the onset and the coda. In Optimality Theory, the effect of templates is obtained with the appropriate ranking of constraints banning codas (*CODA) and complex syllabic constituents (*COMPLEX). The second condition concerns codas in particular and is expressed in Coda Conditions. For example, the coda position may only license coronals, or it may not license laryngeal features.

The last condition falls under the well-known Sonority Sequencing Generalization or Sonority Sequencing Principle (SSP), which can be expressed as follows (Hankamer & Aissen 1974; Hooper 1976; Steriade 1982; Selkirk 1984; Clements 1990, among others; see in particular Clements for an interesting

[4]There has been a debate over whether syllables are built through syllable templates (e.g. Itô 1986) or syllabification rules (e.g. Steriade 1982; Levin 1985). This distinction is not crucial here and my use of templates follows from their being easier to manipulate. See Blevins (1995) and Rubach (1999) – who both argue for the rule-based approach – for recent overviews of this issue.

discussion of this principle, and Cser (2000) for a useful review of the various phonological approaches to sonority):

(2) SEQUENCING SONORITY PRINCIPLE:
Sonority must not increase from the nucleus to the edges of the syllable.

The sonority hierarchy of the different segments has been debated for more than a century (Whitney 1865; Sievers 1881; Jespersen 1904; Saussure 1916; see Ohala 1992 for older references and Rubach 1999 for discussion). Among consonants, the simplest hierarchy would distinguish between sonorants and obstruents (Zec 1995). At the other extreme, numerous fine distinctions can be made within obstruents and sonorants, based on manner of articulation, voicing, or place. The SSP is not a main concern of this dissertation, nor are the precise hierarchy and the range of possible language-specific variations that one should adopt. The data I examine that are accounted for by the SSP are perfectly compatible, and in some respects support, Clements's simple hierarchy in (3), which I will use throughout the dissertation:

(3) CLEMENTS'S (1990) SONORITY HIERARCHY:
vowels > glides > liquids > nasals > obstruents
(x > y: x is more sonorous than y)

When one of the well-formedness conditions is violated, the available repair strategies mainly include deletion (stray erasure), epenthesis (stray epenthesis), and feature-changing processes. Other strategies may be sporadically used (metathesis, the use of syllabic consonants). In addition, well-formedness conditions may serve to block the application of certain processes which are expected otherwise. For instance, vowel syncope or apocope may fail to apply when the resulting string could not be parsed into well-formed syllables. I restrict my attention here to consonant deletion, vowel epenthesis, and vowel deletion. All possible associations of a condition and a process (used to repair a violation or blocked to avoid one) are attested. The following table gives one representative example found in languages of the world. Relevant data and references follow.

Table 1:
Deletion and epenthesis processes triggered by syllable well-formedness conditions

PRINCIPLES→ PROCESSES↓	*Template*	*Coda Conditions*	*SSP*
C deletion	Korean	Lardil	Québec French
V epenthesis	Cairene Arabic	Selayarese	Chaha
V deletion blocked	Tonkawa	Kuuku-Ya'u	Gallo-Romance

1.1.2.1. Syllable templates

The three languages cited in table 1 – Korean, Cairene Arabic, and Tonkawa – can be assumed to have a CVC template. No more than one consonant is allowed in the onset or the coda (I ignore the complexity of the nucleus). Cairene Arabic also allows one additional extrasyllabic consonant phrase-finally.[5]

Korean has a limited number of morphemes that end in a two-consonant cluster underlyingly (K.-O. Kim & Shibatani 1976; Iverson & Lee 1995; S.-H. Kim 1995; Shim 1995 and numerous other references cited in these works). When these morphemes appear before a vowel, the last consonant resyllabifies in the following onset; otherwise, one of the two consonants deletes to conform to the CVC template. This is shown in (4) below (data from S.-H. Kim 1995).

(4) CONSONANT DELETION IN KOREAN:

a.		/kaps+to/	→	[kap.t'o]	'price-ADJUNCTIVE'
		/kaps/	→	[kap]	'price'
	vs.	/kaps+e/	→	[kap.s'e]	'price-LOCATIVE'
b.		/salm+to/	→	[sam.to]	'life-ADJUNCTIVE'
		/salm/	→	[sam]	'life'
	vs.	/salm+e/	→	[sal.me]	'life-LOCATIVE'

In Cairene Arabic (Broselow 1980, 1992; Selkirk 1981; Wiltshire 1994, 1998), unsyllabifiable consonants that arise through morpheme or word concatenation do not delete but are "saved" by an epenthetic vowel that provides an additional nucleus to which the consonant(s) can attach. An epenthetic [i] (underlined in the examples below) is inserted between the second and third consonant:

(5) VOWEL EPENTHESIS IN CAIRENE ARABIC:

a. /katab-t-l-ha/	→	[ka.tab.ti̲l.ha]	'I wrote to her'
b. /katabt gawaab/	→	[ka.tab.ti̲.ga.waab]	'you (m.) wrote a letter'
c. /bint nabiiha/	→	[bin.ti̲.na.bii.ha]	'an intelligent girl'

[5] Other processes analyzed as triggered by syllable templates include: 1. consonant deletion: Menomini (CVC) (Y.-S. Kim 1984), Kamaiurá (CV) (Everett & Seki 1985; McCarthy & Prince 1993); vowel epenthesis: Chukchi (CVC) (Kenstowicz 1994b), Lenakel (CVC) (Lynch 1978; Blevins 1995; Kager 1999); vowel deletion: South-eastern Tepehuan (CVC) (E. Willet 1982; T. Willet 1991; Kager 1997). Turkish displays both consonant deletion (degemination) and vowel epenthesis (CVC) (Clements & Keyser 1983).

Tonkawa has a very productive process of internal vowel syncope, in addition to a process of final vowel deletion, which I disregard here (Hoijer 1946; Kisseberth 1970; Phelps 1973, 1975; Noske 1993). Ignoring morphological constraints on syncope (only non-final vowels in the stem may delete), this process appplies as often as possible, provided the resulting string can be parsed into well-formed CVC syllables. It is blocked when it would result in an unsyllabifiable sequence of consonants. This is illustrated in (6).

(6) SYNCOPE IN TONKAWA:

a. /picena+n+oʔ/	→	[picnanoʔ]	'he is cutting it'
b. /we+picena+n+oʔ/	→	[wepcenanoʔ]	'he is cutting them'

In the form in (6a), only the second vowel of the stem may be dropped. If the first were to delete, we would get an initial [pc...] cluster that cannot be parsed since complex onsets are disallowed according to the CVC template of Tonkawa. In (6b), the presence of the vowel-final prefix allows the first vowel of the stem to delete. But then the second one must stay to prevent the unsyllabifiable three-consonant sequence [pcn]. (I ignore here why it is the first rather than the second vowel of the stem that deletes in (6b)).

1.1.2.2. Coda Conditions

Coda conditions are extremely varied and deal with a great number of distinct features. Cross-linguistically, consonant deletion, vowel epenthesis, and vowel deletion seem to be triggered or blocked by constraints on manner and place features, with laryngeal features playing only a secondary role.[6] The examples presented here involve place features.[7]

Lardil (K. Hale 1973; Klokeid 1976; Itô 1986; Wilkinson 1988) and Kuuku-Ya'u (Thompson 1988) do not allow non-coronal consonants in coda position (with the exception of nasals homorganic with the following onset). Kuuku-Ya'u displays

[6]For example, constraints on voicing alone will not trigger deletion or epenthesis (Steriade 1999d), but they may be involved in conjunction with other features. For instance, voiceless obstruents but not voiced ones delete after nasals, or the other way round (see Archangeli, Moll & Ohno 1998 and Hyman, to appear, for examples of both types).

[7]Examples of deletion and epenthesis triggered by constraints on manner features include Brazilian Portuguese (Olímpio de Magalhães 1999) and Basque (Artiagoitia 1993). In both languages stops are banned from the coda. In Brazilian Portuguese, coda stops are avoided by epenthesis (e.g. *seg*[i]*mento* 'segment'; *ab*[i]*negar* 'renounce'), in Basque by deletion or epenthesis (see chapter 5).

additional restrictions on morpheme-final consonants, which can only be a member of the set {n,l,j}.

In Lardil, the only context where non-coronal consonants do not appear before a vowel (i.e. in onset position) is word-finally, i.e. when stems ending in a non-coronal consonant are uninflected (7a), or when a non-coronal consonant becomes final after the application of an apocope rule that deletes word-final vowels from stems which are longer than disyllabic (7b). In both cases the final non-coronal consonant deletes since it is banned from the coda position. The examples in (7c-d) show the distinct behavior of coronal consonants, which are retained in the output.

(7) NON-CORONAL CONSONANT DELETION IN LARDIL:

	UR	Apocope	Non-cor deletion	SR	
a.	/ŋaluk/ →	n/a	ŋalu	[ŋalu]	'story'
b.	/puṭuka/→	putuk	puṭu	[puṭu]	'short'
c.	/jaɽput/ →	n/a	n/a	[jaɽput]	'snake, bird'
d.	/jalulu/ →	jalul	n/a	[jalul]	'flame'

In Kuuku-Ya'u, an optional process of vowel deletion deletes morpheme-final vowels. However, this process applies only when the preceding consonant is one of the permissible mopheme-final coronal consonant {n,l,j}. Otherwise, syncope and apocope fail to apply to avoid a violation of the coda condition against non-coronal consonants. Vowels that may not delete are underlined.

(8) VOWEL DELETION IN KUUKU-YA'U

a. /t̪aʔi̱-na/	→	[t̪aʔin]	'hit-NONFUTURE'
b. /ŋaŋkala/	→	[ŋaŋkal]	'give-IMPERATIVE.SG'
c. /mukana-pinta̱/	→	[mukanpinta]	'big-COMITATIVE'
d. /taŋu̱-la/	→	[taŋul]	'canoe-POSITIONAL'

Selayarese (Broselow 1999) allows only glottal stops, nasals, and first parts of geminates in coda position. Word-internally, nasals are always homorganic with the following onset; word-finally, they surface as a velar nasal [ŋ]. Complex onsets are banned altogether. This is a cross-linguistically familiar pattern. Words borrowed from Bahasa Indonesia often contain codas or complex onsets that are illegal in Selayarese. In some cases, the unsyllabifiable consonant is transformed into a legal coda; for example, word-final stops become glottal stops. Otherwise, a copy vowel is inserted that turns the illegal consonant into an onset.

(9) VOWEL EPENTHESIS IN SELAYARESE:

	Bahasa Indonesia	Selayarese	
a.	arus	[arusu̲]	'current'
b.	kikir	[kikiri̲]	'metal file'
c.	bakri	[baka̲ri]	'interpretation'

We can interpret the Selayarese data in terms of a constraint against place features in coda. Assuming that glottal stops and velar nasals are placeless (e.g. Trigo 1988; Paradis & Prunet 1993), we see that the only consonants that are tolerated in the language are either placeless or homorganic with the following onset. The data straightforwardly follow from the fact that codas are unable to license place features.

1.1.2.3. The Sonority Sequencing Principle

The SSP requires sonority to fall from the nucleus to both edges of the syllable. In Gallo-Romance (Pope 1961; Jacobs 1989), final vowels other than /a/ were reduced to /ə/ and subsequently lost between the 7th and the 9th century. However, this apocope process was blocked when it would have resulted in a final cluster that did not obey the SSP. The contrast between (10a-b) and (10c-d) illustrates the role of the SSP. A final schwa preceded by a single consonant (10a) or a cluster of falling sonority ([rt] in (10b)) deletes, as shown by the vowel-less Old French form. But the final schwa was retained after a cluster of rising sonority (obstruent-liquid in (10c) or obstruent-nasal in (10d)), and was still present in Old French (which also illustrates other processes: cluster simplification and consonant epenthesis).

(10) APOCOPE IN GALLO-ROMANCE:

	Reconstructed Gallo-Romance after vowel reduction		Old French	
a.	*nɛtə	>	net	'clean, clear'
b.	*fɔrtə	>	fort	'strong'
c.	*pɛðrə	>	pere	'father'
d.	*simlətudnə	>	sembletune	'resemblance'

Eventually, all final vowels were lost in the history of French, so that the modern language has a large number of words ending in clusters that violate the SSP. The spoken language, however, displays a strong tendency to simplify those clusters by deleting the last consonant. This processs is illustrated with data from Québec French:

(11) FINAL CONSONANT DELETION IN QUÉBEC FRENCH:

a.	*poutre*	/putr/	→	[pʊt]	'beam'
b.	*catéchisme*	/kateʃism/	→	[kateʃɪs]	'catechism'

Chaha (Rose 1997b, to appear) also has a number of underlying forms ending in bad sequences of consonants according to the SSP. The only CC clusters that are allowed to surface word-finally in this language are those in which sonority falls (12a-b).[8] Otherwise an epenthetic vowel is inserted between the consonants (12c-d).[9]

(12) VOWEL EPENTHESIS IN CHAHA:

a.	/srt/	→	[sɨrt]	'cauterize!'
b.	/kft/	→	[kɨft]	'open!'
c.	/dβr/	→	[dɨβɨ̲r]	'add!'
d.	/rk'm/	→	[nɨk'ɨ̲m]	'pick!'

1.2. THE SYLLABIC APPROACH: WEAKNESSES

Although the syllabic approach adequately accounts for the above cases, I argue in this section that deletion and epenthesis patterns should not be treated with reference to syllable structure. The following points can be brought in support of this conclusion:

(13) WEAKNESSES OF THE SYLLABIC APPRAOCH:

a. *The syllabic approach is insufficient:*
- Epenthesis and deletion often fail to apply in contexts where syllable well-formedness predicts them to be applicable.
- Epenthesis and deletion often apply in contexts where syllable well-formedness does not predict them to be applicable.

b. *The syllabic approach is inadequate:*
Upon closer examination, the syllabic account cannot be maintained for several of the cases of epenthesis and deletion for which it has been proposed.

c. *The syllabic approach is unnecessary:*
For the patterns that are naturally compatible with a syllabic analysis, an equally simple sequential account that makes no use of syllable well-formedness conditions is easily available.

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[8] We observe variation in whether epenthesis applies in sonorant-sonorant clusters and obstruent-obstruent ones other than fricative-stop (12b). See Rose (to appear) for discussion.

[9] Among other languages that use epenthesis to avoid violating the SSP: Itelmen (Bobaljik 1997), Romansch (Montreuil 1999), Khalkha Mongolian (Svantesson 1995; Harada 1999).

I will present in more detail each of these points. The bulk of the discussion will focus on (13b), which I treat last: We will review a number of deletion and epenthesis patterns that have been accounted for in syllabic terms and show how these analyses are empirically inadequate. Interestingly, the inadequacy of the prosodic approach in consonant phonotactics has been brought to attention for processes other than deletion and epenthesis. This critical view has been expressed in e.g. Lamontagne (1993) for English consonant sequences, and Blevins (1999). But a more articulated version of it is the one developed by Steriade (1999a, c, to appear), who argues for a sequential account of laryngeal and place neutralization processes, in a phonetically-based Optimality framework that is refered to as 'Licensing by Cue' (as opposed to 'Licensing by Prosody'). This approach, which will be presented in chapter 3, has been supported for palatalization processes by Kochetov (1999).[10] The work presented here can be seen as part of this more general line of research questioning the role of the syllable in phonotactic patterns.

1.2.1. IT IS INSUFFICIENT: EXTRASYLLABICITY AND SEQUENTIAL CONSTRAINTS

It is well-known that epenthesis and deletion may behave in ways that are unexpected given syllable well-formedness alone. First, consonants may surface even though they cannot be incorporated into well-formed syllables, which is unexpected from the standpoint of prosodic licensing. Two possibilities arise: 1. consonant deletion and vowel epenthesis fail to apply in contexts where they are expected; 2. vowel deletion applies in contexts where it should not. Second, consonants may delete or trigger vowel epenthesis even though they are properly syllabified, or they may block vowel deletion even though the process would not make them unsyllabifiable.

These "exceptions" are not necessarily problematic for the syllabic approach, if independent and well constrained principles that interact with syllable well-formedness conditions can account for them. The implicit assumption so far has been that such principles exist. On the one hand, a device of extrasyllabicity[11] has been proposed and incorporated into the principle of prosodic licensing to allow certain

[10]Gess (1999), looking at patterns of assimilation in sequences of two nasal consonants, extends Jun's (1995) cue-based, but also syllable-based, approach into a purely sequential model similar to Steriade's.

[11]The terms extrametricality and extraprosodicity are also often used. I prefer extrasyllabicity, which is the only term that is compatible with the different implementations of this idea (see below). Consonants may be extrasyllabic without being extrametrical or extraprosodic: they may occupy the onset position of an empty-headed syllable, or may attach directly to a constituent higher than the syllable (prosodic word or some phrasal constituent).

consonants to escape the requirement of exhaustive syllabification. Consonants may be marked as extrasyllabic and not be subject to syllable well-formedness conditions. On the other hand, epenthesis and deletion processes may be motivated by constraints and principles that are independent of syllable well-formedness, in particular sequential ones, which apply over sequences of segments without reference to syllable structure.

I argue, however, that extrasyllabicity and sequential constraints are not properly constrained, and may always be called on to explain deletion and epenthesis processes for which a syllabic analysis is not available. This considerably weakens the syllabic licensing approach and makes it in essence unfalsifiable. Extrasyllabicity and sequential constraints are reviewed in turn.

1.2.1.1. Extrasyllabicity

Deletion and epenthesis processes are often disrupted at the edges of prosodic constituents, typically the prosodic word. Thus, consonant deletion and vowel epenthesis may apply only domain-internally, but not at the margins, whereas vowel deletion may apply only at edges but not domain-internally. Cairene Arabic provides a case of epenthesis that does not apply phrase-finally. Complex codas and onsets are not allowed phrase-internally, hence epenthesis in the form /katabt gawaab/ → [katabtigawaab] (5b). But final clusters surface intact in phrase-final position: /katabt/ → [katabt]. Lardil (K. Hale 1973) offers an example of vowel deletion that applies only word-finally, but not at word-internal morpheme boundaries. Contrast [karikari-wuṛ] 'butter-fish-FUTURE' with the bare stem [karikar]: the stem-final vowel [i] deletes word-finally but remains before a suffix. See Piggott (1980, 1999) for a similar pattern in Ojibwa.

To account for these "edge effects", it has been proposed that edge consonants may remain extrasyllabic and escape syllable well-formedness conditions and the requirement of exhaustive syllabification. This idea has been implemented in various ways, which differ on how edge consonants are represented and how they are ultimately licensed. The following four approaches may be mentioned[12]:

[12]I leave aside the OT approach to edge effects proposed by McCarthy & Prince (1993), in which edge effects may be derived without extrasyllabicity / extrametricality, by crucially ranking constraints on syllable well-formedness with alignment constraints between syllables and morphological constituents (e.g. the stem). This approach is possible only in the context of Containment theory, in which edge consonants, even if unparsed, remain present in the representation. It does not carry over in Correspondence theory (McCarthy & Prince 1995), now the standard approach in OT and the one I use in this work.

(14) APPROACHES TO EXTRASYLLABICITY:

a. *Extrametricality:* Edge consonants are marked as extrametrical for syllabification purposes, and are ultimately licensed by adjoining to a syllable late in the derivation, once syllable well-formedness conditions no longer apply (Borowsky 1986; Itô 1986; Booij 1999).

b. *Final consonants as onsets:* Final consonants are represented as onsets of empty-headed syllables and are not subject to the coda conditions that apply to domain-internal codas. This approach is prominent in Government Phonology (e.g. Kaye 1990); see also Dell (1995) for French.

c. *Indirect licensing*: Edge segments are licensed not by the syllable but by a higher constituent, especially the prosodic word (Piggott 1999; Spaelti 1999; Auger & Steele 1999; Steele & Auger 1999).

d. *Alignment* (Wiltshire 1994, 1998, to appear; Clements 1997): Extrasyllabicity is derived by interactions between constraints on syllable structure and alignment constraints with higher prosodic domains.

Proposed in the context of edge effects, extrasyllabicity has standardly been restricted to margins of prosodic domains, especially the prosodic word. This is the so-called Peripherality Condition. But extrasyllabic consonants have also been postulated domain-internally in certain languages that allow particularly complex consonant sequences, e.g. Polish (Rubach & Booij 1990), Piro (Lin 1997b), Bella Coola (Bagemihl 1991), French (Rialland 1994). This extension of extrasyllabicity to domain-internal contexts is a major move, as it runs the risk of turning extrasyllabicity into an unconstrained mechanism. Extrasyllabicity is an exceptional device that does not follow naturally from the prosodic approach to deletion and epenthesis processes. Since it allows consonants to escape syllable well-formedness conditions, which form the cornerstone of the whole approach, an unrestricted use of it would render the principle of prosodic licensing meaningless. To be a valid principle of segmental phonology, extrasyllabicity has to be strictly constrained, which is presently not clearly the case.

One additional argument in favor of extrasyllabicity is the fact that certain consonants, especially those at edges, often freely violate constraints which normally apply to syllable-affiliated consonants. For example, Blevins (1995: 241) notes that word-initial clusters in Klamath do not obey the Sonority Sequencing Principle. This relative freedom is expected since syllable well-formedness conditions do not apply in this position.[13] But consonants assumed to be extrasyllabic may not always be so unconstrained. They are highly restricted in other languages. Dutch, for example,

[13]Thus, Itô (1986: 174) rejects the hypothesis that the obstruent in certain word-initial obstruent-liquid clusters is extrasyllabic, for the reason that these clusters obey the sonority requirement.

allows only coronal obstruents in final position, and /s/ in initial position to be extrasyllabic (Booij 1999). While the coronality of these segments may follow from markedness considerations, what about the restriction to obstruents? I suggest that it is motivated by the desire to avoid violations of the SSP (assuming, as in the hierarchy in (3), that fricatives and stops are equal in sonority). But this result cannot follow from extrasyllabicity, since extrasyllabic consonants do not count in the evaluation of sonority.

1.2.1.2. Sequential constraints

The development of prosodic analyses has not removed the need for purely sequential rules and constraints, which apply over sequences of segments irrespective of their prosodic affiliation. This has been recognized by proponents of the prosodic approach, for example Itô (1986: 45), who states that "certain intersyllabic melody constraints are only made unenlightening by reference to syllabic structure". It is therefore not unexpected that epenthesis and deletion patterns may be motivated by sequential principles that are independent of the syllable. See for example Broselow (1982) for vowel epenthesis.[14]

The most widely accepted sequential principle is certainly the Obligatory Contour Principle (OCP), which prohibits identical adjacent segments on a given tier. Proposed by Leben (1973) and Goldsmith (1976) to account for tonal phenomena, it was first extended to segmental processes by McCarthy (1986), Odden (1988), and Yip (1988).[15] A large number of segmental processes have subsequently been argued to fall under the scope of the OCP. The following table provides examples for consonant deletion, vowel epenthesis, and vowel deletion.

Table 2:
Examples of deletion and epenthesis processes triggered by the OCP

PRINCIPLE→ PROCESSES↓	*OCP*
C deletion	Catalan
V epenthesis	English
V deletion blocked	Afar

[14]It must be noted, however, that consonant deletion is one process for which it has been hypothesized that all instances of it follow from Stray Erasure (Steriade 1982; Itô 1986). The existence of consonant deletion patterns that are incompatible with a syllabic analysis therefore shows that such a hypothesis cannot be maintained. Empirical support for this conclusion will be amply given in section 1.2.3; see also Kenstowicz (1994a: 288-291) for discussion of other challenges to Stray Erasure.

[15]See Myers (1997) and Suzuki (1998) for discussions of the OCP within Optimality Theory.

Catalan has a productive process of word-final stop deletion, which applies only if the stop follows a homorganic consonant (Mascaró 1983, 1989; Bonet 1986; Wheeler 1986, 1987; Morales 1995; Herrick 1999). Contrast the examples in (16), in which the stop and the preceding consonant differ in place or articulation, with those in (15), in which the two consonants are homorganic. Only in the first set does deletion apply. This pattern could be analyzed in terms of an OCP constraint on place of articulation: the final stop deletes to avoid sequences of homorganic consonants.[16,17]

(15) DELETION IN HOMORGANIC CLUSTERS IN CATALAN:

a.	/-rt/:	*fort*	'strong'	/fort/	→	[for]
b.	/-lt/:	*alt*	'tall'	/alt/	→	[al]
c.	/-nt/:	*punt*	'point'	/puNt/	→	[pun]
d.	/-mp/:	*camp*	'field'	/kaNp/	→	[kam]
e.	/-ŋk/:	*bank*	'bank'	/baNk/	→	[baŋ]
f.	/-st/:	*bast*	'vulgar'	/bast/	→	[bas]

(16) NO DELETION IN NON-HOMORGANIC CLUSTERS IN CATALAN:

a.	/-lp/:	*balb*	'numb'	/balp/	→	[balp] * [bal]
b.	/-lk/:	*calc*	'calque'	/kalk/	→	[kalk] * [kal]
c.	/-rp/:	*herb*	'herb'	/erp/	→	[erp] * [er]
d.	/-rk/:	*arc*	'arc'	/ark/	→	[arc] * [ar]
e.	/-sp/:	*Casp*	(a town)	/kasp/	→	[kasp] * [kas]
f.	/-sk/:	*fosc*	'dark'	/fosk/	→	[fosk] * [fos]

(Morales 1995)

[16]An OCP-place constraint cannot be the whole story, as homorganic clusters in which the final consonant is not a stop surface intact (e.g. *pots* 'you can' [pots]). Morales's (1995) solution to this is based on Radical Underspecification and the assumption that stops lack manner feature specifications. Also, the constraint against homorganic sequences applies only word-finally; a simple OCP-place constraint does not capture this restriction and needs to have its domain of application restricted. I will provide in the following chapters a different account of the Catalan case and the special status of stops in deletion patterns more generally.

[17]Other cases of deletion motivated by the OCP include Korean /y/-deletion after (alveo-)palatal consonants (H.-S. Kang 1998) and /r/-deletion in Vinzelles Occitan (Elordieta & Franco 1995; see also Morin 1982; Dauzat 1897, 1900). Stop deletion in Baztan Basque is also standardly analyzed as a case of OCP on the continuancy tier, as it is said that stops delete and affricates simplify only before [-continuant] segments (Salaburu 1984; Lombardi 1990; Hualde 1991; H. Kim 1997; Fukazawa 1999). We will see however in chapter 5 that the OCP is clearly not the correct motivation for this process in all the other Basque dialects I have looked at, and that the case for the Baztan variety is unclear.

A classic case of epenthesis is found in the suffixation of *-ed* and *-s* in English. When these suffixes are added to stems ending in a dental stop and a coronal fricative or affricate, respectively, an epenthetic vowel is inserted between the two morphemes. Hence *cheated* [tʃitə̲d] and *passes* [pæsə̲z]. A similar example is found in Hebrew (Kenstowicz 1994a: 533).

Afar (McCarthy 1986, based on Bliese 1981), an East Cushitic language, illustrates how vowel deletion can be blocked by the OCP. This language has a syncope rule that deletes an unstressed vowel in a peninitial two-sided open syllable. This rule, however, systematically fails to apply when the consonants on both sides of the potential deletion site are identical. Contrast the first two examples below with (17c) and (17d), where the second vowel is flanked by two /r/'s and two /n/'s, respectively.

(17) SYNCOPE IN AFAR:

	a.	digib+e	→	[digbe]	'she/I married'
	b.	meˁer+a	→	[meˁra]	'you/he kills a calf'
vs.	c.	xarar+e	→	[xarare]	'he burned'
	d.	gonan+a	→	[gonana]	'he searched for'

The OCP may motivate a large number of deletion and epenthesis processes that do not appear to be syllabically-conditioned. But there remains a substantial residue of cases that can be accounted for neither with syllable well-formedness conditions nor with the OCP. Process- or language-specific sequential rules and constraints are then usually postulated, without there being general principles that govern them. Analyses based on such rules and contraints often have a highly descriptive and ad hoc flavor, and they tend to be used as a fall-back option when a more principled analysis, in particular a prosodic one, does not seem available. This is not meant as an argument against sequential constraints in general but it does represent a weakening of the prosodic approach.

Such sequential constraints, proposed to account for deletion or epenthesis phenomena, show all levels of generality or specificity. Very general ones include *CC or *CCC, which ban sequences of two or three consonants, irrespective of their syllabic affiliation. For example, Archangeli, Moll & Ohno (1998) and Archangeli & Ohno (1999) use *CC in their analysis of the resolution of nasal-consonant (NC) sequences in various languages. These clusters are found in different prosodic positions and often trigger deletion of one of the consonants. Lin (1997b) proposes a constraint *CCC to account for the blocking of vowel deletion in Piro when deletion would yield a three-consonant sequence.

Constraints that deal with more specific sequences of consonants are also needed. For instance, the constraint *RG, which bans sequences of a sonorant consonant followed by a voiced obstruent, was proposed by Nî Chiosáin (1996, 1999; see also Green 1997). This constraint accounts for cases of vowel epenthesis in Irish and Gaelic. Smith (1999) uses similar but even more specific constraints in his analysis of related facts in Leurbost Gaelic.

The OCP – or a similar principle against identical adjacent elements in some dimension(s) – appears to be empirically well-motivated, and plays an important role in the analysis of various deletion and epenthesis patterns developed in chapter 4. But the coexistence of syllabic and non-OCP sequential constraints is problematic, because both types of constraints target the same type of configurations, without there being principled arguments for adopting a sequential or a syllabic point of view. Cases of consonant deletion or vowel epenthesis in contexts of consonant clusters are sometimes compatible and sometimes incompatible with a syllabic analysis. Yet, they all share the same basic motivation: avoiding "difficult" sequences of consonants or consonants in a marked position. I do not see a distinguishing factor that could be used to define two categories of processes: sequential and syllable-based. In fact, it seems that syllabic analyses are usually preferred when they are tenable, sequential ones having acquired the status of a fall-back option. This, in effect, makes the syllabic approach unfalsifiable, as processes that are incompatible with it can be accounted for in sequential terms, without this arguing against syllable well-formedness as a motivation for deletion and epenthesis. On this point, the prosodic licensing theory of segmental processes is not satisfactory.

As an illustration of the tension between syllabic and sequential constraints used to prevent nearly identical configurations, consider vowel deletion in Tonkawa, Piro, and South-eastern Tepehuan. As mentioned above, vowel syncope in Tonkawa may be said to apply whenever the resulting string can be parsed into well-formed CVC syllables (ignoring independent morphological constraints). It is blocked when it would result in an unsyllabifiable sequence of consonants. Word-internally, this means that deletion does not apply when it results in a sequence of three consonants. Two-consonant clusters are acceptable since they can be parsed as a coda-onset sequence. Examples are repeated below.

(6) SYNCOPE IN TONKAWA:

a.	/picena+n+oʔ/	→	[picnanoʔ]	'he is cutting it'
b.	/we+picena+n+oʔ/	→	[wepcenanoʔ]	'he is cutting them'

Exactly the same situation holds in South-eastern Tepehuan (Kager 1997, based on E. Willet 1982; T. Willet 1991). Syncope and apocope are both blocked in this language when the resulting string would not conform to the CVC maximal template. Compare (18a) with (18b):

(18) VOWEL DELETION IN SOUTH-EASTERN TEPEHUAN:

a.	/tɨroviɲ/	→	[tɨrviɲ]		'rope'
b.	/ka-karvaʃ/	→	[kakarvaʃ]	*[kakrvaʃ]	'goats'

Vowel deletion in Piro is subject to exactly the same constraint against sequences of three consonants (Matteson 1965; Lin 1997a,b). It applies (cyclically) to morpheme-final vowels provided a three-consonant cluster is not created.[18] Representative examples follow (from Lin 1997a,b), where deleted vowels are indicated by an underlined gap.

(19) VOWEL DELETION IN PIRO:

a. /nika+ya+waka+lu/ → [nik_yawak_lu]
to eat+LOC+place+it
'to eat it there'

b. /n+yo+hlo+ta+kaka+lu/ → [nyohlot_kak_lu]
I+use an instrument+within+verb suffix+causative+him
'I cause him to spear (something)'

On the basis of these data, the first analysis of Piro that comes to mind is the one offered for Tonkawa and Tepehuan: Piro has a CVC syllable template, with special conditions applying at word edges. More than one consonant may occur word-initially, a fact consistent with extrasyllabicity, and no consonants are permitted word-finally. Such generalizations are not exceptional cross-linguistically. But Lin (1997b) argues that this solution cannot hold. First, three-consonant clusters do occur word-internally (they involve the suffix /m/, the only monoconsonantal suffix in Piro). Such clusters are incompatible with an (inviolable) CVC template.[19] Second, both Matteson (1965) and Lin (1997a,b) argue against the existence of coda consonants in the language, for distributional and phonetic reasons. First, Piro words never end in a consonant, but they may begin in sequences of up to three

[18] Certain morphemes are arbitrarily marked as blocking the deletion of the preceding morpheme-final vowel. Fricative clusters are also special; unexpectedly, vowel deletion applies in sequences FFV+C (where F=fricative). The resulting three-consonant cluster FFC, however, does not surface, but is repaired by deletion of the first fricative with compensatory lengthening of the preceding vowel. These exceptions and the behavior of deletion and compensatory lengthening need not concern us here.

[19] But the idea of a violable syllable template is not problematic in a framework like OT.

consonants. Second, all non-prevocalic consonants surface "either as a syllabic consonant or has to be followed by a very short epenthetic vowel" (Lin 1997b: 405), properties that are considered uncharacteristic of coda consonants.[20] Lin and Matteson differ, however, on the alternative template they propose: CCCV for Matteson, CV for Lin, with extrasyllabic consonants appearing between syllables and licensed by the mora. Arguments for positing these templates need not concern us here; what is crucial is that both force the use of a sequential constraint of the type *CCC to account for the blocking of vowel syncope.[21]

We see that syncope in Tonkawa, North-eastern Tepehuan, and Piro is subject to the same descriptive constraint, that of avoiding sequences of three consonants word-internally. But only Tonkawa and Tepehuan seem to be amenable to an analysis in terms of syllable templates.[22] Is there a principled reason for adopting two radically different analyses – sequential and syllabic – for what appears to be manifestations of the same generalization? I believe not and argue that the tension between the two types of analysis should rather be relieved by eliminating one of them. Since a syllabic analysis is not viable for a number of deletion and epenthesis processes, as we will see in more detail in the following section, we should look for a uniform non-syllabic approach to them. This is the direction I explore in this dissertation, arguing that it yields a more coherent theory. In the case of Tonkawa, Tepehuan, and Piro, I propose that the relevant constraint is that all (word-internal) consonants have to be adjacent to a vowel. We will shortly come back to this generalization.

1.2.2. It is unnecessary: equivalent sequential analyses

We have seen that the analysis of deletion and epenthesis patterns generates an undesirable tension between syllabic and sequential accounts. I have suggested that we should seek a unified approach to these processes, which has to be

[20]Hsin (1999) uses identical arguments to argue for a CCV rather than CVC structure in Tsou. (See Steriade (1999a) for an approach to syllabification that is crucially based on word-edge phonotactics.)

[21]Lin (1997b) first proposes *CCC but later replaces it with a constraint that bans sequences of two adjacent extrasyllabic moras. *CCC is presented as problematic because it counts the number of segments, but it is not clear to me that the proposed alternative is really more satisfactory in this respect. Another solution will be given below.

[22]Landau (1997) discusses a pattern of vowel deletion in Modern Hebrew that also appears not to be driven by syllable well-formedness. Deletion is blocked when it would create a triconsonantal cluster, except when the first consonant is a sibilant fricative. As Landau notes, this process has to do with permissible consonant sequences rather than the complexity of syllabic constituents. The data presented in the paper, however, are too limited to draw clear conclusions about the segmental constraints active in the process.

sequential in nature since processes may resist a syllabic analysis. But would not such a move make us lose the insight and simplicity of syllabic explanations, which are precisely the reasons why they were thought to be superior to the previous linear analyses (see e.g. Vennemann 1972)? In this and the next sections, I argue on the contrary that abandoning syllable well-formedness conditions does not negatively affect accounts of (non-rhythmic) deletion and epenthesis. I review a number of deletion and epenthesis patterns for which an explanation in syllabic terms has been offered, and conclude that reference to the syllable is either undesirable or unnecessary.

For several cases, syllabic analyses are based on incomplete data, and a more thorough investigation reveals that the facts are incompatible with a non-circular definition of well-formed syllables (that is a definition derived from factors that are independent from the deletion / epenthesis process to be analyzed). Not surprisingly, these patterns are among the most complex ones, and I postpone the lengthy discussion of them until the next section. For now, I focus on the remaining cases – those that are adequately accounted for in syllabic terms. These appear to be rather straightforward, and can just as easily be formulated in sequential terms without loss of simplicity and generality. We may then wonder: Why the syllable?

Consider first the following list of languages in which a consonant deletion pattern has been claimed to follow from Stray Erasure of unsyllabified consonants. This corresponds to the list given in Blevins (1995: 223-224), augmented with the five cases in (20d, h-k).[23]

(20) Patterns of C deletion claimed to result from Stray Erasure:
  a. Attic Greek
  b. Diola Fogny

[23]I have omitted from Blevins's list the analysis of liaison consonants in French (the case of consonant deletion in (20k) is a different one). The non-surfacing of liaison consonants in French has also been analyzed as a consequence of Stray Erasure (Levin 1988; see also Plénat 1987; Bosch 1991). This is a very particular, complex, and controversial case, which is well beyond the scope of this dissertation. It is not clear whether liaison consonants should be treated as deleted in non-liaison contexts or inserted in liaison ones (see Tranel 1995a for a recent summary of some of the issues). Recent research on the acquisition of liaison may support the insertion analysis (Chevrot & Fayol, to appear; Braud & Wauquier-Gravelines 1999). As for the Stray Erasure analysis in particular, it is problematic because it cannot work without 'brute force' stipulations that make widespread use of lexical marking (Plénat 1987; Bosch 1991) or posit final underlying schwas for all words ending in stable consonants (Levin 1988). This last assumption is not new in French phonology (see for example François Dell's work on schwa), but I think, in accordance with Tranel (1981), that it is empirically unjustified (see chapter 2 on the distribution of schwa in French).

c. Icelandic
d. Hungarian
e. Korean (K.-O. Kim & Shibatani 1976)
f. Turkish (Clements & Keyser 1983)
g. Menomini (Y.-S. Kim 1984)
h. Kamaiurá (McCarthy & Prince 1993; Wiltshire, to appear)
i. Basque (Artiagoitia 1993)
j. Lardil (Wilkinson 1988)
k. Québec French (Côté 1997a)
l. English (Borowsky 1986)

These languages can be divided into two main groups. The four cases in (20a-d), examined in detail in the next section, appear to be incompatible – or at least clearly problematic – for the Stray Erasure account. For the rest, the syllabic analysis could be maintained, but I argue that an equally simple sequential analysis is available.

Recall from (4) that Korean enforces a strict CVC template or, in an OT terminology, an undominated constraint against complex codas and onsets *COMPLEX. Consonant deletion applies when a consonant cannot fit into this template. But notice that we could equally well characterize the facts by saying that all consonants in Korean must be adjacent to a vowel. A constraint requiring that consonants be adjacent to a vowel would trigger consonant deletion in the same way as *COMPLEX, without referring to syllables.[24] The Menomini case is equivalent (contrast for the stem /mɛtɛmohs-/ 'woman' the plural form [metɛmohsak] with the singular one [metɛmoh]).[25] Degemination in Turkish follows the same logic (Clements & Keyser 1983): a stem-final geminate consonant surfaces before a vowel-initial suffix but degeminates word-finally and before consonant-initial suffixes (contrast for the stem /hiss-/ 'feeling' the accusative form [hissi] with the nominative one [his] and the ablative one [histen]). In Kamaiurá, consonant deletion is motivated by a CV template, rather than a CVC one as in the three cases above, or an undominated constraint against codas *CODA. This restriction can be reformulated in sequential terms: all consonants have to be followed by a vowel.

[24]Except at word edges, this constraint is also equivalent to *CCC (see previous section), but does not count consonants, something that has been brought as a criticism againt constraints of this type.

[25]According to Kim (Y.-S. 1984), Menomini actually allows C+glide complex onsets. A sibilant is also exceptionally allowed word-finally after a glottal stop.

In Lardil, as seen in (7), non-coronal consonants delete word-finally but surface before a vowel-initial suffix. This has been claimed to follow from a syllable well-formedness condition banning non-coronals from the coda position. Here again, however, the same result would obtain with an equally simple sequential constraint requiring that non-coronals be followed by a vowel. A similar pattern is found in Basque: stem-final stops delete before consonant-initial suffixes but are retained before vowel-initial ones. (Basque differs from Lardil in that extrasyllabic stops are allowed word-finally). A syllable-based analysis straightforwardly derives these facts by assuming that stops cannot be licensed in coda, but stating that stops in Basque want to be followed by a vowel would be equally successful in accounting for the contrast between consonant-initial and vowel-initial suffixes.

Québec French optionally deletes all word-final consonants in C_1C_2 clusters in which C2 is more sonorous than C_1, given the sonority hierarchy proposed in (3). Examples were given in (11). The process follows straightforwardly from the SSP, which requires sonority to fall within the coda. The SSP, however, can be reformulated independently from syllabic constituents. Suppose each language specifies a set of possible sonority peaks, which corresponds to the set of possible syllabic nuclei. French, for example, allows only vowels as nuclei or sonority peaks. I then propose the following sequential version of the Sonority Sequencing Principle:

(21) SONORITY SEQUENCING PRINCIPLE (sequential):
Sonority maxima correspond to possible sonority peaks.

All segments in the string are associated with a certain sonority level. (Local) sonority maxima correspond to segments in the sequence whose sonority value is higher than that of the adjacent segment(s). Consider the three sequences [tun], [tln] and [tr]. In [tun], [u] is a point of maximum sonority because both its adjacent segments are lower in sonority. [u], a vowel, is also a possible sonority peak, so [tun] does not violate the sequential SSP. The case of [tln] is different: [l] is also a sonority maximum, but not a possible peak because it is nonvocalic, in violation of the SSP. Finally, the [r] in a (word-final) sequence [tr] also violates the principle in (21). Therefore both the segmental and syllabic SSP account for final sonorant deletion in Québec French.

The proposed correspondences between syllabic and sequential constraints are summarized below:

(22) CORRESPONDENCES BETWEEN SYLLABIC AND SEQUENTIAL CONSTRAINTS:

a. Korean/Menomini: *Syllabic*: *COMPLEX (CVC template)
Sequential: Consonants are adjacent to vowels

b. Kamaiurá: *Syllabic*: *CODA (CV template)
Sequential: Consonants are followed by a vowel

c. Lardil/Basque: *Syllabic*: *F/CODA (coda condition)
(F a feature or combination of features)
Sequential: F is followed by a vowel

d. Québec French: *Syllabic*: Sonority does not increase from the nucleus to the edges of the syllable
Sequential: Sonority maxima correspond to possible sonority peaks

Note that I am not claiming that the sequential and syllabic constraints above are empirically equivalent in all respects – they are not. For example, the exclusion of stops from the coda position is perfectly compatible with the existence of stop-liquid complex onsets, but a constraint requiring stops to be followed by a vowel also has the effect of banning stop-liquid sequences.[26] Likewise, a sequence [rmt] does not violate the sequential version of the SSP because [m] is not more sonorous than both [r] and [t], but it may violate the syllabic version, depending on the position of syllable breaks in the sequence. If the sequence is syllabified [r.mt] with a boundary between the first two consonants, we have an onset [mt] that is ill formed from the point of view of the syllabic SSP.[27] But a syllabification [rm.t] is unproblematic, [rm] being a well-formed coda.[28] The crucial point here is that the sequential and syllabic constraints do an equally good job of accounting for the deletion patterns in (20e-j).

[26]Modern Basque does allow stop-liquid complex onsets. Does this argue against the sequential constraint proposed above to motivate stop deletion before consonant-initial suffixes? I think not, for the following reason. Although complex onsets are found stem-internally, stem-final stops do delete before all liquid-initial suffixes. So whether we use a coda-based or sequential phonotactic constraint to motivate deletion, we need an additional morphologically-based constraint to distinguish between stem-internal and stem-final stops. In each case one can find a well-motivated constraint to derive the desired facts. Hualde (1997) addresses this issue in a syllable-based approach; see chapter 5 for a sequential alternative.

[27]I have not encountered clear cases where a sequence like [rmt] was ruled out by the SSP, which would support the syllabic version of this principle. As we will see in chapter 2 with respect to the French schwa, sequences that violate the stronger sequential version of the SSP are systematically avoided, but those that only violate the milder syllabic SSP are tolerated, and their behavior can be accounted for in terms of principles and generalizations independent from the SSP. This, I believe, argues for the stronger version.

[28]If a sequence violates the sequential SSP, it necessarily also violates the syllabic version, but not vice versa.

The language that remains to be discussed is English. Borowsky (1986) uses coda conditions to account for word-final consonant deletion in nasal-nasal (*condemn* vs. *condemnation*), voiced stop-nasal (*resign* vs. *resignation*), and nasal-voiced stop (*bomb* vs. *bombard*) sequences, as well as /h/-deletion before a (non-word-initial) unstressed vowel (*vehicle*). These are fairly limited cases, which require specific coda conditions against certain combinations of consonants and a constraint against onset /h/, coupled with a rule that resyllabifies /h/ into the coda of a preceding stressed syllable. To the extent that these coda conditions cannot be established independently from the deletion facts themselves, the analysis faces circularity. More constructively, I believe more insightful non-syllabic accounts are available. I refer to Davis (1999) for a critique of Borowsky's account of /h/-deletion and an alternative proposal in which syllable well-formedness plays no role.[29] The cluster simplification cases would fall out naturally from the special status of stops and the approach to contrast I introduce in my analyses of Hungarian, English, Icelandic, and French in the next section, and more fully develop in chapter 4.

This exhausts the list in (20). I conclude that the syllable never appears to be necessary or even useful in analyzing consonant deletion processes. It does not seem to provide any insight into the nature and characteristics of segmental deletion and epenthesis, or allow a more simple analysis. This conclusion is further supported by patterns of vowel deletion and vowel epenthesis. Cases naturally explained under a syllabic approach fall into the categories in (22), while some others are clearly problematic for it (French schwa). I list below cases of vowel deletion or epenthesis that may be argued to follow from the sequential generalizations in (22):

(23) SEQUENTIAL CONSTRAINTS AND VOWEL DELETION:

a. Consonants are adjacent to a vowel (√ CVCCVC, *CVC<u>C</u>CVC, *#<u>C</u>CV, *VC<u>C</u>#):
Tonkawa, Tepehuan, Cairene Arabic, Chukchi, Lenakel

b. Consonants are followed by a vowel (√ CVCV, *CV<u>C</u>CV, *#<u>C</u>CV, *V<u>C</u>#):
Lenakel (optional)

c. A feature F is followed by a vowel:
Selayarese (F=[place]), Kuuku-Ya'u (F=[coronal])[30]

[29]Davis does use syllables in his analysis, but only in terms of alignment with the stressed syllable. I believe the analysis could equally refer to feet, as Davis himself mentions, or stressed vowels.

[30]The case of epenthesis in Brazilian Portuguese (Olímpio de Magalhães 1999) mentioned in note 7 is unclear but raises interesting questions. Stops are assumed to be banned from the coda position, but tolerated in complex stop-liquid onsets. I do not know, however, what happens in words like *atlas* and *Atlantico*. If epenthesis does not apply, the relevant generalization would be that vowel insertion occurs between a stop and any [-approximant] segment. If it does, the sequential generalization would be more complex, but it does not necessarily argue for a syllabic approach.

d. The SSP:
   Chaha, Romansch, Mongolian, Gallo-Romance, Itelmen

Those in (23a-b) and, to a lesser extent (23d), will play a central role in the discussions and analyses to follow. Consonants tend to delete or trigger vowel epenthesis when they are not adjacent to a vowel. Certain languages obey even stricter requirements and demand that consonants be specifically followed by a vowel; likewise, vowel deletion tends to be blocked when this would leave a consonant that is not adjacent to or followed by a vowel. This generalization forms the basis or cornerstone of the analysis to be developed in the rest of the dissertation. For that reason and in order to faciliate reference to it, I present it in the shaded box below:

Generalization 1:	Consonants want to be adjacent to a vowel, and preferably followed by a vowel.

Additional generalizations will be presented in the following section. All are refinements, more specific instances of this generalization, which identify consonants that need more than others to be adjacent to or followed by a vowel. The SSP, though not itself the focus of this research, will interact in numerous occasions with the proposed generalizations. I repeat it below. It is this sequential definition that I use hereafter whenever I refer to the SSP.

Sonority Sequencing Principle:	Sonority maxima correspond to sonority peaks.

[tl] sequences are indeed standardly assumed to form illegal onsets, [tl] not being an attested word-initial cluster. Internal [tl] are then heterosyllabic and epenthesis is expected. But note that internal heterosyllabicity is not a necessary corequisite of the absence of [tl] initially. The words *atlas* and *Atlantic* are clearly syllabified with coda [t]'s in English, but not in Québec French, even though [tl] is not attested word-initially in either language. I asked two speakers of Québec French to syllabify *atlas* and *Atlantique*; both spontaneously indicated [a.tlas] and [a.tlɑ̃.tik]. One wonders then how speakers of English and Québec French can converge on different syllabic statuses for [tl] in the face of almost identical phonotactics. It could be that they actually use phonetic characteristics of consonants in different positions (e.g. English glottalization) to determine the syllabification, in which case syllabification cannot "precede" the application of segmental processes. On the other hand, the marked status of /tl/ and /dl/ sequences and their distinct behavior from other stop+liquid clusters certainly have a phonetic basis, which has to uncovered. I suspect it has to do with the weakness of coronal stops in preconsonantal position (see discussion of the Attic Greek case later in this chapter and chapter 3 for perceptual motivations). We may get the contrast between /r/ and /l/ after /t,d/ if we accept that /r/ is more sonorous – more "vowel-like" – than /l/. The quality of the stop release burst might also be involved. It is plausible that the burst of alveolar stops is weakened before /l/ because only the lateral constriction of the stop may be released into the /l/, the central one being maintained since it is also involved in the production of the following lateral. More phonetic work is required here.

To conclude, I have argued that syllable well-formedness conditions are unnecessary in accounting for deletion and epenthesis. Were they only unnecessary, we could still have good reasons to use them, in particular if they allowed a unified approach to various segmental and rhythmic processes. But the syllable is not only unnecessary, it is in several contexts clearly inadequate. This is my main argument for seeking an alternative approach to deletion and epenthesis, discussed at length in the coming section.

1.2.3. It is inadequate: a review of some syllabic analyses

This section is devoted to patterns I believe are problematic for the syllabic approach. These include consonant deletion in Hungarian, Attic Greek, English, and Icelandic. Vowel deletion and epenthesis in French will be treated in the next chapter. Discussing these cases also allows me to present some empirical generalizations which will be the focus of the following chapters, and which have gone unnoticed or remained mysterious under a syllabic approach. They are constraints that condition the application of consonant deletion, vowel deletion, and vowel epenthesis:

Generalization 2:	Stops want to be adjacent to a vowel, and preferably followed by a vowel.
Generalization 3:	Stops that are not followed by a [+continuant] segment want to be adjacent to a vowel, and preferably followed by a vowel.
Generalization 4:	Consonants that are relatively similar to a neighboring segment, want to be adjacent to a vowel, and preferably followed by a vowel.
Generalization 5:	Consonants that are not at the edge of a prosodic domain want to be adjacent to a vowel, and preferably followed by a vowel.
Generalization 6:	Coronal stops want to be followed by a vowel.

Hungarian establishes generalizations 2-5; Attic Greek focuses on 6. Generalizations 2-5 are further supported in the remaining cases, and will come back in full force in the discussion of the French schwa.

1.2.3.1. Hungarian cluster simplification and degemination

Hungarian has an optional process of cluster simplification in internal position (Dressler & Siptár 1989; Siptár 1991; Ács & Siptár 1994; Törkenczy & Siptár 1999; Siptár & Törkenczy 2000). This process applies to a subset of sequences of three or more consonants, and always deletes a medial consonant. Dressler & Siptár (1989), Siptár (1991), and Ács & Siptár (1994) suggest that the process is syllabically-driven. More specifically, it is claimed to depend on whether the last two consonants can form a permissible onset. This would account for the contrast between (24), where simplification is possible, and (25), where it is not. All data come from Törkenczy & Siptár (1999) and Siptár & Törkenczy (2000) and appear in their Hungarian spelling, together with the IPA transcription.[31]

(24) CLUSTER SIMPLIFICATION IN HUNGARIAN:

	No simplification	Simplification	
a. *lambda*	[lɔmbdɔ]	[lɔmdɔ]	'lambda'
b. *asztma*	[ɔstmɔ]	[ɔsmɔ]	'asthma'
c. *röntgen*	[røndgɛn]	[røŋgen]	'X-ray'
d. *dombtető*	[domptɛtø:]	[domtɛtø:]	'hilltop'

(25) CLUSTER RETENTION IN HUNGARIAN:

a. *ámbra*	[a:mbrɔ]	*[a:mrɔ]	'ambergris'
b. *eszpresszó*	[ɛspres:o:]	*[ɛsres:o:]	'espresso'
c. *centrum*	[tˢɛntrum]	*[tˢɛnrum]	'center'
d. *templom*	[tɛmplom]	*[tɛmlom]	'church'

The contrast between (24) and (25) derives from the following three assumptions: 1. Complex codas are disallowed (at least word-internally); 2. Consonantal nuclei are not tolerated; 3. Only the most unmarked complex onsets are permitted. From these assumptions it follows that in three-consonant sequences such as those above, the only possible syllabification is [C_1. C2C3]; [C1C2. C3] is excluded by the constraint against complex codas and [C1. C2. C3] by that against consonantal nuclei. So the fate of the clusters in (24)-(25) depends on the well-formedness of C2C3 as complex onsets. The last two members of the clusters in (25) form stop-liquid sequences that constitute typical complex onsets cross-linguistically. These sequences appear in word-initial position as well in Hungarian (26). It is then suggested that they can form complex onsets, which explains the stability of the medial clusters in (25), correctly syllabified [C_1. C2C3], for example [m.br] in (25a). On the other hand, the last two segments in the clusters of (24) – [bd], [tm], [dg], [pt] – are much more marked as complex onsets and do not appear in word-initial

[31]The examples presented here mostly involve word-internal clusters, but simplification is also possible in compounds (i) and across word boundaries (ii).

		No simplification	Simplification	
(i)	a. *lombkorona*	[lompkoronɔ]	[lomkoronɔ]	'foliage of a tree'
	b. *testnevelés*	[tɛʃtnɛvɛle:ʃ]	[tɛʃnɛvɛle:ʃ]	'PE'
(ii)	a. *dobd ki*	[doptki]	[dopki]	'throw (it) out'
	b. *most pedig*	[moʃtpɛdig]	[moʃpɛdig]	'and now'

position (Siptár 1980; Olsson 1992). If it is assumed that these sequences are ill-formed as onsets in Hungarian, no possible syllabification is available for the clusters in (24) and the deletion of the medial segment then just follows from Stray Erasure.

(26) WORD-INITIAL STOP-LIQUID SEQUENCES:

a. *bronz*	'bronze'	b. *prém*	'fur'
c. *tréfa*	'joke'	d. *pléh*	'sheet-metal'

However, Törkenczy & Siptár (1999) and Siptár & Törkenczy (2000) convincingly show that this syllabic approach to cluster simplification cannot hold. Numerous clusters do not simplify, even though the last two segments should not be considered better-formed onsets than those in (24). Consider the data in (27).

(27) NO DELETION IN C1C2C3 CLUSTERS WHERE C2C3 IS NOT A POSSIBLE ONSET:

a. *aktfotó*	[ɔktfoto:]	*[ɔkfoto:]	'nude photograph'
b. *hangsor*	[hɔŋkʃor]	*[hɔŋʃor]	'sound sequence'
c. *handlé*	[hɔndle:]	*[hɔnle:]	'second-hand dealer'
d. *bazaltkő*	[bɔzɔltkø:]	*[bɔzɔlkø:]	'basalt stone'
e. *szerbtől*	[sɛrptø:l]	*[sɛrtø:l]	'from (a) Serb'
f. *sejtmag*	[ʃɛjtmɔg]	*[ʃɛjmɔg]	'cell nucleus'
g. *szenvtelen*	[sɛnftɛlɛn]	*[sɛntɛlɛn]	'indifferent'
h. *narancsból*	[nɔrɔndʒbo:l]	*[nɔrɔnbo:l]	'from (an) orange'

None of the final two consonants in the underlined sequences in (27) appears in initial position in Hungarian, and all are rather marked crosslinguistically as complex onsets. In fact, the last two consonants are in some cases identical or almost identical to those found in (24). See [tm] in (27f) and (24b), [pt]/[bd] in (27e), (24d) and (24a), [tk]/[dg] in (27d) and (24c). Yet consonant deletion occurs in the examples in (24) but not in those in (27). Therefore, simplification cannot be related to the well-formedness as onsets of the last two consonants.

Törkenczy & Siptár (1999) and Siptár & Törkenczy (2000) propose that deletion of the middle consonant in three-consonant clusters conforms to the following generalizations:[32]

[32]Kenesei et al. (1998: 388) also mention cases of word-initial consonant deletion in "substandard dialects and in fast speech styles". These also mainly target stops, when they are followed by a nasal or another obstruent (see 28b): /pt-, ps-, pn-, ks-, kn-, gn-/. Strident fricatives in the same position never delete (/sk-, sp-, sf-, sn-, etc./), except when followed by another strident fricative or affricate /ʃtʃ, stʃ/. The remaining cases of possible deletion include: /ft-, mn-, ng-, hr-/. These cases will not be discussed any further.

(28) GENERALIZATIONS IN CONSONANT DELETION (T&S 1999; S&T 2000):
- a. Only stops delete; fricatives and affricates never do (27g-h).
- b. Stops do not delete if preceded by a [+sonorant, +continuant] segment: glides (27f) and liquids (27d-e).
- c. Stops do not delete if followed by a [+continuant] segment: glides (31b), liquids (25, 27c), and fricatives (27a-b).

These generalizations are further supported by the examples below, also from Törkenczy & Siptár (1999) and Siptár & Törkenczy (2000). (29) illustrates the non-deletion of fricatives and affricates, even if the preceding segment is not a liquid or glide and the following one not [+continuant]. In (30) and (31) the medial stop is stable because it is preceded by a liquid or glide (30) or followed by a liquid, glide or a fricative (31).

(29) NO DELETION IN C1C2C3 CLUSTERS IF C2 IS A FRICATIVE/AFFRICATE:

a.	*könyvtár*	[kønʲfta:r]	*[kønʲta:r]	'library'
b.	*eksztázis*	[ɛksta:ziʃ]	*[ɛkta:ziʃ]	'extasy'
c.	*Amszterdam*	[ɔmstɛrdɔm]	*[ɔmtɛrdɔm]	'Amsterdam'
d.	*inspekció*	[inʃpɛktˢio:]	*[inpɛktˢio:]	'inspection'
e.	*obskurus*	[opʃkuruʃ]	*[opkuruʃ]	'obscure'
f.	*lánctalp*	[la:ntˢtɔlp]	*[la:ntɔlp]	'caterpillar track'
g.	*táncdal*	[ta:ndᶻdɔl]	*[ta:ndɔl]	'popular song'
h.	*parancsnok*	[pɔrɔntʃnok]	*[pɔrɔnnok]	'commander'

(30) NO DELETION IN C1C2C3 CLUSTERS IF C1 IS A LIQUID OR GLIDE:

a.	*talpnyaló*	[tɔlpnʲɔlo:]	*[tɔlnʲɔlo:]	'lackey'
b.	*partner*	[pɔrtnɛr]	*[pɔrnɛr]	'partner'
c.	*fajdkakas*	[fɔjdkɔkɔʃ]	*[fɔjkɔkɔʃ]	'black cock'

(31) NO DELETION IN C1C2C3 CLUSTERS IF C3 IS [+CONTINUANT]:

a.	*pántlika*	[pa:ntlikɔ]	*[pa:nlikɔ]	'ribbon'
b.	*kompjúter*	[kompju:tɛr]	*[komju:tɛr]	'computer'
c.	*pemzli*	[pɛmzli]	*[pɛmli]	'brush'

The restriction to stops in this deletion pattern is just the first instance of a generalization that we will find again in numerous other deletion and epenthesis processes to be described in this section and the following chapters. Stops are more likely than other consonants to delete, trigger vowel epenthesis, or block vowel deletion. I interpret this as a more restrictive subcase of the first generalization: stops, more than other consonants, want to surface next to a vowel. I take this to be

the basic motivation in Hungarian for deleting stops that find themselves in interconsonantal position. Other languages, described in chapter 5, also delete stops that are not *followed* by a vowel, e.g. Basque and Marais-Vendéen. This constitutes our second generalization.

Generalization 2: Stops, more than other consonants, want to be adjacent to a vowel, and preferably followed by a vowel.

Notice, however, that it is not the case that all stops surface next to a vowel in Hungarian: stops are often found in interconsonantal position, as in numerous examples in (25), (27), (30), and (31). The point is that only stops delete, and they do so only in interconsonantal position. But deletion is subject to additional conditions, to which I turn next.

The stability of stops before [+continuant] segments reflects transparently the next generalization. As will be explained in more detail in chapter 3, the role of the continuancy value of the following element on stop deletion can be related to the well-known tendency for stops to be possibly "unreleased", that is to lack an *audible* release, in certain contexts, essentially before [-continuant] consonants (oral and nasal stops) and in final position (Laver 1994: 359-360). These contexts form the complement set to [+continuant] elements. Since the burst plays an important role in the perception of stops, we can make sense of their greater vulnerability when not followed by a continuant segment.[33]

Generalization 3: Stops that are not followed by a [+continuant] segment want to be adjacent to a vowel, and preferably followed by a vowel.

The fact that stops do not delete when preceded by a liquid or glide can be interpreted in terms of contrast in manner of articulation. Stops may delete only if preceded by a relatively similar consonant; deletion is blocked by a bigger contrast between the two segments. Stops contrast with liquids and glides in both continuancy and sonorancy, but in none or only one of these features with nasals and obstruents. Alternatively, we can use the major class system proposed in Clements (1990). Three major class features are used to distinguish among the consonants, which are defined in the following way:

[33] It will become clear in the discussion of the French case why adjacency to vowels is important in the formulation of this and the following two generalizations, and why the correct one could not simply be something like "Consonants want to be followed by a [+continuant] segment" or, for the following generalization, "Consonants want to be adjacent to segments that are relatively dissimilar".

(32) CLEMENTS'S (1990) MAJOR CLASS FEATURES:

	Obstruents	Nasals	Liquids	Glides
Sonorant	–	+	+	+
Approximant	–	–	+	+
Vocoid	–	–	–	+

The level of contrast between two classes of consonants can be derived by comparing the number of plus- or minus-specifications they are associated with. Obstruents have no plus-specifications, liquids and glides have (at least) two: [sonorant] and [approximant]. Stops thus contrast more with liquids than with nasals, which have only one plus-specification [sonorant], or fricatives. This is the system I will use in chapter 4 to deal with contrast in manner of articulation.

The role of contrast extends beyond manner of articulation and the data presented so far. It appears that when the conditions for deletion are met, not all stops are as likely to be dropped. An additional factor in the likelihood of deletion is homorganicity. A medial stop more readily deletes when it agrees in place of articulation with the preceding consonant than when it does not (Törkenczy, p.c.). Compare the two forms in (33), which contrast in the place of articulation of the medial stop – velar in (33a), alveolar in (33b) – the flanking consonants being alveolar and labial in both cases. Both stops may be dropped but according to Törkenczy, deletion is more frequent and natural in *parasztból*, in which C_1 and C_2 share the same point of articulation, than in *Recskből*. Note that it is really homorganicity, and not the coronality of the medial stop itself, that favors deletion, since non-coronal stops homorganic with the preceding segments also readily delete, as in (24a, 24d) repeated below.

(33) STOP DELETION MORE LIKELY IN HOMORGANIC CLUSTERS:

a.	*Recskből*	[rɛdʒgbøːl]	[rɛdʒbøːl]	'from Recsk'
b.	*parasztból*	[pɔrɔzdboːl]	[parazboːl]	'from the peasant'

(24)

a.	*lambda*	[lɔmbdɔ]	[lɔmdɔ]	'lambda'
d.	*dombtető*	[domptɛtøː]	[domtɛtøː]	'hilltop'

These facts about manner and place of articulation can be generalized and suggest that the more contrast there is between the medial stop and the adjacent segments, the more likely simplification is. In other words, dissimilarity with adjacent consonants protects the stop from deletion. It also prevents vowel epenthesis. This follows from the following generalization, to which chapter 4 will be

entirely devoted. This generalization is obviously related to the OCP, but requires a more general approach to contrast.

Generalization 4: Consonants that are relatively similar to a neighboring segment want to be adjacent to a vowel, and preferably followed by a vowel.

Contrast in manner of articulation is also a major factor in the likelihood of degemination, interpreted as a specific instance of consonant deletion. According to Siptár (2000), the traditional generalization concerning geminates in Hungarian is that they only occur intervocalically (e.g. *áll Attila* 'Attila stands') and utterance-finally if preceded by a vowel (*áll* 'stand'). But this view is oversimplified: retention of gemination is in many contexts optional, and its likelihood depends on the nature of the flanking segments and the morphological and prosodic structure.

Siptár (2000), after Nádasdy (1989), distinguishes between underlying geminates (ex. *áll* 'stand'), those that arise from assimilation processes (ex. *báty-ja* [tʲː] 'his brother'), and those that arise through the juxtaposition of identical consonants at morpheme and word boundaries (ex. *comb-ból* 'from thigh'). The first two types (underlying and assimilation-based) constitute *true* geminates; they pattern together and contrast in their behavior with juxtaposition-based or *fake* geminates. Degemination occurs only next to a consonant, and a distinction is made between left-flanked and right-flanked geminates. Left-flanked true[34] geminates arise only at the word level and degemination is obligatory. I disregard this process of degemination and focus on the other cases of degemination, which apply to right-flanked true geminates and right- and left-flanked fake geminates.

Let us first look at fake or juxtaposition-based geminates, which optionally undergo degemination when preceded or followed by a consonant. Two cases arise: left-flanked geminates involve a morpheme/word ending in a cluster followed by a consonant-initial morpheme/word ($C_1C_2\#C_2$); right-flanked geminates occur at boundaries between a final consonant and an initial cluster ($C_1\#C_1C_2$). For them Siptár (2000) provides the following hierarchy of probability: degemination is most likely if the flanking consonant is an obstruent (O), less likely if it is a nasal (N), and least likely if it is a liquid (L). (See also Kenesei et al. 1998: 448.) This hierarchy holds across all morphological and prosodic contexts. The examples below illustrate the process with left-flanked (34) and right-flanked (35) geminates in compounds and at

[34] The case for underlying left-flanked geminates is not clear; they occur at best in very limited contexts. See Siptár (2000).

word boundaries.[35] Since all initial and practically all final clusters begin and end, respectively, in an obstruent, this type of gemination concerns mostly obstruents.

(34) DEGEMINATION OF FAKE LEFT-FLANKED GEMINATES:

a. In compounds:

O-	*direkttermő*	[dirɛkt(:)ɛrmø:]	'a type of wine'	| degemination
N-	*csonttányér*	[tʃont(:)a:nʲe:r]	'bone plate'	| less
L-	*talppont*	[tɔlp(:)ont]	'foot-end'	↓ likely

b. In phrases:

O-	*most talán*	[moʃt(:)ɔla:n]	'now perhaps'	| degemination
N-	*tank körül*	[tɔŋk(:)øryl]	'around tank'	| less
L-	*szerb bor*	[sɛrb(:)or]	'Serbian wine'	↓ likely

(35) DEGEMINATION OF FAKE RIGHT-FLANKED GEMINATES:

a. In compounds:

-O	*kisstílű*	[kiʃ(:)ti:ly:]	'petty'	| degemination
-N	*őssmink*	[öʃ(:)miŋk]	'proto-make-up'	| less
-L	*széppróza*	[se:p(:)ro:zɔ]	'prose fiction'	↓ likely

b. In phrases:

-O	*olasz sztár*	[olɔs(:)ta:r]	'Italian (film) star'	| degemination
-N	*kész sznob*	[ke:s(:)nob]	'a perfect snob'	| less
-L	*ügyes srác*	[ydʲɛʃ(:)ra:tˢ]	'smart boy'	↓ likely

These data can be interpreted in terms of syntagmatic contrast, using the feature specifications in (32). In cluster simplification, a stop adjacent to a liquid – that is, which contrasts in the feature [approximant] with a neighboring segment – is stable; see the examples in (27d-f) and (30). The same holds here, if we see the geminate as two segments: gemination is generally maintained when the geminate surfaces next to a liquid. When a geminate obstruent is adjacent to a nasal, it shows less contrast, i.e. only a contrast in the feature [sonorant] but not [approximant]. In this case degemination is more likely. When no contrast exists (according to the specifications in (32)), degemination is almost obligatory. This situation arises when the geminate occurs next to an obstruent.

Dressler & Siptár (1989) identify an additional factor in the likelihood of degemination: the strength of the prosodic boundary the geminate is adjacent to. The weaker the boundary, the more likely degemination is. They cite the following contrast between *párt#tag* 'party member' and *tart tőle* 'be afraid of'. The two forms

[35]Left-flanked geminates also occur at suffix boundaries, but right-flanked ones do not, since there are no instances of suffixes beginning in a cluster attaching to consonant-final morphemes.

contain identical consonant sequences but degemination is more likely in the first one, in which the double consonant is only adjacent to a compound boundary, than in the second one, which involves a word boundary. The same hierarchy should hold within the data in (34) and (35).

I now turn to right-flanked underlying/assimilation-based (true) geminates. These provide a better illustration of the effect of the prosodic boundary and further support the role of contrast. Almost all consonants in Hungarian can be underlyingly geminated morpheme-finally. Dressler & Siptár (1989) state that geminate obstruents followed by another obstruent obligatorily degeminate word-internally, before suffixes as well as in compounds (36a-b). However, if the geminate and the following consonant contrast in sonorancy, they note that degemination may be avoided in formal speech (36c-e).

(36) DEGEMINATION OF TRUE RIGHT-FLANKED GEMINATES WORD-INTERNALLY:

a.	*lakktól*	/lɔk:-to:l/		[lɔkto:l]	'from varnish'
b.	*üsd*	/yt-j-d/	(33d)	[yʒd]	'hit it!'
c.	*hallgat*	/hɔl:-gɔt/		[hɔl(:)gɔt]	'listen'
d.	*sakkra*	/ʃɔk:-rɔ/		[ʃok(:)rɔ]	'to chess'
e.	*mennybe*	/mɛɲ:-bɛ/		[mɛɲ(:)bɛ]	'into heaven'

In phrasal domains degemination is always optional and its likelihood correlates with the strength of the adjacent boundary. (37) shows a series of examples involving the sequence /ɲ:-b/, with an increasingly strong boundary from a. to g. Siptár (2000: 115) and Dressler & Siptár (1989) express this generalization in terms of syntactic boundaries. I believe this can unproblematically be reinterpreted in terms of prosodic boundaries.

(37) DEGEMINATION OF TRUE RIGHT-FLANKED GEMINATES ABOVE THE WORD:

a.	*menny+be*	'into heaven'	affix boundary	|
b.	*menny#bolt*	'firmament'	compound boundary	|
c.	*menj be*	'go in!'	clitic boundary	| Degem-
d.	*menj balra*	'go left!'	word boundary	| ination
e.	*menj, Béla*	'go, Béla!'	phrase boundary	| less
f.	*menj, bár*	'go, although...'	clause boundary	| likely
g.	*Menj. Balfelő*	Go! On the left-hand side...'		|
			sentence boundary	↓

This establishes the final generalization about Hungarian, which concerns prosodic structure. It should be interpreted in a cumulative fashion. That is, for any domain i, consonants at the edge are licensed more easily than domain-internal consonants. It follows that consonants at the edge of domain i are licensed more easily than consonants at the edge of domain j, if the edge of domain i constitutes a stronger boundary than the edge of domain j (in other words if domain i is higher in the prosodic hierarchy than domain j).

Generalization 5: Consonants that are not at the edge of a prosodic domain want to be adjacent to a vowel, and preferably followed by a vowel.

This concludes our description of consonant deletion in Hungarian, which, as it will become clear after discussing these generalizations, has the ingredients of a classic case of cluster simplification, subject to well-attested and motivated constraints.

1.2.3.2. Attic Greek coronal stop deletion

In Attic Greek the possible contexts of occurrence of stops with different points of articulation are severely restricted. In Steriade (1982), followed by Itô (1986), these restrictions are said to result from a coda condition against stops, all cases of deletion resulting from Stray Erasure. In this section I argue that this syllable-based analysis is not desirable, for three different reasons. First, it does not account for the full range of facts in Attic Greek itself. Second, it crucially relies on restrictions on the application of a laryngeal assimilation rule that are not well motivated. Third, it is disconnected from other processes, in Greek as well as other languages, that achieve the same purpose: avoid certain stops in certain contexts. More specifically, I propose that the Attic Greek facts follow from a purely sequential constraint against coronal stops in pre-consonantal, in particular pre-obstruent, position (Wetzels 1989; Y. Kang 1999, 2000). This constitutes our sixth generalization:

Generalization 6: Coronal stops want to be followed by a vowel.

Generalizations on attested non-geminate stops in Attic Greek can be summarized as follows:

(38) GENERALIZATIONS ON THE OCCURRENCE OF STOPS IN ATTIC GREEK:
   a. Non-coronal and coronal stops appear before sonorants.
   b. Only non-coronal stops appear before obstruents; in this case the second obstruent is always a coronal.
   c. No stops may appear in word-final position.

All morpheme-initial and morpheme-internal stops conform to the generalizations in (38a-b), as illustrated below. All data are taken from Steriade (1982). Syllable boundaries, as given in this reference, are indicated by a dot when relevant.

(39) INTERNAL CORONAL AND NON-CORONAL STOPS IN PRE-SONORANT POSITION:

a. ʰag.nos	'holy'	b. or.pʰnɛː	'darkness'
c. ked.nos	'careful'	d. es.tʰlos	'good'

(40) INTERNAL NON-CORONAL STOPS IN PRE-OBSTRUENT POSITION:

a. ok.tɔː	'eight'	b. ʰeb.do.ma	'week'
c. ark.sai	'to have begun'	d. skep.sis	'consideration'

(41) INITIAL CORONAL AND NON-CORONAL STOPS IN PRE-SONORANT POSITION:

a. gnɔːmɛː	'judgement'	b. pʰlauros	'petty'
c. dnopʰos	'darkness'	d. tlaɔː	'to endure'

(42) INITIAL NON-CORONAL STOPS IN PRE-OBSTRUENT POSITION:

a. kteːnɔː	'to kill'	b. ptuttɔː	'to spit'
c. ksenos	'stranger'	d. psauɔː	'to touch'

When a stop finds itself in a disallowed environment, through morpheme concatenation, a repair strategy must be adopted. Deletion is of course one of them, and it is used in two contexts: word-finally (when a stem is followed by a null inflectional suffix) (43) and for coronal stops that appear before a non-coronal obstruent (44). The data in (44) are to be contrasted with those in (45), where a non-coronal obstruent remains before a coronal one.[36]

(43) DELETION OF WORD-FINAL STOPS:

a. /gunaik+ø/	→	[gunai]	'woman+VOC'
b. /melit+ø/	→	[meli]	'honey+VOC'

(44) DELETION OF CORONAL STOPS BEFORE A NON-CORONAL OBSTRUENT:

a. /ke+komid+k+a/	→	[kekomika]	'I have provided'
b. /pe+pɛːtʰ+k+a/	→	[pepɛːka]	'I have persuaded'

(45) RETENTION OF NON-CORONAL STOPS BEFORE A CORONAL OBSTRUENT:

a. /leg+tʰɛːsomai/	→	[lekʰtʰɛːsomai]	'I will be counted'

[36] Steriade (1982: 300) notes that verbal stems ending in a labial or velar stop do not take the perfect /k/ suffix used in (44), so that no direct comparison is possible here between coronal and non-coronal stops in the same pre-stop context.

b. /plek+dɛ:n/ → [plɛgden] ‘entwined’

As a special case, non-coronal stops remain before the word-final vocative suffix /s/, which is assumed to be the only final extraprosodic consonant allowed in Attic Greek (46). By contrast, stems ending in a coronal stop do not take the vocative suffix /s/ and always lose they final segment, as in (43b).

(46) NON-CORONAL STOPS BEFORE THE VOCATIVE SUFFIX /-s/:

a. /pʰleb+s/ → [pʰleps] ‘vein.VOC’
b. /pʰula:k+s/ → [pʰula:ks] ‘guard.VOC’

Golston (1996) reports that the vocative suffix /s/ in Greek is historically epenthetic. It is hypothesized that it was added to save stem-final labial and velar stops from deletion.[37] I suggest that /s/ epenthesis after final stops may be related to the third generalization, presented in the context of Hungarian: a stop wants to be followed by a [+continuant] segment. In final position after a stop, a fricative is the only epenthetic segment that will comply with the desire for stops to be followed by a [+continuant] segment, without generating a violation of the SSP or create an additional syllable or sonority peak. A similar process of /s/ epenthesis after stops can be found in Limburg Dutch (Hinskens 1996). But this hypothesis clearly needs to be investigated further. Now, why was /s/ not added to stems ending in coronal stops? A possible reason is that this would not have saved coronal stops from deletion anyway, since, as we will see below, they were subject to assimilation and deletion before coronal obstruents.

Steriade (1982), followed by Itô (1986), proposes a syllabic account of the restrictions on obstruents in Greek. The idea is that Greek imposes a coda condition that bans all stops from this position, formulated as follows by Itô (1986):

(47) ATTIC GREEK CODA CONDITION (Itô 1986):

```
   * C]σ
     |
[-son, -cont]
```

This coda condition directly takes care of the data in (43). The final stop can neither be an onset nor an extraprosodic segment (/s/ being the only extraprosodic consonant allowed). It cannot be incorporated into a coda because of the coda

[37] Note that the form in (43a) is one of the exceptions to the addition of the vocative /s/. Another such exception is *ana* ‘king.VOC’, which is found only in Homer, other dialects having regular *anaks*.

condition (47). It is therefore stray-erased. For this analysis to account for the behavior of other stops, three additional hypotheses are necessary. The first one relates to the syllabification rules of consonant clusters. Steriade argues that all sequences of a voiceless stop followed by a sonorant and a voiced stop followed by [r] obligatorily form complex onsets. Sequences of a voiced stop followed by a liquid ([bl, gl]) may also constitute complex onsets, but this is only an option. The stops in (39b,d) and (41b,d) are all voiceless and followed by a sonorant; therefore they are part of complex onsets and are not subject to the coda condition.

The second additional hypothesis has to do with the constraints on the application of coda conditions. Crucially, coda conditions apply only to singly-linked segments, i.e. segments that are exhaustively contained in the coda. This linking constraint, developed in Hayes (1986b), saves from Stray Erasure consonants that have doubly-linked features with the following onset or extrametrical segment. Steriade (1982) proposes for Attic Greek a Laryngeal Feature Assimilation (LFA) rule that spreads the laryngeal features of a *coronal* to the preceding obstruent. Sequences such as /gtʰ/ (45a) /kd/ (45b) and /bs/ (46a) become respectively [kʰtʰ], [gd] and [ps] by LFA. The example in (45b) is illustrated in (48a). Through this assimilatory process, non-coronal stops preceding coronal obstruents escape deletion: laryngeal features being now doubly linked in these sequences, the coda condition against stops does not apply, and [g] is safely incorporated (and licensed) in coda position. The same mechanism applies (vacuously or not) in (39a,c) and (40).

(48) LARYNGEAL FEATURE ASSIMILATION AND STRAY ERASURE:

a.
```
      Rime Onset
       /\    |
C C V C  C V C
| |  | |  | | |
p l  e k  d ɛ: n          →        [plegdɛ:n]
       ≠⋰  |
[-voice] [+voice]
```

b.
```
               Rime  Onset
                 | ⟍ |
C C V C  C V  C C V
| |  | |  | |  | | |       Stray Erasure
k e- k o  m i  d- k a          →          [kekomika]
               |  |
             [+v] [-v]
```

But the coda condition against stops does apply to the forms in (44), in which the stop is followed by a non-coronal obstruent. Since laryngeal spreading does not originate from non-coronals, the preceding coronal stop does not contain doubly-linked laryngeal features and is consequently subject to the coda condition. It cannot be incorporated into a syllabic constituent and is subsequently stray-erased. This is illustrated in (48b) for the example in (44a). The consonant [d] has not linked features with the following onset [k], so it cannot form a coda and attach to the preceding rime.

The final hypothesis concerns word-initial consonants that can neither be part of a complex onset nor be incorporated into a coda at the word-level, i.e. those in (41a,c) and (42). These consonants are saved from deletion by syllabifying as codas at the phrasal level, or adjoining to the following syllable by a late adjunction rule.

This analysis accounts for the given data, but there are reasons to doubt that it is the correct one. Two of these reasons have also been mentioned by Yip (1991). First, recall that the generalizations in (38a-b) – the contrast between coronal and non-coronal stops in pre-obstruent position – apply not only to coda stops but also to word-initial sequences. This total convergence is accidental in the syllabic account, since word-initial stops are licensed by a completely separate mechanism, i.e. late adjunction or extrasyllabicity. I believe the ideal analysis should unify those cases, and such an analysis seems not to be syllabically-conditioned, since the data to be accounted for are found in different syllabic positions. The discussion to follow further supports this point.[38]

Second, the laryngeal linking constraint on the application of the coda condition crucially depends on LFA being triggered only by coronals. The evidence brought by Steriade for this restriction in Attic Greek is unclear, as it relies on a delicate issue of phonetic interpretation of orthographic signs. Furthermore, I am

[38]Yip (1991) also extends this criticism to Diola Fogny. This language allows only homorganic consonant clusters: nasal-stop ones, plus, morpheme-internally, /lt/ and /rt/. Other clusters automatically simplify by deletion. Steriade's (1982) and Itô's (1986) account of these data (based on Sapir 1965) involves a coda condition against all consonants, which does not apply to those that have doubly-linked place features. However, Diola Fogny also permits extra consonants at both edges of words, e.g. [mba] 'or', [bunt] 'lie'. Clusters at word edges are subject to the homorganicity condition, just like word-internal ones, but the coda condition does not deal with word-initial ones. Again, this convergence is accidental in the syllabic analysis. To remedy this problem, Yip suggests that Diola Fogny rather obeys a cluster condition, that prohibits adjacent consonants with more than one place specification, coronals being unspecified for place. I concur with Yip that consonant deletion and phonotactics in Diola is not syllabically-based. But a complete analysis of the facts has yet to be developed, since the cluster condition alone allows numerous unattested clusters.

not aware of a cross-linguistic tendency for laryngeal assimilation to be preferentially triggered by coronals (see Steriade 1999c). Steriade (1982: 231-232 and section 5.5.5) argues that there is no voicing assimilation in the /s/+non-coronal stop clusters. The data she mentions are *pelasgos* and *presbus*, in which the clusters are spelled <sg (σγ)> and <sb (σβ)> respectively. This contrasts, I assume, with the absence of clusters spelled <sd (σδ)>. It is not clear, however, how the sign <σ> should be interpreted phonetically. The difficulty here lies in the fact that there was no sign to transcribe the sound [z], but there was one for the sequence [zd], i.e. <ζ>. Assimilation in /s/+coronal stop clusters was therefore easy to transcribe, but not that in /s/+non-coronal stop sequences. It is conceivable that <σ> was used for both [s] and [z] in contexts other than [zd], and that assimilation took place from coronal and non-coronal obstruents alike. Steriade thinks it was not the case, and argues that <δ> could be used to transcribe [z], and would have been used in words like *pelasgos* and *presbus* if assimilation had applied. One would prefer to have more solid arguments for restricting laryngeal assimilation to coronal triggers, especially given the crucial role that this restriction plays in Steriade's syllabic account. But in any case, there are additional empirical problems with this analysis, to which I now turn.

The syllabification rules argued for by Steriade (1982) were also crucial, specifically the fact that all voiceless stop+sonorant clusters obligatorily form complex onsets. Since these sequences disagree in voicing, the stop cannot have doubly-linked laryngeal features and must be in onset position to avoid stray erasure (if it is not subject to word-initial adjunction). This syllabification rule, however, is questionable, and has been revised in Steriade (1999c). In this later paper she supports syllabifications like [mak.ro.te.ros] 'longer', with voiceless stops in coda position (see also Devine & Stephens 1994). Golston (1996) also gives the syllabifications [a.rit^h.mos] 'number' and [e.ret.mon] 'oar', but does not justify them. A second crucial assumption for the syllabic analysis to work thus turns out to be problematic. This point will become even clearer when I discuss the Latin facts below.

The third objection that can be raised against this account is that it misses what seems to be the correct generalization. The discussion so far has ignored one important category of data: what happens to coronal stops when they precede another coronal obstruent? The approach presented predicts that coronal stops should be licensed in coda position in this case, since LFA is expected to take place. In fact, no sequence of a coronal stop followed by a coronal obstruent surfaces in Greek. The difference from clusters of a coronal stop before a *non*-coronal obstruent is that here the stop does not delete, as in (44), but becomes [+continuant]. This is true both before /t,d/ (49a-b) and before /s/ (49c-e). Laryngeal assimilation and degemination subsequently apply.

(49) FRICATIVIZATION OF CORONAL STOPS BEFORE CORONAL OBSTRUENTS:

a.	/komid+tɛː+s/	→	[komistɛːs]			'one who takes care of'
b.	/koruth+tɛː+s/	→	[korustɛːs]			'man with a helmet'
c.	/pod+si/	→	(possi)	→	[posi]	'foot+DAT.PL'
d.	/ornith+si/	→	(ornissi)	→	[ornisi]	'bind+DAT.PL'
e.	/kharit+s/	→	(khariss)	→	[kharis]	'??+NOM.SG'

This change in continuancy is accounted for by Steriade by a linear rule triggered by and targeting coronal obstruents, a rule that is completely disconnected from stray erasure of coronal stops before non-coronal obstruents. (They are in some sense radically different as one is sequential and the other one prosodic.) Notice, however, that the result of the continuancy and deletion rules is the same: they both remove coronal stops from a pre-obstruent position. If the two processes have the same motivation, they should be linked in the grammar, which is not the case here. Data beyond Attic Greek strongly suggest that they should indeed be put together, as the avoidance of coronal stops in pre-obstruent (and more generally pre-consonantal[39]) position is a well-attested tendency cross-linguistically (Blust 1979; Y. Kang 1999, 2000), and is achieved by a variety of means. Attic Greek uses stop deletion and fricativization, Tagalog metathesis and assimilation. Yakut (Wetzels 1989) and Latin use assimilation alone.[40] This convergence of the Greek facts with known crosslinguistic tendencies provides strong evidence that coronal stop deletion in this language is not syllabically-driven but motivated by a stricty sequential constraint against pre-obstruent coronal stops. The shortcomings of the prosodic approach to the deletion process further support this conclusion.

A comparison with Latin sheds additional light on the Greek data. Word-internally, Latin looks just like Attic Greek and the generalizations in (38a-b) equally apply to it. Coronal stops are allowed before a sonorant (50), but only non-coronal ones appear before an obstruent (which is always coronal in this case) (51)-(52). The discussion of the Classical Latin facts is based primarily on Jacobs (1989).

[39]Coronal stops may also delete, fricativize, or assimilate before sonorant consonants in both Greek and Latin, but the relevant cases are restricted to specific (morphological) contexts, and are much more limited than before obstruents. The language retains numerous examples of coronal stop+sonorant sequences. This suggests that coronal stops are marked before all consonants, but more so before obstruents.

[40]The weakness of pre-consonantal coronal stops is also reflected in English in the behavior of word-final stops. Coronal stops assimilate to a following obstruent (*ten pounds* [mp], *hot cakes* [kk]), but non-coronal ones remain intact (*home town* *[nt], *ping pong* *[mp]) (Mohanan 1993; Jun 1995).

(50) CORONAL STOPS BEFORE A SONORANT:
a. *rhythmus* 'symmetry, rhythm'
b. *athleta* 'athlete'
c. *atlantion* 'atlas (the first cervical vertebra)'

(51) MORPHEME-INTERNAL NON-CORONAL STOPS BEFORE AN OBSTRUENT:
a. *doctor* 'doctor'
b. *sculptor* 'sculptor'

(52) NON-CORONAL STOPS BEFORE AN OBSTRUENT ACROSS A BOUNDARY:

a.	*clepsi*	/klep+si/	'steal+PERF'
b.	*dixi*	/dik+si/	'say+PERF'
c.	*urbs*	/urb+s/	'city+NOM.SG'
d.	*arx*	/ark+s/	'stronghold+NOM.SG'

One interesting point about the data in (50) is that both Steriade (1982) and Jacobs (1989) argue that [tm] and [tl] can clearly not form complex onsets in Latin, in particular because they do not appear word-initially (except in the Greek borrowing *tmesis*). The voiceless stop therefore has to be in the coda, and the coda condition+LFA approach proposed for Greek cannot work for Latin. Yet the two languages look so similar that one expects a similar analysis.

However, Latin differs from Attic Greek in the strategy used to prevent coronal stops from appearing before an obstruent. In Latin coronal stops assimilate to the following obstruent, yielding a geminate consonant. This is true both before coronal and non-coronal obstruents. Thus, unlike Greek, Latin treats all pre-obstruent coronal stops alike, and this further casts doubt on the radical distinction made between the deletion and fricativization processes in Greek. For example, coronal stops assimilate before the suffix /-kus/ (Steriade 1982: 277-278) (53a), the nominative singular /s/ (53b-c) or the perfective suffix /-si/ (53d-f) (Monteil 1970). Degemination of the resulting geminate takes place word-finally and after a consonant, a long vowel, or a diphthong (Monteil 1970: 311).[41] The forms in (53) contrast with those in (52), in which the stem ends in a non-coronal stop. Massive regressive assimilation is also found at the boundary between the prefix *ad-* and consonant-initial stems, e.g. /ad-porto/ → *apporto*, /ad-grego/ → *aggrego*. *Ad-* contrasts with *ab-* in this respect, e.g. /ab-grego/ → *abgrego*.

[41]In fact, Jacobs (1989) ambiguously talks about deletion and assimilation of coronal stops in Latin. Since all the examples he gives involve degemination (except the crucial case in (53f) in a footnote), deletion and assimilation yield identical results. Monteil (1970) is clear about assimilation.

(53) ASSIMILATION OF CORONAL STOPS BEFORE AN OBSTRUENT:

a.	*siccus*	/sit+ko+s/	'dry+NOM.SG'	(cf. *sitis*	'thirst')
b.	*cohors*	/cohort+s/	'cohort+NOM.SG'	(cf. *cohorti*	'cohort+GEN.SG')
c.	*lis*	/lit+s/	'fight+NOM.SG'	(cf. *litis*	'fight+GEN.SG')
d.	*clausi*	/claud+si/	'close+PERF'	(cf. *claudo*	'close+PRES.1SG')
e.	*sensi*	/sent+si/	'feel+PERF'	(cf. *sentio*	'feel+PRES.1SG')
f.	*concussi*	/concut+si/	'feel+PERF'	(cf. *concutio*	'feel+PRES.1SG')

To complete the description of the Latin patterns, a quick word about the fate of word-final stops. If Latin looks like Attic Greek word-internally, it differs from it word-finally. Whereas Greek disallows all stops in this position (38c), Latin permits them.

(54) WORD-FINAL STOPS IN LATIN:
a. *caput* 'head'
b. *lac* 'milk'

Let us now return to our initial concern about the syllabic motivation for consonant deletion. What can we conclude from the discussion on Greek? The syllabic account based on a coda condition is problematic for Greek itself, and it cannot extend to very similar facts in related languages, as shown by Latin. An analysis of the generalizations on stops in the two languages should rest on the general tendency to avoid pre-consonantal, in particular pre-obstruent, coronal stops. This was our sixth generalization, repeated below. Pre-obstruent stops typically occur in coda, but are by no means restricted to this position. It follows that a phonological account of this phenomenon should be sequential rather than syllable-based in character.[42] Wetzels's (1989) Preconsonantal Decoronalization

[42]Yip (1991) also concludes that the obstruent cooccurrence restrictions in Greek are not syllabically-driven but obey a cluster condition defined on sequences of consonants (see note 38). The alternative analysis she proposes, however, is not satisfactory. Her cluster condition states that adjacent consonants cannot have more than one place specification, coronals being unspecified for place. This linear condition explains the absence of clusters like [kp], with two non-coronals, in Greek, but does not alone account for the contrast between /kt/, which surfaces intact, and /tk/, which simplifies to [k]. Both clusters contain only one non-coronal and fare equally well with respect to the cluster condition. Yip's analysis works only if we add to it something along the lines of the association rule she proposes for English (p. 64): Associate place with leftmost [-continuant] consonant. This solution is not optimal, for two reasons. First, the marked status of coronal-first obstruent clusters is valid cross-linguistically; it is then undesirable to account for it by means of language-specific association rules. Second, and more importantly, Yip's cluster condition freely allows coronal stop+coronal obstruent clusters since they do not contain more than one place specification. The facts tell a different story: coronal stops are disfavored before all obstruents.

Principle, expressed in a rule-based framework, and Y. Kang's (1999) perceptually-based analysis in Optimality Theory (to which we will return) conform to this requirement.

Generalization 6: Coronal stops want to be followed by a vowel.

Two things remain to be addressed to complete the picture of stops in Attic Greek and Latin, First, how should we account for the word-final facts? In Steriade/Itô's account of Greek, word-final deletion is intimately linked to word-internal deletion. It is striking, though, that in both Latin and Greek, the word-final conditions apply to all stops alike, whereas the word-internal facts crucially distinguish coronal from non-coronal stops. This suggests that the fate of word-final stops is not directly linked to that of word-internal ones. Word-internal stops are subject to the principle of avoidance of pre-consonantal coronal stops. Word-final ones depend more on language-specific edge effects. It is well-known that special conditions often apply at word margins. These often allow for more consonants or more complex ones than found in word-internal codas (e.g. Latin), but other languages put additional restrictions word-finally. Attic Greek and a number of Australian languages (Hamilton 1996) are of the second type. (See chapter 5 for a discussion of edge effects.)

Finally, it was noticed that in stop-obstruent clusters in Attic Greek and Latin, the second obstruent is always coronal. This is not predicted by the principle of avoidance of pre-consonantal coronal stops. I here follow Jacobs (1989), who concludes that the tendency to avoid clusters entirely composed of non-coronals is independent from that to avoid pre-consonantal coronal stops. Among the languages that actively eliminate pre-consonantal coronal stops, some allow clusters of non-coronals (Cebuano Bisayan, Yakut), for example [kp, pk], as well as [kt, pt]. But others only have coronals in second position (Greek, Latin, Tagalog), allowing [kt, pt] but not *[kp, pk]. To account for the latter set of languages, we could adopt Clements's (1990) Sequential Markedness Principle, or Yip's (1991) cluster condition (see note 42), which both favor structurally less complex segments. All else equal, this favors coronals over non-coronals if the former are unspecified for place.

1.2.3.3. English final coronal stop deletion

All varieties of English display a process of final stop deletion in clusters, which has been among the most extensively studied variable phenomena, especially in the sociolinguistic literature (e.g. Shiels-Djouadi 1975; Algeo 1978; Guy 1980, 1991a, 1991b; Neu 1980; Temperley 1987; Khan 1991; Santa Ana 1992, 1996; Kiparsky 1993, 1994; Bayley 1994; Reynolds 1994; Guy & Boberg 1997; and Labov 1997, who also summarizes the research on this topic since the 60', with older references). Classic examples of this process are *old man* and *west side*. This variable process applies after all types of consonants, depending on a number of well described grammatical and extra-grammatical factors:

- Nature of the preceding segment
- Nature of the following environment (segment, pause)
- Morphological status of the final stop
- Social and personal characteristics of the speaker
- Register / style

What has not been addressed, however, is the question: Why is it only stops that are subject to deletion and not other consonants? As is already clear, English is not isolated in targeting stops in cluster simplification: this is an instantiation of the second generalization, given for Hungarian above, that stops want, more than other consonants, to be adjacent to or followed by a vowel. The answer to the question "why stops?" will come in the next chapter.

The research has examined almost exclusively the deletion of alveolar stops /t,d/, as illustrated by the two examples cited above. But this should not be taken to imply that other stops cannot be dropped; they can. The focus on /t,d/ in the sociolinguistic literature is motivated by the fact that the vast majority of stop-final clusters in English end in an alveolar stop, and only they can cluster with a full range of preceding consonants. To the extent that sociolinguistic studies aim at statistically meaningful results based on natural speech corpora, the limited distribution and reduced frequency of labial- and velar-final clusters justified their exclusion from the studies (see Guy 1980). I will follow the existing literature and also restrict my attention to coronal stops.[43]

The factor I am concerned with in English final stop deletion is the adjacent phonological context. Regarding the preceding segment, studies on a variety of dialects converge on one result: the more similar the final stop is to the preceding segment, the more likely it is to delete. This follows from generalization 4, noted for Hungarian, that consonants want to be adjacent to segments that are relatively dissimilar. The opposite situation makes them more susceptible to deletion. One

[43]Independently from frequency, it could be that coronal stops are associated with a significantly higher propensity to delete than other stops. This would be consistent with the greater vulnerability of coronal stops to delete in non-prevocalic position, as illustrated by the Attic Greek case. I leave the question open.

particular interest of the convergence between the English and Hungarian results (in addition to those reviewed in chapter 4, in particular Québec French) is that they are based on different kinds of data: the sociolinguistic literature on English coronal stop deletion uses actual frequencies based on corpora, whereas the Hungarian and other patterns derive from introspective acceptability judgments.

Similarity can be described in terms of shared features. Interestingly, varieties of English differ on what shared features trigger deletion. In their study of Philadelphia English, Guy & Boberg (1997) observe that final stops delete more frequently in natural speech after the segments in (55a) and least frequently (practically never) after those in (55c), the segments in (55b) forming an intermediate category:

(55) LIKELIHOOD OF STOP DELETION ACCORDING TO THE PRECEDING SEGMENT:
   a. stops (*act*), coronal fricatives (*wrist*), /n/ (*tend, tent*)
   b. /l/ (*cold, colt*), non-coronal fricatives (*draft*), non-coronal nasals (*summed*)
   c. /r/ (*cart*), vowels (*cat*)

A clear pattern emerges from this hierarchy: the more features /t,d/ share with the preceding segment, the more likely they are to delete. Using the features [coronal], [sonorant], and [continuant], it is easy to see that the segments in (55a) share two features with /t,d/, those in (55b) one feature, and those in (55c) no features (assuming that coda /r/ in this dialect is really vocalic in nature and does not carry the feature [coronal]). The same results obtain with the feature [approximant] rather than [continuant], as in (32) above. The addition of [voice] to the set of relevant features confirms these results, as clusters that agree in [voice] are reduced more often than those whose members do not share the same value for that feature, all else being equal.

Other dialects tend to favor specific features, i.e. deletion is triggered not by an overall level of contrast, as in Philadelphia English, but by agreement on a particular dimension between the coronal stop and the preceding segment. In Black and Puerto Rican English, the deletion of stops in word-final clusters is closely correlated with agreement in voicing between the members of the cluster. Thus, in Black English, the percentage of simplification in clusters that agree in voicing oscillates between 60% and 86%, whereas this number drops to around 0-13% for clusters that disagree in voicing. For example, after /n/, the percentage of /d/-deletion is 86%, as opposed to 13% for /t/ (Shiels-Djouadi 1975). In the variety of Indian English studied by Khan (1991), place of articulation plays a more dominant role than voicing or manner of articulation, so that heterorganic stop-stop clusters

/pt, kt/ are reduced significantly less often than homorganic sonorant-stop ones /ld, nd/, even though the latter display more contrast in manner of articulation.

The role of contrast/similarity, analyzed in OCP terms by Guy & Boberg (1997), seems to be orthogonal to syllable well-formedness and does not constitute an argument in the debate about the status of the syllable in deletion and epenthesis processes. More interesting for our purposes is the context following the final stop.

Many have analyzed the effect of the following context in terms of resyllabification possibilities. The retention of a final consonant is favored when it can be integrated into a following onset (Guy 1991b; Kiparsky 1993, 1994; Reynolds 1994). This directly explains why final stop deletion is very rare, in most dialects, before vowel-initial words. Before consonant-initial words, the resyllabification approach predicts that we should observe less frequent deletion before consonants which are attested as the second element of complex onsets after /t,d/, that is /r/ and the glides /w,j/, which are the most sonorous consonants. Independently of, or in addition to, the effect of attested complex onsets in English, it has been proposed that the frequency of stop retention correlates with the sonority level of the following consonant: the lower the segment on the sonority scale (3), the more likely deletion is (e.g. Guy 1991b; Santa Ana 1991, 1996; Bayley 1994; Reynolds 1994). Sonority can obviously be integrated into a resyllabification approach, since the goodness of complex onsets cross-linguistically is assumed to correlate with the difference in sonority between the elements of the cluster. /r,w,j/ are the consonants that may appear with /t,d/ in complex onsets; they are also the most sonorous consonants.[44] Resyllabification, on the basis of both English-specific phonotactics and universal sonority tendencies, predicts the following hierarchy: obstruents > nasals > /l/ > /r,w,j/, with stop deletion being maximally favored by a following obstruent.

The facts fail to support this account of the effect of the following segment. First, sonority as a factor in the deletion of /t,d/ has been investigated in particular by Santa Ana (1991, 1996) for Chicano English and Bayley (1994) for Tejano English. In both Tejano and Chicano English, stops delete before nasals more than any other class of consonants. In Tejano English, they also delete more often before /l/ than before fricatives other than /s/. These results are inconsistent with the sonority hierarchy. More problematic data come from Labov's study of Philadelphia English. His investigation of word-final /t,d/ deletion in English shows that a resyllabification

[44] Liquids are grouped together in the sonority hierarchy in (3), but it has often been suggested that /r/ is in fact more sonorous than /l/, in particular in earlier works in this topic (Sievers 1881; Jespersen 1904; Vennemann 1988).

approach, however it is implemented, cannot explain the effect of the following segment on the variable retention of the stop. Based on two Philadelphian speakers' spontaneous speech, segments can be grouped as in (56), the segments in (56a) triggering deletion more than those in (56b), and those in (56b) more than those in (56c).

(56) LIKELIHOOD OF STOP DELETION ACCORDING TO THE FOLLOWING SEGMENT:

a.	stops, fricatives, /w/, nasals	more deletion of preceding /t,d/
b.	/h/, /l/	↓
c.	/j/, /r/, vowels, pause	less deletion of preceding /t,d/

One element in this scale immediately stands out: the position of /w/. Resyllabification predicts at least that the consonants /r,w,j/ and the vowels will not favor deletion of the preceding stop. While /r,j/ and the vowels correctly appear at the bottom of the scale, the presence of /w/ alongside obstruents and nasals is mysterious. The contrast between /j/ and /w/ is even more unexpected since /tj, dj/ are actually highly restricted onsets in American English, in contrast with /tw, dw/. If anything, we should expect more deletion before /j/ than before /w/. This obstruent-like behavior of /w/ is not exceptional and has been reported in several past studies of /t,d/ deletion.

Labov also did a careful study of 150 tokens in which the final stop was kept before /r,w,j/ and vowels, looking for phonetic evidence that could tell whether /t,d/ behave as onsets or codas (aspiration, voicing, release, glottalization, flapping). In most cases, no clear conclusion could be drawn. But in the vast majority of cases for which a conclusion could be reached (40 tokens), it appeared that they were clearly incompatible with resyllabification of the stop in onset position. Only 5 tokens showed /t,d/ to be in onset position; four of them involved a following /j/, which triggered palatalization of the preceding stop, as in *told you* [toldʒu].

These results suggest that a resyllabification approach to /t,d/ deletion is supported neither by the phonetic facts nor by the frequency data. Labov therefore wonders what alternatives can be investigated. Although he does not develop the idea, he suggests that perception would be the most fruitful direction to explore. He only mentions the difference between /j/ and /w/: /t,d/ is quite salient before /j/ because the clusters tend to form a noisy affricate /tʃ, dʒ/. No such tendency is observed with /w/. The contrast between /w/ and /r/, however, is left unaddressed. Unfortunately, I will have no better solution to offer. The rest of this dissertation supports Labov's suggestion that perception may bring new insight to our understanding of deletion patterns, but the effect of the following segment on coronal stop deletion in English will not be among the issues discussed.

1.2.3.4. Icelandic consonant deletion

Itô (1986) states that consonant deletion in Icelandic is a straightforward case of Stray Erasure, which automatically deletes unsyllabifiable consonants. She assumes that Icelandic consonants conform to the following restrictions: only one consonant is allowed in coda and complex onsets are permitted provided they have the right sonority profile. These conditions lead to the following two predictions: 1. underlying word-internal three-consonant sequences XYZ may surface only if YZ form a permissible onset, the sequence being syllabified as X.YZ, and 2. if YZ is not an acceptable onset, it is always the middle consonant Y that is lost, since the first and the last can always be syllabified in coda and onset positions, respectively.

In support of her analysis, Itô provides the data in (57)[45], which all contain an internal three-consonant sequence, represented in the orthographic form. In all cases, the first consonant automatically goes into the coda. In (57a), the remaining two consonants form a permissible complex onset, and all the segments are properly licensed. In the last two cases, the medial consonant is lost since neither [b̥d̥] nor [vn], according to Itô, are acceptable onsets given their sonority profile. The deleted consonant is crossed in the orthographic form.

(57) CONSONANT DELETION IN THREE-CONSONANT SEQUENCES IN ICELANDIC:

a.	*timbri*	[tʰɪm.b̥rɪ]	'timber.DAT'
b.	*kembdi*	[cʰɛm.d̥ɪ]	'comb.PRET'
	cf. *kemba*	[cʰɛm.b̥a]	'comb.INF'
c.	*hálfna*	[haul.na]	'finish one half.INF'
	cf. *hálfur*	[haul.vʏr̥]	'half.NOM'

In this section I test Itô's predictions on a well-defined yet rich enough set of data. I investigate clusters formed by the addition of the past tense morpheme *-di*/*-ti*/*-ði* directly to verb stems ending in two consonants. The form in (57b) is one such example (*kemb+di*). The relevant verb stems, in Einarsson's (1945) terminology, are those pertaining to the first three classes of weak verbs. The fourth class, the most productive one, uses /-aðɪ/ as the preterit suffix, which automatically prevents the formation of new clusters in morpheme concatenation. The factors that determine the choice of the allomorph *-di*, *-ti* or *-ði* with each verb can be considered irrelevant

[45]The phonetic transcriptions are those given in Einarsson (1945), adapted according to the indications in footnote 47.

and I simply take this choice as given. I leave aside stems ending in a coronal stop or non-sibilant fricative, which involve the formation of geminate consonants when followed by the preterit suffix, e.g. *hlýddi* 'obey.PRET' [hlid̥:ɪ] (cf. *hlýða* [hliða] 'obey.INF'). These geminate consonants then degeminate in post-consonantal position: *sendi* 'send.PRET' [sɛnd̥ɪ] (cf. INF. *senda* [sɛnd̥a]).

These preterit forms provide enough information to allow us to safely identify relevant generalizations, but a complete description of consonant deletion in Icelandic will not be undertaken here. I use the data obtained from two native speakers of Icelandic, noted H and O.[46] These data are complemented by the pronunciations indicated in Blöndal (1920) (B), Einarsson (1945) (E), Rögnvaldsson (1989) (R) and, to a lesser extent, Halle & Clements (1983: 163) (who cite Höskuldur Thráinsson as their source).[47]

What first strikes the analyst about consonant deletion in weak preterits is its variability. There are classes of verbs that do not display any variation, deletion being for all speakers obligatory or excluded. But in a large part of the data, speakers have quite different judgments on a given item, deletion is often optional, and the same speaker may treat differently verbs that contain the same consonant sequences. Itô's syllabic analysis is unable to account for this variability and the data often contradict the two predictions given at the outset of this section: 1. deletion is automatic if the last two consonants do not form a permissible complex onset; 2. it is

[46]I thank Ølafur Páll Jónsson and Haraldur Bernharðsson, as well as Hanna Øladóttir, for patiently going through a long list of verbs with me and answering my questions. Haraldur also provided me with useful references and easy access to Blöndal (1920), Rögnvaldsson (1989), and Helgason (1993). I should also note that Ølafur is from the South-east of Iceland, while Haraldur is from the North. The different geographical origin might explain at least part of the important differences that exist between the two speakers, but its significance is not clear yet and I do not want to extend their individual patterns to a larger domain or community.

[47]I adopt here an IPA transcription. When using data from Blöndal (1920) and Einarsson (1945), I have made the following adaptations in accordance with the IPA and/or in conformity with other sources (e.g. Rögnvaldsson 1989; Helgason 1993):

-[kʲ, gʲ] are replaced with [c, ɟ]	-[q] is replaced with [ɣ]
-[ŋ] before [c] ([gʲ]) is replaced with [ɲ]	-[þ] is replaced with [θ]
-[λ] is replaced with [l̥]	-[ρ] is replaced with [r̥]

Icelandic stops are all phonetically voiceless but show a contrast in aspiration. Voiceless unaspirated stops normally correspond to orthographic <*b,d,g*>. Stops corresponding to orthographic <*p,t,k*> are usually aspirated but become unaspirated when preceded by a voiceless fricative, nasal, or liquid. Authors vary in their transcription of unaspirated stops: Rögnvaldsson (1989) systematically uses [b̥,d̥,g̊], Helgason (1993) systematically writes [p,t,k]. Einarsson (1945) distinguishes the underlyingly unaspirated [b̥,d̥,g̊] from the deaspirated [p,t,k]. Blöndal (1920) does not note devoicing of orthographic <*b,d,g*> and simply transcribed them [b,d,g]. I follow Einarsson's practice here, and adapt the other authors' transcriptions accordingly. This decision allows me to mark the underlying distinction among unaspirated stops.

always the second consonant that is dropped. The observed patterns can rather be largely understood in terms of three of the sequential tendencies uncovered in this chapter: 1. the special status of stops, extended to non-strident fricatives; 2. contrast within the cluster; 3. the Sonority Sequencing Principle.

In presenting the data I distinguish between two main categories of clusters that appear stem-finally: those that include an obstruent and those that do not. Let us first look at the no-obstruent group, comprised only of liquid+nasal stems, specifically /lm/, /rm/, and /rn/. In the preterit form of these verbs the cluster-medial nasal never deletes in any of my sources. Only cluster-initial /r/ may be dropped, subject to some individual or dialectal variation. /lm/ clusters before the preterit morpheme surface intact for my two informants, and neither Einarsson nor Rögnvaldsson, who otherwise give a complete list of cases of consonant deletion, note the dropping of a consonant in such forms. This is shown in (58); the consonant that would be expected to delete according to Itô's syllabic analysis is underlined.

(58) NO DELETION IN /lm/ STEMS (ALL SOURCES):
hylmdi [hılmd̥ı] 'conceal.PRET' (cf. INF. *hylma* [hılma])

The last two consonants in the sequence [lmd̥] can hardly be considered more acceptable as a complex onset than those in (57b-c). An onset [md̥] violates the SSP and is worse in terms of sonority than the stop-stop and fricative-nasal sequences in (57). Itô is not totally explicit about the exact shape of the permissible complex onsets – she only assumes, as a mininal requirement, that only sequences of rising sonority can form a complex onset. This should automatically rule out [md̥] in (58) as a potential candidate. Moreover, we will see shortly other forms whose underlying sequence also ends in a nasal-stop sequence, but which are subject to obligatory cluster reduction. Sonority is therefore not the relevant factor here.

Variation already shows up in /r/+nasal stems. For my two informants, as well as Einarsson[48], /rm/ stems behave like /lm/ ones above and tolerate no simplification (59). Only Rögnvaldsson indicates the deletion of the initial /r/ in similar forms (60).

(59) NO DELETION IN /rm/ STEMS (O, H, E):
a. *vermdi* [vɛrmd̥ı] 'warm.PRET' (cf. INF. *verma* [vɛrma])
b. *fermdi* [fɛrmd̥ı] 'load.PRET' (cf. INF. *ferma* [fɛrma])
c. *þyrmdi* [θırmd̥ı] 'spare.PRET' (cf. INF. *þyrma* [θırma])

[48]Blöndal does not cite the forms in (59) but it must be noted that he and Einarsson almost invariably agree in the pronunciations they propose.

(60) /r/ DELETION IN /rm/ STEMS (R):
a. *þyrmdi* [θımd̥ı] 'spare.PRET' (cf. INF. *þyrma* [θırma])
b. *fermdist* [fɛmd̥ıst] 'load.PRET,MIDDLE' (cf. INF. *ferma* [fɛrma])

With /rn/ stems, /r/-deletion is more frequent and occurs not only in Rögnvaldsson, who cites (61), but also in informant H's speech. H, however, considers that deletion is optional in this case (62). The possibility of /r/-dropping is also noted in Blöndal and Einarsson (p. 82) (62a).[49] Speaker O, unlike all the others, does not accept the /r/-less outputs (63).

(61) /r/ DELETION IN /rn/ STEMS (R):
stirndi [stınd̥ı] 'glitter.PRET' (cf. INF. *stirna* [stırna])

(62) VARIABLE /r/ DELETION IN /rn/ STEMS (H, B, E):
a. H,B,E *stirndi* [stı(r)nd̥ı] 'glitter.PRET' (cf. INF. *stirna* [stırna])
b. H *spyrndi* [spı(r)nd̥ı] 'spurn.PRET' (cf. INF. *spyrna* [spırna])

(63) NO DELETION IN /rn/ STEMS (O):
a. *stirndi* [stırnd̥ı] 'glitter.PRET' (cf. INF. *stirna* [stırna])
b. *spyrndi* [spırnd̥ı] 'spurn.PRET' (cf. INF. *spyrna* [spırna])

/r/ deletion in this context seems to be just a specific instantiation of a more general tendency toward the loss of rhotic articulations before certain consonants (Einarsson 1945; Rögnvaldsson 1989). Speaker O appears to lack this process, at least in the context of past forms, as he rejects the /r/-less pronunciations. I suspect that this follows from a variable that is independent from the behavior of clusters in preterit forms. But what is of interest to us is the variation observed in the domain of application of /r/-deletion. For Rögnvaldsson, it applies before /n/ and /m/ alike, whereas for speaker H and Einarsson it is restricted to /n/. I suggest that this distinction relates to the role of contrast in consonant deletion already noted for Hungarian and English: /r/ is more likely to delete before homorganic than non-homorganic nasals (/n/ vs. /m/), i.e. in the absence of contrast in place of articulation.

Let us now turn to stems ending in a cluster that includes an obstruent, with the following main categories: sonorant+obstruent, obstruent+sonorant, and

[49]According to Blöndal /r/-deletion in (62a) applies only in some varieties. Einarsson notices the possibility of omitting the /r/ in the same form but fails to mention the existence of dialectal or individual variation.

fricative+stop. In all cases, if a consonant deletes, it is the obstruent; in the case of fricative+stop it is the stop. The main determining factor in the application of deletion appears to be the amount of contrast in manner of articulation between the obstruent and the other consonant in the stem. We also observe lexical effects and a substantial amount of interspeaker variation. So deletion is not determined by the position but by the nature of the consonants, as the deleted obstruent may be the first or the middle consonant in the cluster.

The stems whose final cluster comprises an obstruent and a nasal (in either order) show no variation across speakers or verbs: the obstruent invariably deletes. This is shown in (64) for nasal+stop stems (see also *kembdi* in (57b)), (65) for stop+nasal stems and (66) for fricative+nasal stems. In all cases the remaining nasal takes on the place of articulation of the deleted obstruent.

(64) OBSTRUENT DELETION IN NASAL+STOP STEMS (ALL SOURCES):

a.	*hangdi*	[hauŋd̥ɪ]	'hang.PRET'	(cf. INF. *hanga* [hauŋga])
b.	*hringdi*	[hr̥iŋd̥ɪ]	'ring.PRET'	(cf. INF. *hringja* [hr̥iɲɟa])[50]
c.	*tengdi*	[tʰeiŋd̥ɪ]	'join.PRET'	(cf. INF. *tengja* [tʰeiɲɟa])
d.	*skenkti*	[sceiŋ̊tɪ]	'pour.PRET'	(cf. INF. *skenkja* [sceiɲ̊cʰa])

(65) OBSTRUENT DELETION IN STOP+NASAL STEMS (ALL SOURCES):

a.	*gegndi*	[ɟeiŋd̥ɪ]	'obey.PRET'	(cf. INF. *gegna* [ɟɛg̊na])
b.	*rigndi*	[rɪŋd̥ɪ]	'rain.PRET'	(cf. INF. *rigna* [rɪg̊na])
c.	*signdi*	[sɪŋd̥ɪ]	'bless.PRET'	(cf. INF. *signa* [sɪg̊na])

(66) OBSTRUENT DELETION IN FRICATIVE+NASAL STEMS (ALL SOURCES):

a.	*efndi*	[ɛmtɪ]	'carry.PRET'	(cf. INF. *efna* [ɛpna])
b.	*hefndi*	[hɛmtɪ]	'avenge.PRET'	(cf. INF. *hefna* [hɛpna])
c.	*nefndi*	[nɛmtɪ]	'call.PRET'	(cf. INF. *nefna* [nɛpna])
d.	*stefndi*	[stɛmtɪ]	'take a course.PRET'	(cf. INF. *stefna* [stɛpna])

The remaining stems show a substantial amount of variation in the preterit form. Those ending in a fricative+stop sequence – two stems in /-sk/ – have a strong tendency to lose the middle velar stop. For speaker H, retention of the /k/ is acceptable, though somewhat marginally, with one of the two verbs (67a). Einarsson also marks the stop as optional in this form. Speaker O (in agreement with Blöndal) omits the stop in both forms.

[50]The [hr̥-] transcription is the one given in Einarsson; Halle & Clements write [hr-] and Rögnvaldsson [r̥-].

(67) VARIABLE STOP DELETION IN FRICATIVE+STOP STEMS:

a.	*æskti*	H,E	[ais(k)tɪ]	'wish.pret'	(cf. inf. *æskja* [aisca])
		O, B	[aistɪ]		
b.	*ræskti*	(All)	[raistɪ]	'clear the throat.pret'	(cf. inf. *ræskja* [raisca])

Stems composed of an obstruent and a liquid show a split between speaker H on the one hand and speaker O, Blöndal, and Einarsson on the other hand. For the latter three sources, obstruent deletion can be considered optional next to a liquid. (A more pronounced tendency toward retention can be observed for informant O, as opposed to B and E). For obstruent+liquid stems, metathesis of the two consonants is also attested, besides obstruent deletion and retention of the whole cluster. A few illustrative examples are given below, for /l/+obstruent (68), obstruent+/l/ (69), and /r/+obstruent (70) combinations. Note that variable deletion or metathesis apply differently in different sources: for a given consonant sequence and a given speaker, deletion or metathesis may be felt as optional in some verbs, obligatory in other verbs and excluded in yet other verbs. Other speakers may split the data differently. I largely disregard the detailed behavior here but refer the reader to the appendix for the complete list of the forms I have obtained.[51] The reader should also observe that underlying velar stops undergo fricativization to /ɣ/ or /x/ for O, B, and E.[52] In addition, underlying /f/ surfaces as a voiced [v] except in word-initial position and preceding a voiceless consonant (simplifying somewhat, see Einarsson for more details). These fricativization and voicing processes will become relevant later in the discussion.

(68) VARIABLE OBSTRUENT DELETION IN /L/+OBSTRUENT STEMS (O, B, E):

a.	*velgdi*	OBE	[vɛl(ɣ)d̥ɪ]	'warm up.pret'	(cf. inf. *velgja* [vɛlɟa])
b.	*fylgdi*	OBE	[fɪl(ɣ)d̥ɪ]	'follow.pret'	(cf. inf. *fylgja* [fɪlɟa])
c.	*velkti*	BE	[vɛl̥(x)tɪ]	'soil.pret'	(cf. inf. *velkja* [vɛl̥ca])
		O	[vɛl̥xtɪ]		

[51]Relevant factors in the behavior of particular verbs certainly include frequency, register, and homophony with the past form of another verb. But I am not in a position to discuss this aspect of the data.

[52]Fricativization also optionally applies to /p/→ [f] for informant O (i,a-b), but I found no mention of this in Blöndal or Einarsson. Fricativization with labials is never obligatory and it seems to be blocked with certain verbs, like *verpti* in (i,c). The contrast between informant O and the others for the optional fricativization of labial stops is shown below. This process can probably be disregarded for the rest of the discussion.

(i) a.	*skyrpti*	O	[skɪr̥ptɪ] [skɪr̥ftɪ]	H	[skɪr̥(p)tɪ]	'spit.PRET'
b.	*skerpti*	O	[skɛr̥ptɪ] [skɛr̥ftɪ]	B	[skɛr̥(p)tɪ]	'sharpen.PRET'
c.	*verpti*	O	[vɛr̥ptɪ] *[vɛr̥ftɪ]	E	[vɛr̥(p)tɪ]	'lay eggs.PRET'

d. *skelfdi*	E	[skɛl(v)d̥ɪ]	'frighten.pret'	(cf. inf. *skelva* [skɛlva])
	OB	[skɛlvd̥ɪ]		

(69) VARIABLE OBSTRUENT DELETION AND METATHESIS IN OBSTRUENT+/l/ STEMS (O, B, E):

a. *sigldi*	O	[sɪɣld̥ɪ]	'sail.PRET'	
	E	[sɪ(ɣ)ld̥ɪ][53]		(cf. INF. *sigla* [sɪg̊la])
	B	[sɪɣld̥ɪ] [sɪlɣd̥ɪ]		
b. *yggldi*	B	[ɪlɣd̥ɪ]	'frown.PRET'	
	O	[ɪld̥ɪ]		(cf. INF. *yggla* [ɪg̊la])
c. *efldi*	BE	[ɛl(v)d̥ɪ] [ɛvld̥ɪ]	'strengthen.PRET'	
	O	[ɛl(v)d̥ɪ]		(cf. INF. *efla* [ɛpla])
d. *skefldi*	BE	[skɛl(v)d̥ɪ] [skɛvld̥ɪ]	'form snowdrifts.PRET'	
	O	[skɛld̥ɪ][54]		(cf. INF. *skefla* [skɛpla])

(70) VARIABLE OBSTRUENT DELETION IN /r/+OBSTRUENT STEMS (O, B, E):

a. *bergði*	BE	[bɛr(ɣ)ðɪ]	'taste.PRET'	(cf. INF. *bergja* [bɛrɟa])
	O	[bɛrɣðɪ]		
b. *merkti*	OBE	[mɛr̥(x)tɪ]	'mark.PRET'	(cf. INF. *merkja* [mɛr̥ca])
c. *horfði*	OE	[hɔr(v)ðɪ]	'look.PRET'	(cf. INF. *horfa* [hɔrva])
d. *þurfti*	OE	[θʏr̥(f)tɪ]	'need.PRET'	(cf. INF. *þurfa* [θʏrva])
	B	[θʏr̥tɪ]		
e. *verpti*	E	[vɛr̥(p)tɪ]	'lay eggs.PRET'	(cf. INF. *verpa* [vɛr̥pa])
	B	[vɛr̥tɪ]		
	O	[vɛr̥ptɪ]		

Let us now turn to speaker H, who is generally more inclined to deletion than speaker O. Obstruents are always dropped next to /l/ (71-72) but are variably retained after /r/, depending on the particular sequence and verb (73).[55] Notice that this speaker does not fricativize voiced stops, as shown in (73a-b).[56]

[53]In the lexicon, Einarsson gives only the pronunciation [sɪɣld̥ɪ], but in the grammar (p.82), he explicitely states that the [ɣ] tends to be lost, as the [v] in (70c-d). I take this to mean that the [ɣ] is optional, which is also in accordance with Kress (1963: 41-42), who notes for *sigldi* the alternation between retention [sɪɣld̥ɪ], metathesis [sɪlɣd̥ɪ], and deletion [sɪld̥ɪ].

[54]For this verb, metathesis was explicitely rejected by informant O because it makes it homophonous with *skelfdi* in (68d). It is possible that in natural linguistic contexts, where the risk of confusion between the two verbs is almost inexistent, metathesis would not be unthinkable.

[55]Rögnvaldsson gives examples of obstruent deletion for /l/+obstruent (i,a-b), obstruent+/l/ (i,c-d), and /r/+obstruent (i,e-g) stems (see appendix for additional forms). But it cannot be determined on the basis of his data whether other verbs with the same segmental make-up behave differently and whether deletion is in all cases obligatory.

(71) OBSTRUENT DELETION IN /l/+OBSTRUENT STEMS (H):

a. *velgdi*	[vɛld̥ɪ]	'warm up.PRET'	(cf. INF. *velgja* [vɛlɟa])
b. *fylgdi*	[fɪld̥ɪ]	'follow.PRET'	(cf. INF. *fylgja* [fɪlɟa])
c. *velkti*	[vɛl̥tɪ]	'soil.PRET'	(cf. INF. *velkja* [vɛl̥ca])
d. *skelfdi*	[skɛld̥ɪ]	'frighten.PRET'	(cf. INF. *skelva* [skɛlva])

(72) OBSTRUENT DELETION IN OBSTRUENT+/l/ STEMS (H):

a. *efldi*	[ɛld̥ɪ]	'strengthen.PRET'	(cf. INF. *efla* [ɛpla])
b. *skefldi*	[skɛld̥ɪ]	'form snowdrifts.PRET'	(cf. INF. *skefla* [skɛpla])
c. *sigldi*	[sɪld̥ɪ][57]	'sail.PRET'	(cf. INF. *sigla* [sɪg̊la])
d. *yggldi*	[ɪld̥ɪ]	'frown.PRET'	(cf. INF. *yggla* [ɪg̊la])

(73) VARIABLE OBSTRUENT DELETION IN /r/+OBSTRUENT STEMS (H):

a. *bergði*	[bɛr(g̊)ðɪ]	'taste.PRET'	(cf. INF. *bergja* [bɛrɟa])
b. *ergði*	[ɛrg̊ðɪ]	'tease.PRET'	(cf. INF. *ergja* [ɛrɟa])
c. *merkti*	[mɛr̥tɪ]	'mark.PRET'	(cf. INF. *merkja* [mɛr̥ca])
d. *verpti*	[vɛr̥tɪ]	'lay eggs.PRET'	(cf. INF. *verpa* [vɛr̥pa])
e. *skyrpti*	[skɪr̥(p)tɪ]	'spit.PRET'	(cf. INF. *skyrpa* [skɪr̥pa])
f. *þurfti*	[θʏr̥tɪ]	'need.PRET'	(cf. INF. *þurfa* [θʏrva])
g. *horfði*	[hɔrðɪ]	'look.PRET'	(cf. INF. *horfa* [hɔrva])

The data in (67)-(73) display a lot of variation, but the absence of deletion is widely attested, against Itô's predictions. In most cases where the three-consonant cluster surfaces intact, the last two consonants would form an onset with a high degree of markedness, e.g. [ɣð], [vð], [ld̥], [ɣd̥], [g̊ð], [pt]. Some, like [ld̥], radically violate the SPP. I believe that consonant deletion in Icelandic is not syllabically-driven.[58] The same conclusion is reached by Gibson (1997), who brings as evidence

(i) Stems composed of an obstruent and a liquid (R):

a.	*fylgdi*	[fɪl̥tɪ]	'*follow*.PRET'	(cf. INF. *fylgja* [fɪlca])
b.	*hvolfdi*	[kʰvɔl̥tɪ]	'capsize.PRET'	(cf. INF. *hvolfa* [kʰvɔlva])
c.	*sigldi*	[sɪl̥tɪ]	'sail.PRET'	(cf. INF. *sigla* [sɪkla])
d.	*skefldi*	[skɛl̥tɪ]	'form snowdrifts.PRET'	(cf. INF. *skefla* [skɛpla])
e.	*skyrpti*	[skɪr̥tɪ]	'spit.PRET'	(cf. INF. *skirpa* [skɪr̥pa])
f.	*erfði*	[ɛrðɪ]	'inherit.PRET'	(cf. INF. *erfa* [ɛrva])
g.	*þurfti*	[θʏr̥tɪ]	'need.PRET'	(cf. INF. *þurfa* [θʏrva])

[56]Speaker H deletes the stop in examples like (72c), but he mentioned that, if a segment had to surface there, it would sure be a stop [g] and not a fricative, as for speaker O, B and E (69a).

[57]According to Helgason (1993), [sɪld̥ɪ] is the only natural pronunciation of this verb. Compare (72c) with (69a) above.

[58]Note that this conclusion weakens Vennemann's (1972) argument for the syllable (see section 1.1.1). Vennemann claimed that the introduction of the syllable simplified the phonology of Icelandic to the extent that numerous processes in this language refered to syllable boundaries.

Einarsson's pronunciations for *vermdi* (59a) and *sigldi* (69a), as well as cases of word-final clusters which I do not discuss here. However, she does not suggest an alternative solution, nor does she provide empirical generalizations. The behavior of these past forms is indeed quite complex, but some of the tendencies in deletion processes noticed in the other patterns examined in this chapter can go a long way toward explaining the Icelandic process of consonant deletion. These are: the role of contrast and the special status of stops, extended to non-strident fricatives. The SSP also appears to play a subsidiary role. Let us examine each of these factors.

First, it must be noted that consonant deletion does not take place, at least never obligatorily, in word-internal two-consonant clusters, that is when each consonant is flanked by a vowel. In this case the basic requirement that each consonant be adjacent to a vowel is met and there is no need for a repair strategy. Deletion occurs primarily in three-consonant sequences, when this requirement is violated. This follows from our first generalization, repeated below.

Generalization 1:	Consonants want to be adjacent to a vowel, and preferably followed by a vowel.

Let us now look at the type of consonants that delete. Apart from the particular case of /r/ before a nasal (60)-(62), the only consonants that delete are stops and the fricatives [f, v, x, ɣ] (the latter two only for the speakers that fricativize velar stops, i.e. O, B, and E). These segments contrast with nasals and liquids, which are stable, even in cluster-medial position. This explains the retention of the full cluster with /lm/ stems, for instance in (58). The deletion of stops constitutes by now a familiar generalization, as we have seen other examples of the greater propensity for stops to be dropped. I believe that the similar behavior of [f, v, x, ɣ] can be interpreted as an extension of the special status of stops. These segments may be classified as non-strident fricatives. Their frication noise is much weaker than for strident fricatives, which makes them resemble stops from the point of view of the cues present during the closure. See chapter 3 for a discussion of acoustic cues and perceptual motivations for the generalizations proposed in this chapter. The basic split among obstruents is usually taken to be between stops and fricatives, based on the presence or absence of frication noise during the closure. I suggest that another possible split distinguishes between strident and non-strident obstruents, the latter being more likely to delete and trigger epenthesis than the former. So I take the greater vulnerability of non-strident fricatives in Icelandic to follow from a modified

The two processes he cites is vowel lengthening in stressed position and cluster simplification. If the latter is not in fact syllable-dependent, other processes should be put forward for the argument to go through.

version of generalization 2 concerning the special status of stops in deletion and epenthesis, which may also include non-strident fricatives.

Generalization 2: (modified)	Non-strident obstruents, more than other consonants, want to be adjacent to a vowel, and preferably followed by a vowel.

This argument, however, has to be completed with a note concerning the status of /s/, the only strident fricative in Icelandic. The preterit forms presented in this section do not allow us to draw firm conclusions about the behavior of /s/, as it does not appear in all the relevant positions in stem-final clusters. The only strident fricatives are found in /-sk/ stems, and we have seen that it is the stop that deletes. But there are no liquid+/s/ or nasal+/s/ stems.[59] A look at the behavior of /s/ in other contexts, however, clearly suggests that it is more resistent than non-strident fricatives and attests to its greater strength in interconsonantal position. First, there are stems that end in /rst/ and /lsk/ sequences, like those in (74), that is exactly of the liquid+obstruent+stop type found in preterit forms and that are subject to cluster reduction through deletion of the obstruent. Yet, the medial /s/ never deletes in these forms. In *-rst* stems it is rather the initial /r/ that may be dropped, as noticed above about /r/+nasal stems (60)-(62). As /r/ never deletes before obstruents other than /s/ (70, 73), its behavior here suggests that it is weaker than /s/, that is less resistent to deletion, but stronger than non-strident obstruents.

(74) NO DELETION OF /s/ IN INTERCONSONANTAL POSITION:
  a. *þyrsta* [θɪ(r̥)sta] 'get thirsty.INF' *þyrsti* [θɪ(r̥)stɪ] 'get thirsty.PRET'
  b. *byrsta* [bɪ(r̥)sta] 'scorn.INF' *byrsti* [bɪ(r̥)stɪ] 'scorn.PRET'
  c. *elska* [ɛlska] 'love.INF' *elskaði* [ɛlskaðɪ] 'love.PRET'

The stability of /s/ is also apparent in superlative forms of adjectives obtained by the addition of the suffix *-stur*. When added to stems ending in a consonant, a three-consonant cluster of the type consonant+obstruent+stop is created. Again, the medial /s/ never deletes, unlike stops in identical or similar contexts in preterit forms:

(75) NO DELETION OF /s/ IN THE SUPERLATIVE SUFFIX *-stur*:
  a. *þynnstur* [θɪnstʏr̥] 'thinnest' (compare *skenkti* [sceiŋ̊tɪ] (64d))
  b. *grennstur* [grɛnstʏr̥] 'most slender'
  c. *mýkstur* [mixstʏr̥] 'smoothest'

[59]The stems I have seen of that sort take the /-aðɪ/ preterit suffix, which is of no interest here, e.g. INF. *dansa* 'dance', PRET. *dansaði*.

Finally, Rögnvaldsson and Einarsson both provide long and systematic lists of cases of consonant deletion. Interestingly, both fail to provide a single example of /s/ deletion. This further supports the distinct status enjoyed by /s/ as opposed to non-strident fricatives.

Consider now the contexts in which non-strident obstruents delete. We observe a clear hierarchy based on the amount of contrast in manner of articulation between the obstruent and the adjacent consonant in the stem. As noted in the section on Hungarian, I use the major class features proposed by Clements (1990) to distinguish among consonants. The feature specifications are repeated from (32) above. In addition, obstruents are distinguished by the feature [strident].

(32) CLEMENTS'S (1990) MAJOR CLASS FEATURES:

	Obstruents	Nasals	Liquids	Glides
Sonorant	–	+	+	+
Approximant	–	–	+	+
Vocoid	–	–	–	+

The specifications in (32) allow us to establish a hierarchy among consonants in the degree of contrast they display with obstruents. Glides contrast the most with obstruents (contrast in [vocoid]), liquids show less contrast (contrast in [approximant]), and nasals still less (contrast in [sonorant]). A contrast in stridency between two obstruents is independent from this hierarchy.

Recall that speaker H systematically deletes (non-strident) obstruents when the adjacent segment in the stem is a nasal (64)-(66) or /l/ (71)-(72), but variably retains them next to /r/ (73) or /s/ (67). Speaker O, Blöndal, and Einarsson also obligatorily delete non-strident obstruents next to a nasal, but optionally retain them next to both /r/ and /l/ (68)-(70). After /s/, speaker O and B delete the stop but Einarsson optionally keeps it (67). I interpret these results in the following way. First, I consider /r/ to be more sonorous than /l/, as is standardly assumed; I take /r/ to be a glide, specified as [+vocoid], whereas /l/ is a liquid [-vocoid, +approximant].[60] The generalizations concerning obstruent deletion can now be stated as follows. The likelihood that a non-strident obstruent is retained correlates with the amount of contrast in manner of articulation between it and the adjacent consonant within the stem. With only a contrast in [sonorant] (nasals), the obstruent is obligatorily deleted in all speakers; with a larger contrast in [approximant] (/l/), the obstruent is variably retained in a subset of speakers (O, B, E) but still systematically deleted in others (H); with a maximal contrast in [vocoid] (/r/), all speakers allow the optional retention of

[60]I will argue for the same specifications in French in the following chapter.

the obstruent. Obstruents that contrast in [strident] with another obstruent are generally variably maintained. The main difference between H and O, B, E lies in the more stringent conditions imposed by H on the licensing of non-strident obstruents: whereas a contrast in [approximant] is sufficient for O, B, E to maintain an obstruent, H requires a bigger contrast in [vocoid]. This follows from the fourth generalization.

Generalization 4: Consonants that are relatively similar to a neighboring segment want to be adjacent to a vowel, and preferably followed by a vowel.

Contrast alone accounts for obstruent deletion in consonant+obstruent stems. Something more has to be said, however, about obstruent+sonorant stems. These differ from consonant+obstruent ones in two ways. First, the initial obstruent follows a vowel and deletion is unexpected in a position that is adjacent to a vowel. Second, obstruent+/l/ stems display variable metathesis in preterit forms, for speaker O, B, and E. Thus [ɣl] / [vl] alternate with [lɣ] / [lv] (metathesis) and [l] (deletion) in (76=69a, 69c).

(76) DELETION AND METATHESIS IN OBSTRUENT+/l/ STEMS:

a.	*sigldi*	O	[sɪɣld̥ɪ]	'sail.PRET'	(cf. INF. *sigla* [sɪg̊la])
		E	[sɪ(ɣ)ld̥ɪ]		
		B	[sɪɣld̥ɪ] [sɪlɣd̥ɪ]		
b.	*efldi*	BE	[ɛl(v)d̥ɪ] [ɛvld̥ɪ]	'strengthen.PRET'	(cf. INF. *efla* [ɛpla])
		O	[ɛl(v)d̥ɪ]		

I suggest that to account for the behavior of these stems contrast operates in conjunction with the SSP, repeated below. The addition of the preterit suffix to them creates an obstruent+sonorant+obstruent cluster which violates the SSP and is unacceptable. Metathesis is motivated by the desire to avoid the SSP violation, by putting the obstruent rather than the sonorant in cluster-medial position.

Sonority Sequencing Principle: Sonority maxima correspond to sonority peaks.

Metathesis, however, is unavailable in onstruent+nasal stems for all speakers and obstruent+/l/ ones for speaker H. This follows from the role of contrast. Would metathesis apply, the SSP violation would be avoided but the resulting sequence would not display a sufficient amount of contrast. Therefore metathesis cannot save these clusters and deletion remains the only solution. Nasals and obstruents contrast only in the feature [sonorant], which is for no speakers sufficient to license non-strident obstruents. Consider the examples in (77=65a, 66a). The faithful output *[ɟeigndɪ] in (77a) violates the SSP; the metathesized form *[ɟeingdɪ] fails to meet the contrast requirement; hence deletion [ɟeiŋdɪ]. /l/+obstruent sequences contrast in [approximant]. This contrast is large enough for speaker O, B, and E to license the obstruent, hence metathesis in (76). But speaker H requires a still bigger contrast, one in [vocoid], so forms like [ɛlvdɪ] (76b) are unacceptable for this speaker with respect to contrast, which explains the absence of metathesis and the obligatoriness of obstruent deletion, in both /l/+obstruent (71) and obstruent+/l/ (72).

(77) DELETION IN OBSTRUENT+NASAL STEMS:

a.	*gegndi*	[ɟeiŋdɪ]	'obey.PRET'	(cf. INF. *gegna* [ɟɛgna])
b.	*efndi*	[ɛmdɪ]	'carry.PRET'	(cf. INF. *efna* [ɛbna])

This account of deletion and metathesis in preterit forms raises one obvious question, though: Why are [sɪɣldɪ] (76a) and [ɛvldɪ] (76b) acceptable at all for O, B, and E if they violate the SSP? Here I rely on Helgason's (1993) discussion of the behavior of voiced fricatives in Icelandic. Icelandic has on the surface three such fricatives: [v], [ð], and [ɣ]. [ɣ] originates from a process of fricativization of [g], which applies in the context of the preterit suffix next to a liquid [r,l]. This process is active for speaker O, as well as Einarsson and Blöndal, but is does not apply in speaker H's speech. According to Helgason (1993: 31-32), these voiced fricatives are subject to a variable approximantization rule when preceded by a voiced segments and followed by any segment. The approximant versions of these fricatives are noted [ʋ], [ð̞], and [ɰ]. The alternation between fricative and approximant articulations for these sounds is not exceptional from a crosslinguistic point of view. Ohala (1983: 198), for instance, notes that "the phonetic symbols [v, β, ð, ɣ] are often used for either fricatives or frictionless continuants". Lavoie (2000) also provides references and arguments pointing to the same conclusion. Examples of approximantization from Helgason (1993: 32) are provided below:[61]

[61]The approximants [ʋ], [ð̞], and [ɰ], to which we have to add [j], are themselves subject to deletion in various contexts, notably in preconsonantal position (Árnason 1980: 218; Rögnvaldsson 1989: 52; Helgason 1993: 38-40). This is also in line with crosslinguistic tendencies, as the loss of these segments is a frequent historical process. Examples from Helgason follow:

(i)	Citation form		Spoken form	
a. *dagblaði*	[taɣplaðɪ]	([taɰplað̞ɪ])	[ta:plaðɪ]	'newspaper+DAT'
b. *sagði*	[saɣðɪ]	([saɰð̞ɪ])	[saðɪ]	'say+PRET'
c. *afmæli*	[avmailɪ]	([aʋmailɪ])	[am:ailɪ]	'birthday'
d. *eðlilega*	[ɛðlɪlɛɣa]	([ɛð̞lɪlɛɰa])	[ɛlɪlɛɣa]	'naturally'

It is unclear at this point how approximantization affects and interacts with consonant deletion in preterit forms.

(78) APPROXIMANTIZATION OF VOICED FRICATIVES:

		Citation form	Spoken form	
a.	*segðu*	[seiɣðʏ]	[seiɰð̞ʏ]	'say+IMP'
b.	*hugmynd*	[hʏɣmɪnt]	[hʏɰmɪnt]	'idea'
c.	*töfrandi*	[tʰœvɾantɪ]	[tʰœʋɾantɪ]	'charming'

If [sɪɣldɪ] and [ɛvldɪ] should really be transcribed [sɪɰldɪ] and [ɛʋldɪ], we get no sonority violation. [ɰ] and [ʋ] should probably be considered more sonorous than laterals: Ladefoged & Maddieson (1996) treat [ɰ] and [ʋ] together in a section on vowel-like consonants in the chapter on vowels (even though they consider that of these two only [ɰ] is properly a glide). Now, this proposal raises the additional question of why this approximantization process is not used by speaker H, or with fricative+nasal stems by any of the sources. We would then get pronunciations like *[ɛʋndɪ] *efndi* in (77), which is on the surface conform to both the SSP and the minimal amount of contrast. This problem would be solved if contrast had to be computed on the "deep" fricative specifications of these consonants rather than the "surface" approximant ones, while sonority would be a more surfacy constraint. This is not a trivial issue, especially in an output-oriented framework like Optimality Theory, but my understanding of approximantization and sonority in Icelandic is too limited to proceed to a thorough and meaningful discussion of this problem, which I leave for future work.

To sum up this long section on Icelandic and leaving aside the problem mentioned in the previous paragraph, I have suggested that consonant deletion in preterit forms of weak verbs is not syllabically-driven but can be accounted for in large part by some of the sequential principles I propose in this chapter: 1) the avoidance of consonants that are not adjacent to a vowel, 2) the greater vulnerability of stops, to which we can add non-strident fricatives, to deletion, 3) the inhibiting effect of contrast with adjacent segments on consonant deletion, and 4) the Sonority Sequencing Principle.

1.3. CONCLUSIONS

In this chapter I have argued that approaches based on syllable well-formedness should be rejected in accounts of consonant deletion, vowel epenthesis, and vowel deletion. This conclusion is supported in large part by the analysis of several deletion patterns for which syllable-driven accounts appear untenable. An additional problematic case – the French schwa – will be reviewed in the following chapter. These patterns rather reveal a number of sequential generalizations, which the rest of the dissertation will account for and further illustrate. The argument against reference to the syllable in deletion and epenthesis processes was completed by discussions suggesting that it is also insufficient, as the necessity of independent principles has never been questioned, and unnecessary, to the extent that patterns successfully accounted for in syllabic terms are amenable to an equally simple and insightful sequential analysis.

APPENDIX:
PRETERIT FORMS OF ICELANDIC WEAK VERBS

This appendix gives all the forms I obtained from my informants and various written sources for the Icelandic weak verbs whose preterit is formed by direct attachment of *-di/-ti/-ði* to the stem.

Sources:	B	Blöndal (1920)	E	Einarsson (1945)
	O	Informant O	H	Informant H
	R	Rögnvaldsson (1989)	H&C	Halle & Clements (1983)

Note 1: Einarsson (1945) is composed of a grammar and a lexicon. Almost all the data below are taken from the lexicon, in which every form is given with its pronunciation. In some cases, however, I have found additional forms or observations on the pronunciation of certain verbs in the grammar; these are also indicated, followed by the page number from which they are taken.

Note 2: Einarsson and Blöndal sometimes provide two pronunciations, which are supposed to reflect dialectal variation. In such cases I give both forms, but since it is not always clear what dialectal area they cover, I do not try to specify it.

Note 3: "---" indicates that the relevant form cannot be found in the given source.

Note 4: For nasal+stop and obstruent+nasal stems, I have not checked the pronunciations in Blöndal (1920), except for *efndi*, because there does not seem to be any variation on these forms.

	B	E	O	H	R	H&C
Nasal+Stop stems:						
hangdi 'hang'	?	[hauŋ̊d̥ɪ]	—	[hauŋ̊d̥ɪ]	—	—
hengdi 'hang'	?	[heiŋ̊d̥ɪ]	[heiŋ̊d̥ɪ]	[heiŋ̊d̥ɪ]	[heiŋ̊d̥ɪ]	—
hringdi 'ring'	?	[hr̥iŋ̊d̥ɪ]	[hr̥iŋ̊d̥ɪ]	[hr̥iŋ̊d̥ɪ]	[r̥iŋ̊d̥ɪ]	[hriŋ̊d̥ɪ]
kembdi 'comb'	?	[cʰɛmd̥ɪ]	[cʰɛmd̥ɪ]	[cʰɛmd̥ɪ]	[cʰɛmd̥ɪ]	—
skenkti 'pour'	?	[sceiŋ̊tʰɪ] [sceiŋ̊tɪ]	[sceiŋ̊tɪ]	[sceiŋ̊tɪ]	—	—
sprengdi 'explode'	?	[spreiŋ̊d̥ɪ]	[spreiŋ̊d̥ɪ]	[spreiŋ̊d̥ɪ]	—	—
tengdi 'join'	?	[tʰeiŋ̊d̥ɪ]	[tʰeiŋ̊d̥ɪ]	[tʰeiŋ̊d̥ɪ]	—	—

<u>Obstruent+Nasal stems:</u>						
signdi	?	—	[siŋd̥ɪ]	[siŋd̥ɪ]	—	[siŋd̥ɪ]
'bless'						
gegndi	?	—	[ɟeiŋd̥ɪ]	[ɟeiŋd̥ɪ]	—	—
'obey'						
rigndi	?	[rɪŋd̥ɪ]	[rɪŋd̥ɪ]	[rɪŋd̥ɪ]	[rɪŋd̥ɪ]	—
'rain'						
efndi	[ɛmd̥ɪ]	[ɛmd̥ɪ]	[ɛmd̥ɪ]	[ɛmd̥ɪ]	[ɛmd̥ɪ]	—
'carry'						
hefndi	?	[hɛmd̥ɪ]	[hɛmd̥ɪ]	[hɛmd̥ɪ]	—	—
'avenge'						
nefndi	?	[nɛmd̥ɪ]	[nɛmd̥ɪ]	[nɛmd̥ɪ]	—	—
'call'						
stefndi	?	[stɛmd̥ɪ]	[stɛmd̥ɪ]	[stɛmd̥ɪ]	—	—
'take a course'						
<u>Liquid+Nasal stems:</u>						
fermdi(st)	—	[fɛrmd̥ɪ]	[fɛrmd̥ɪ]	[fɛrmd̥ɪ]	[fɛmd̥ɪst]	—
'confirm (a child); load'						
vermdi	—	[vɛrmd̥ɪ]	[vɛrmd̥ɪ]	[vɛrmd̥ɪ]	—	—
'warm'						
þyrmdi	?	—	?	[θɪrmd̥ɪ]	[θɪmd̥ɪ]	—
'spare'						
hylmdi	—	*hylmdi* p.82	[hɪlmd̥ɪ]	[hɪlmd̥ɪ]	—	—
'conceal'						
stirndi	[stɪ(r)nd̥ɪ]	*sti(r)ndi* p.82	[stɪrnd̥ɪ]	[stɪ(r)nd̥ɪ]	[stɪnd̥ɪ]	—
'glitter'						
spyrndi	—	—	[spɪrnd̥ɪ]	[spɪ(r)nd̥ɪ]	—	—
'spurn'						
<u>Non-nasal consonant+Obstruent stems</u>:						
bergði	[bɛr(ɣ)ðɪ]	[bɛr(ɣ)ðɪ]	[bɛrɣðɪ]	[bɛr(g̊)ðɪ]	—	—
'taste'						
byrgði	[bɪr(ɣ)ðɪ]	[bɪr(ɣ)ðɪ] p.82	[bɪrɣðɪ]	[bɪr(g̊)ðɪ]	—	—
'lock up'						
ergði	[ɛr(ɣ)ðɪ]	—	[ɛrɣðɪ]	[ɛrg̊ðɪ]	—	[ɛrðɪ]
'tease'						
syrgði	[sɪrðɪ]	[sɪrðɪ] [sɪrɣðɪ]	[sɪrɣðɪ]	[sɪr(g̊)ðɪ]	—	—
'mourn'						
fylgdi	[fɪl(ɣ)d̥ɪ]	[fɪl(ɣ)d̥ɪ]	[fɪl(ɣ)d̥ɪ]	[fɪld̥ɪ]	[fɪld̥ɪ]	[fɪɬd̥ɪ]
'follow'						
svelgdi	[svɛl(ɣ)d̥ɪ]	[svɛl(ɣ)d̥ɪ]	[svɛld̥ɪ]	[svɛld̥ɪ]	—	—
'swallow'						
telgdi	[tʰɛlɣd̥ɪ] [tʰɛɣld̥ɪ]	[tʰɛlɣd̥ɪ] [tʰɛɣld̥ɪ]	[tʰɛlɣd̥ɪ]	[tʰɛld̥ɪ]	—	—
'whittle'						
velgdi	[vɛl(ɣ)d̥ɪ]	[vɛl(ɣ)d̥ɪ]	[vɛl(ɣ)d̥ɪ]	[vɛld̥ɪ]	—	—
'warm up'						

belgdi	?	—	?	?	[b̥ɛld̥ɪ]	—
'inflate'						
merkti	[mɛr̥(x)tɪ]	[mɛr̥(x)tɪ]	[mɛr̥(x)tɪ]	[mɛr̥tɪ]	—	—
'mark'						
styrkti	[stɪr̥(x)tɪ]	[stɪr̥(x)tɪ]	[stɪr̥xtɪ]	[stɪr̥tɪ]	—	—
'help'						
fylkti	—	[fɪl̥tɪ] [fɪlxtɪ]	[fɪl̥xtɪ]	[fɪl̥tɪ]	—	—
'array'						
velkti	[vɛl̥(x)tɪ]	[vɛl̥(x)tɪ]	[vɛl̥xtɪ]	[vɛl̥tɪ]	—	—
'soil'						
verpti	[vɛr̥tɪ]	[vɛr̥(p)tɪ]	[vɛr̥ptɪ]	[vɛr̥tɪ]	—	[vɛr̥tɪ]
'lay eggs'						
skerpti	[skɛr̥(p)tɪ]	—	[skɛr̥ptɪ] [skɛr̥ftɪ]	[skɛr̥tɪ]	—	—
'sharpen'						
skyrpti	—	—	[skɪr̥ptɪ] [skɪr̥ftɪ]	[skɪr̥(p)tɪ]	[skɪr̥tɪ]	—
'spit'						
erfði	[ɛr(v)ðɪ]	[ɛr(v)ðɪ]	[ɛrvðɪ]	[ɛrðɪ]	[ɛrðɪ]	—
'inherit'						
horfði	—	[hɔr(v)ðɪ]	[hɔr(v)ðɪ]	[hɔrðɪ]	[hɔrðɪ]	—
'look'						
hvolfdi	—	[hw̥ɔld̥ɪ] [kʰvɔld̥ɪ]	[kʰvɔlvd̥ɪ]	[kʰvɔld̥ɪ]	[kʰvɔld̥ɪ]	—
'capsize'						
skelfdi	[skɛlvd̥ɪ]	[skɛl(v)d̥ɪ] p.82	[skɛlvd̥ɪ]	[skɛld̥ɪ]	—	—
'frighten'						
þurfti	[θʏr̥tɪ]	[θʏr̥(f)tɪ]	[θʏr̥(f)tɪ]	[θʏr̥tɪ]	[θʏr̥tɪ]	—
'need'						
æskti	[aistɪ]	[aistɪ] [ais(k)tɪ]	[aistɪ]	[ais(k)tɪ]	—	—
'wish'						
ræskti	[raistɪ]	—	[raistɪ]	[raistɪ]	—	[raisti]
'clear the throat'						
<u>Obstruent+Liquid stems</u>:						
yggldi	[ɪlɣd̥ɪ]	—	[ɪɬd̥ɪ]	[iɬd̥ɪ]	[ɪld̥ɪ]	[ɪɬd̥ɪ]
'frown'						
sigldi	[sɪɣld̥ɪ] [sɪlɣd̥ɪ]	[sɪɣld̥ɪ] p.82: (ɣ)	[sɪɣld̥ɪ]	[sɪld̥ɪ]	[sɪld̥ɪ]	—
'sail'						
efldi	[ɛl(v)d̥ɪ] [ɛvld̥ɪ]	[ɛvld̥ɪ][ɛl(v)d̥ɪ]	[ɛl(v)d̥ɪ]	[ɛld̥ɪ]	[ɛld̥ɪ]	—
'strengthen'						
skefldi	[skɛlvd̥ɪ] [skɛvld̥ɪ]	p.14: vl/lv; p.82: (v)	[skɛld̥ɪ]	[skɛld̥ɪ]	[skɛld̥ɪ]	—
'form snowdrifts'						