Chapter 4

CONTRAST

Contrast, or its counterpart similarity, is emerging as one of the most fundamental notions in phonology.[1] The desirability of contrast between phonological elements, or the avoidance of similarity, pervades all corners of the field and manifests itself in a variety of ways. It constrains the application of phonological processes, the form of morphemes, the inventory of phonemes, and the specific realization of sounds. It applies under adjacency or at a distance, in a categorical or gradient fashion.

Much recent work focuses on the role of similarity avoidance in shaping the possible or prefered form of morphemes (Morpheme Structure Constraints), e.g. Pierrehumbert (1993, 1994a, 1994b), Berkley (1994), Frisch, Broe & Pierrehumbert (1997) and, from a different perspective, MacEachern (1997) (see also Frisch 1996). Others look at how similarity constrains the application of phonological processes: consonant deletion (Côté 1997a,b, 1998; Guy & Boberg 1997), dissimilation (Suzuki 1998), reduplication (Kelepir 1998; Wedel 1999, 2000), tonal patterns (Harrikari 1999), voicing agreement at a distance (Walker 2000, to appear).

The research just cited deals with syntagmatic aspects of contrast, between elements that cooccur in the speech stream. Phonologists have also recently explored its paradigmatic aspects, in attempts to define the role of perceptual contrast in determining inventories of phonemes and the specific realizations of phonemes in different contexts (e.g. Flemming 1995; Padgett 1997, 2000, to appear). This line of investigation draws on previous phonetic research on perceptual distance in the configuration of vocalic systems (Liljencrants & Lindblom 1972; Lindblom 1986), as well as Stevens et al's theory of enhancement features (Stevens, Keyser & Kawasaki 1986; Stevens & Keyser 1989; Keyser & Stevens 2001).

This chapter is concerned with the role of syntagmatic contrast in consonant deletion and vowel epenthesis. It elaborates on the generalization noted in chapters 1 and 2 that consonants that are more similar to adjacent segments are more likely to delete or trigger epenthesis than consonants that are more contrastive. An

[1] The same conclusion has been reached in phonetic research. For instance, Laver (1994: 391) writes: "One of the most basic concepts in phonetics, and one of the least discussed, is that of phonetic similarity."

alternative formulation is that consonants that are more similar to adjacent segments need to benefit from the cues associated with a flanking vowel, preferably a following one.

In the first section I review the aspects of the constraint system presented in the previous chapter that are relevant to the study of contrast, and expand on them. I also compare this approach to syntagmatic contrast with previously proposed ones, in particular the OCP. It is concluded that this principle is insufficient and fails to account for the full range of effects of identity or similarity avoidance. A distinction between *absolute* and *relative* identity avoidance is introduced. In the following two sections I apply the system to several case studies of consonant deletion and vowel epenthesis, in order of increasing complexity. Catalan, Black English, and French illustrate the role of agreement in single place, voicing, and manner features in deletion and epenthesis patterns. Hungarian shows the possible interaction of manner and place of articulation. Finally, I analyze in detail the very complex pattern of word-final cluster simplification in Québec French, which most clearly illustrates the gradient effect of similarity on consonant deletion. In addition to further illustrating the role of contrast in deletion and epenthesis, this chapter allows me to demonstrate the functioning of the constraint system developed in chapter 3 with more complex cases. Similarity avoidance often interacts in particular with the greater vulnerability of stops.

4.1. THE PROPOSED APPROACH TO CONTRAST BETWEEN ADJACENT SEGMENTS

4.1.1. REVIEW OF THE CONSTRAINT SYSTEM

The approach to contrast presented in chapter 3 rests on a proposed correlation between the amount of acoustic modulation in a sound sequence and its perceptual salience (e.g. Kawasaki 1982; Ohala & Kawasaki 1985; Wright 1996; Boersma 1998). The perceptibility of consonants is assumed to be determined in part by the amount of contrast between them and their adjacent segments, hence the desirability of maximizing this contrast (see section 3.1.4). Too much similarity (as determined on a language-specific basis) may trigger a repair, here deletion or epenthesis; enough contrast between a segment and its neighbors may block deletion. A trade-off relation can be established between the elements on both sides of a segment: the more similar a consonant is to one adjacent segment, the more contrasting it wants the adjacent element on the other side to be. Since the segments that are most dissimilar to consonants are vowels, we can hypothesize that the more similar a consonant is to a neighboring segment, the more it needs to be adjacent to a vowel to comply with the Principle of Perceptual Salience.

This idea is encoded in sub-families of markedness and faithfulness constraints. Markedness constraints require that consonants that agree in some feature F with a neighboring segment be adjacent to, or followed by, a vowel. These markedness constraints, given in (13) in chapter 3, are repeated below:

(1) MARKEDNESS CONSTRAINTS ENCODING THE ROLE OF SIMILARITY:

a. C(AGREE=F) ↔ V — A consonant that agrees in some feature F with a neighboring segment is adjacent to a vowel.

b. C(AGREE=F) → V — A consonant that agrees in some feature F with a neighboring segment is followed by a vowel.

Different features can be combined in more complex constraints of the type in (2). The inherent rankings are given in (3). (3a) is motivated by the lower perceptibility of consonants that violate a constraint of the C↔V family, in comparison with that of consonants that violate the corresponding constraint of the C→V family. (3b-c) encode the fact that the more features a consonant shares with its neighbors, the less perceptible it is, and the more stringent the requirement that it be adjacent to a vowel is. A consonant that agrees in some feature F needs an adjacent vowel more than a consonant that does not agree in F (3b). Consequently, a consonant that agrees in the features F and G needs an adjacent vowel more than one that agrees only in one of these features (3c).

(2) COMPLEX MARKEDNESS CONSTRAINTS ENCODING SIMILARITY:

a. C(AGREE=F∧G) ↔ V
A consonant that agrees in some features F and G with a neighboring segment is adjacent to a vowel.

b. C(AGREE=F∧G) → V
A consonant that agrees in some features F and G with a neighboring segment is followed by a vowel.

(3) INHERENT RANKINGS BETWEEN MARKEDNESS CONSTRAINTS:

a. C(AGREE=F) ↔ V >> C(AGREE=F) → V

b. C(AGREE=F) → V >> C → V
C(AGREE=F) ↔ V >> C ↔ V

c. C(AGREE=F∧G) → V >> C(AGREE=F) → V ; C(AGREE=G) → V
C(AGREE=F∧G) ↔ V >> C(AGREE=F) ↔ V ; C(AGREE=G) ↔ V

As discussed in section 3.2.3, MAX-C constraints against the deletion of consonants are also projected and ranked according to the consonants' relative

perceptibility. Consonants that contrast in some feature F are more perceptible than consonants that do not, and the constraints that regulate their deletion are ranked higher. This is expressed in the constraints in (4a) and the general rankings in (4b).

(4) FAITHFULNESS CONSTRAINT ENCODING SIMILARITY AND INHERENT RANKING:

a. MAX-C/CONTRAST=F
Do not delete a consonant that contrasts in some feature F with an adjacent segment.

b. MAX-C/CONTRAST=F >> MAX-C

In consonant deletion patterns, the desirability of contrast can often be integrated in either markedness or faithfulness constraints. When the situation arises, I have simply chosen the most transparent or simple analysis, without trying to establish broader generalizations on the domain of application of each type of constraint. Further research may limit the range of possible accounts, but, in the mean time, I do not see this indeterminacy of analysis as a problem. The basic idea remains the same: less perceptible consonants are more likely to drop than more perceptible ones. That different speakers may encode and implement this idea in various ways is not surprising, and there is no reason to expect that only one analysis is possible.

4.1.2. COMPARISONS WITH OTHER APPROACHES TO SYNTAGMATIC CONTRAST

Before moving to specific case studies, let us briefly discuss previous references to the idea of the desirability of contrast between adjacent segments, and its expression in terms of contrasting features. This idea is not new and has been a recurrent one in the development of the field. It dates back at least to Trnka (1936) and it has more recently been implemented in perhaps the most successful principle in post-SPE phonological theory: the Obligatory Contour Principle. When relevant, points of comparison between my proposal and these various approaches will be discussed. An important result of this section is that the approach advocated here subsumes the OCP, at least when it operates under strict adjacency, and integrates it into a more general framework based on the desirability of maintaining a sufficient amount of contrast between adjacent segments, which ultimately follows from the Principle of Perceptual Salience. In addition to the effects which are amenable to an OCP-based analysis, this approach accounts for the existence of compensatory effects between different adjacent elements in the desirability of contrast, a phenomenon termed *relative identity avoidance*. These effects cannot be handled by the standard version of the OCP, which only deals with *absolute identity avoidance*.

4.1.2.1. Early proposals

Trnka (1936) already proposed a Law of Minimal Phonological Contrast, which states that a segment *p* can be neither followed nor preceded in the same morpheme by a segment that differs from *p* by only one feature value. This law accounts for the impossibility of, for instance, sequences such as [fp] and [pb] in English, [ppʰ] in Sanskrit and Old Greek, [t-tʲ] in Russian, a nasal vowel and the corresponding oral one in French[2] (Trnka 1936: 57-58). Trnka's principle says nothing beyond the threshold of one contrast. The approach taken here is more global and allows any level of contrast to be relevant. Moreover, Trnka's one-feature rule does not apply to all features alike; /s/ and /t/, for instance, also differ by only one feature and /-st/ is yet a permissible sequence. This suggests that one has to look at specific features and that generalizations based on numbers of features, irrespective of their nature, are problematic.

With respect to consonant clusters in particular, Saporta (1955) suggested, on the basis of English and Spanish[3], that they should reflect the conflicting demands of hearers, who want more acoustic distinctions, and those of speakers, who try to minimize articulatory effort. These demands act in opposite directions on the amount of contrast in clusters, and Saporta predicts that these tend to show an intermediate amount of phonological contrast, computed in featural terms (using Jakobson et al's (1952) set of distinctive features). The results support this approach, as clusters composed of highly distinctive (e.g. /ŋθ, kz/) or highly similar (e.g. /dð, bv/) consonants were less frequent than combinations with an intermediate amount of contrast (e.g. /sp, nθ/).

Cutting (1975) tested Saporta's idea with another set of consonant clusters, containing a liquid /r, l/ or a glide /j, w/, that is clusters that are all quite common. He found that clusters with the highest frequency of occurrence actually showed the greatest number of featural contrasts. He hypothesized that clusters, at least frequently occuring ones, should show a maximal rather than an intermediate amount of contrast.

The evolution of word-final clusters from Old to Modern English, studied in McCalla (1980), provides some support for the principle of minimal contrast, which disfavors sequences composed of highly similar segments. The author computes the

[2]Sequences of a nasal vowel and the corresponding oral one in French are actually not quite impossible, as shown by the family name *Trahan* in Québec, pronounced [traã].
[3]See Bursill-Hall (1956) for an application of this proposal to French consonant sequences.

number of phonological differences between the members of two-consonant clusters in Old and Modern English.[4] The conclusion is that all the clusters that occur only morpheme-internally (monomorphemic clusters) and contain only one feature distinction in Old English have disappeared, so that Modern English does not have any such clusters.[5] This contrasts with the fact that most clusters containing two, three, and four distinctions have been retained in the language.

Kawasaki (1982), discussing Saporta's and Cutting's studies, objects to the use of distinctive features to evaluate contrast. She points out that the actual realization of a segment highly depends on the context in which it appears, as extensive interactions take place between adjacent segments. A feature-based account of contrast does not take into consideration the possible effect of these interactions, since features are invariable attributes of segments. So she considers more appropriate to look at contrast "at the level of concrete phonetic realization of segments" (Kawasaki 1982: 54). I could add to this criticism that different featural contrasts may affect the perceptibility of segments in quite different ways, and that classifying clusters on the number of contrasting features may be misleading.

One might reply that if features have any psychological reality, we may expect that speakers abstract away from the phonetic variability when computing contrast. I have no claim to make on this issue. But I would like to point out that my approach to contrast largely escapes the objections above. The only inherent rankings I propose rest on the idea that a contrast in the features F+G is preferable to a contrast in F only or G only, or that a contrast in F is preferable to no contrast in F. This should be generally true, independently of phonetic variation. But I make no comparisons between two different features F and G, and I do not give any phonological status to the *number* of contrasting features, irrespective of their identity, unlike Trnka, Cutting, Saporta, or earlier work of mine (Côté 1997a,b, 1998).

4.1.2.2. The Obligatory Contour Principle

The OCP has been widely used and accepted as a principle dealing with contrast between phonological elements (see section 1.2.1.2). But it has become

[4]The author adopts the feature system of Jakobson, Fant & Halle (1967), but notes that the use of Chomsky and Halle's (1968) system would not alter the conclusions of the study.
[5]The only clusters in Modern English with only one contrast are /-nd/ and /-st/, which occur across morpheme boundaries as well as morpheme-internally. This favors their conservation. Note, however, that the highest frequency of deletion of final /t, d/ is precisely observed in the sequences /st/ and /nd/ (see sections 1.2.3.3. and 4.3.3.3.), yielding such rimes as *fine* / *mind* and *down* / *ground* (Vennemann 1988).

increasingly clear that, in its standard version, the OCP can only scratch the surface of the role of constrast and similarity in phonology. Consider the following definition of the OCP, from McCarthy (1986: 208):

(5) OBLIGATORY CONTOUR PRINCIPLE (OCP):
At the melodic level, adjacent identical elements are prohibited.

Suzuki (1998) provides a clear and detailed discussion of the limitations of such an approach to identity avoidance. I would like to mention two of the shortcomings pointed out in this work, both related to the categorical nature of this definition. (5) prohibits elements that are identical and adjacent, but is irrelevant to non-adjacent and non-identical elements. Yet evidence for a more gradient approach has been accumulating, on both the adjacency and identity dimensions. First, more similar segments are avoided more than less similar segments; the correlation between the degree of similarity between phonological elements and the extent to which they are prevented to surface is not conveyed by the standard approach to the OCP. Second, similarity avoidance does not only apply to elements that are adjacent but correlates with their proximity. The closer the distance between elements, the stronger the identity avoidance. Obviously, the avoidance is greatest when elements are strictly adjacent, but there is no reason to limit its application to this context.[6]

The approach taken here deals with gradient effects on the identity dimension. This is achieved through the hierarchy of C(AGR=F)→V and C(AGR=F)↔V constraints that can be constructed using the inherent rankings in (3). The rankings in (6), for example, encodes the fact that the more features a consonant shares with an adjacent segment, the more marked it is. The interaction of these rankings with faithfulness constraints necessarily leads to more similar segments being avoided more than less similar ones.

(6) HIERARCHY OF AGREEMENT AND CONTRAST CONSTRAINTS:
C(AGR=F∧G∧H)↔V >> C(AGR=F∧G)↔V >> C(AGR=F)↔V >> C↔V
C(AGR=F∧G∧H)→V >> C(AGR=F∧G)→V >> C(AGR=F)→V >> C→V

But the effects of these constraints do not extend beyond strictly adjacent segments, as their definition in (1) makes clear. In the deletion and epenthesis

[6]Feature geometry and the segregation of features on different planes or tiers provides no solution to the non-adjacency problem of the definition in (5). The notion of tier-adjacency has been central in the application of the OCP, but it fails to account for the effect of proximity, as discussed in Suzuki (1998).

patterns I analyze, the role of contrast does not seem to involve non-adjacent segments. The primacy of adjacent elements is expected under the perceptual approach proposed here. Contrast reflects the amount of acoustic modulation, a major component of the perceptibility of consonants. It is reasonable to suppose that the perceptibility of a segment is primarily determined by modulation in its strict vicinity, hence the adjacency restriction. But I do not exclude the possibility that the constraints in (1) should be reformulated to allow reference to non-adjacent elements. Note that Boersma (1998) establishes a sharp distinction between contrast between adjacent vs. distant elements. He suggests that contrast between adjacent elements is perceptually-based, which is also the position taken here, but that contrast between non-adjacent elements is motivated by the desire to avoid repetitions of the same articulatory gestures. I think more research is needed to determine precisely the contribution of perceptual and articulatory factors in different aspects of contrast. But if indeed the desirability of contrast between adjacent and non-adjacent elements should be distinguished, we expect that it will be handled by different sets of constraints. The task, then, would not be to reformulate the constraints in (1) but to design a different family of constraints to deal with contrast at a distance. It is unclear at this point to what extent similarity avoidance in phonology is a unified phenomenon that impacts sound patterns through one or multiple sets of constraints.

Besides the proximity and identity dimensions in contrast, clearly identified by Suzuki (1998), the deletion and epenthesis patterns investigated in this and chapters 1-2 reveal the existence of another dimension that escapes the OCP: the distinction between what I call absolute and relative similarity avoidance. *Absolute similarity avoidance* refers to situations where agreement in some feature F between two adjacent segments is not tolerated, independently of the context in which these two segments find themselves. *Relative similarity avoidance* is characterized by the presence of compensatory effects between different components of consonant perceptibility. The degree of tolerance for a certain level of similarity, expressed by featural agreement, between two adjacent segments is not determined in an absolute fashion, but depends on quality and quantity of the perceptual cues that are otherwise available to these segments. In other words, the negative effects of a similar adjacent segment on the perceptibility of a consonant can be (partially) offset by the presence of good cues in other portions of the string. In particular, similarity on one side can be compensated by having a more dissimilar segment on the other side. More specifically, the patterns described in this chapter suggest that consonants that are next to a vowel tolerate more similarity with an adjacent segment on the other side than consonants that do not benefit from the strong cues associated with an adjacent vowel.

An example will help to make the absolute/relative distinction clear. Suppose the three sequences in (7), in which C_1 and C_2 agree in a feature F. Suppose also the existence of a constraint that militates against a segment sharing the feature F with an adjacent segment.

(7) ABSOLUTE VS. RELATIVE SIMILARITY AVOIDANCE:

a. VC_1C_2V	C_1, C_2=[F]	*absolute	√relative
b. $VC_1C_2C_XV$	C_1, C_2=[F]	*absolute	*relative
c. VC_1C_2##	C_1, C_2=[F]	*absolute	*relative

If this constraint is interpreted in an absolute fashion, the three forms in (7) are equivalent with respect to it. C_1 and C_2 are adjacent and they are both specified for F; this is sufficient to induce a violation of the constraint, no matter what other segments appear next to C_1 and C_2. But if the constraint is interpreted relatively, it may distinguish (7a) from (7b) and (7c). Specifically, it would be violated only in (7b-c). In (7a), C_1 and C_2 agree in F, but they are also adjacent to a vowel, which provides them with optimal perceptual cues. They may therefore tolerate a relatively similar segment on the other side, specifically one that shares the feature F. In (7b) and (7c), however, C_2 is followed by another consonant C_X or by no segment, two contexts in which C_2 does not benefit from good contextual cues. In such situations C2 may not tolerate too similar adjacent segments on the other side, in this case segments that agree with it in the feature F.

The OCP is designed to derive cases of absolute identity avoidance: two adjacent segments cannot share one or several feature specifications, irrespective of how they stand with respect to other adjacent segments. But this principle cannot, without additional assumptions, account for cases of relative identity avoidance and the existence of trade-off effects between different sources of cues, in particular the type of segment and the elements on both sides of it. The constraint system proposed here, however, is able to handle both types of contrast effects. Constraints of the C(AGREE=F)→V family are equivalent to OCP-F constraints and deal with absolute identity. Constraints of the C(AGREE=F)↔V family directly derive the relative interpretation of similarity avoidance, and the inherent rankings in (3b-c) encode the idea that the more similar a consonant is to an adjacent segment, the better cues it needs otherwise, in particular vocalic transitions, to ensure a sufficient level of perceptual salience. The OCP is thus subsumed into a more general approach to similarity avoidance.

The interaction of the constraints C(AGREE=F)↔V >> C(AGREE=F)→V (3a) with faithfulness constraints determine whether agreement in the feature F between adjacent segments is: tolerated (FAITH ranked high, 8a), subject to relative avoidance (8b), or subject to absolute avoidance (FAITH ranked low, 8c).

(8) DERIVING IDENTITY AVOIDANCE EFFECTS:

a. FAITH >> C(AGREE=F)↔V >> C(AGREE=F)→V
Agreement in F always tolerated

b. C(AGREE=F)↔V >> FAITH >> C(AGREE=F)→V
Relative avoidance of agreement in F

c. C(AGREE=F)↔V >> C(AGREE=F)→V >> FAITH
Absolute avoidance of agreement in F

To illustrate the effect of C(AGREE=F)→V, C(AGREE=F)↔V, and OCP constraints, let us briefly consider three simple examples from Lenakel, French, and Hungarian introduced in previous chapters. Lenakel illustrates absolute identity avoidance, while French and Hungarian display the effect of relative identity avoidance.

We saw in section 3.3.1 that in Lenakel epenthesis obligatorily takes place between two identical consonants across a morpheme boundary (9).[7] This is an effect of the role of contrast: only sequences of consonants that are minimally distinct are tolerated; identical consonants may not appear next to each other.

(9) EPENTHESIS BETWEEN IDENTICAL CONSONANTS IN LENAKEL:

a. /i-ak-kin/	→	[yɑgə̲gən]	'I eat it'
b. /t-r-rai/	→	[tɨɾɨ̲ɾɑy] / [dɨɾɨ̲ɾɑy]	'he will write'

This process was accounted for with a constraint C(AGREE=∀F)→V requiring that a consonant that agrees with an adjacent segment in all features be followed by a vowel (10a). Equivalently, we could use a standard OCP constraint (10b). These constraints crucially dominate the constraint DEP-V. This is illustrated in the following tableau.

[7] In sequences of coronal consonants, including identical ones, we observe deletion of the first consonant rather than epenthesis. Coronal deletion, however, fails to apply to four verbal prefixes: the future /t-/, the third person singular subject /r-/, the perfective /n-/, and the negative /is-/. If one of these coronal consonants is followed by an identical consonant, the general epenthesis rule takes place, as in (9b).

(10) RELEVANT MARKEDNESS CONSTRAINTS OF THE C→V AND OCP FAMILIES:
a. C(AGREE=∀F)→V
A consonant that agrees in all features with a neighboring segment is followed by a vowel.
b. OCP-Root
No sequence of identical segments.

(11) EPENTHESIS BETWEEN IDENTICAL CONSONANTS IN LENAKEL:

/i-ak-kɨn/	C(AGREE=∀F)→V OCP-Root	DEP-V
yɑggən	* !	
→ yɑgə̲́gən		*

OCP-Root and C(AGREE=∀F)→V have the same effect of eliminating *any* sequence of identical segments. This is clear in the definition of the OCP constraint in (10b), but achieved somewhat indirectly by the C(AGREE=∀F)→V constraint. In any sequence of two consonants, the first one necessarily fails to be followed by a vowel. Such sequences are therefore subject to violating a C(AGREE=F)→V constraint. So a violation of C(AGREE=∀F)→V automatically follows if the two adjacent consonants are identical, as in (11).

Consider now the case of French, which is developed in more detail in section 4.2.3. As discussed in section 2.3.5.2, this language obligatorily inserts schwa between a verbal stem ending in a consonant and a 1st/2nd plural conditional ending /-rjɔ̃, -rje/ (12a). But no epenthesis takes place with stems ending in a vowel (12b).

(12) (NON-)EPENTHESIS BEFORE 1/2 PL. COND. ENDINGS IN FRENCH:

a. *fumeriez*	'smoke+COND.2PL'	/fym+rje/	[fymə̲rje]
b. *finirions*	'finish+COND.1PL'	/fini+rjɔ̃/	[finirjɔ̃]

I argued that /r/ and /j/ are both glides specified as [+vocoid], and that epenthesis in (12a) is motivated by the desire for every consonant that agrees in the feature [+vocoid] to be adjacent to a vowel. I take this process to be an effect of similarity avoidance, and account for it with the constraint in (13), which dominates the constraint against epenthesis, as shown in (14). Epenthesis always takes place at morpheme boundaries; this is derived by a CONTIGUITY constraint which prohibits insertion morpheme-internally.

(13) RELEVANT MARKEDNESS CONSTRAINT OF THE C↔V FAMILY:
C(AGREE=[+vocoid]) ↔ V
A consonant that agrees in [+vocoid] with a neighboring segment is adjacent to a vowel.

(14) (NON-)EPENTHESIS BEFORE 1/2 PL. COND. ENDINGS IN FRENCH:

/fym+rje/	C(AGR=[+voc])↔V	CONTIGUITY	DEP-V
fymrje	(r) !		
→ fymə̲rje			*
fymrə̲je		* !	*
/fini+rjɔ̃/			
→ finirjɔ̃			
finiə̲rjɔ̃			* !
finirə̲jɔ̃		* !	*

Notice, crucially, that epenthesis does not remove the sequence of [+vocoid] segments [rj], since schwa is inserted before the [r]: [fymə̲rje]. This form violates an OCP-[+vocoid] constraint (15a) or its equivalent C(AGR=[+voc])→V (15b), just like the faithful output [fymrje]. These constraints are ranked below DEP-V and are too low to have an effect. So epenthesis cannot naturally be seen as derived by the OCP, which fails to establish the connection between epenthesis and identity avoidance.

(15) MARKEDNESS CONSTRAINTS OF THE C→V AND OCP FAMILIES:
a. OCP-[+vocoid]
No sequence of [+vocoid] consonants.
b. C(AGREE=[+vocoid]) → V
A consonant that agrees in [+vocoid] with a neighboring segment is followed by a vowel.

In this particular case the OCP approach could be made to work if the domain of application of the OCP constraint were restricted to the syllable. Only tautosyllabic sequences sharing the feature [+vocoid] would violate OCP-[+vocoid], heterosyllabic ones being immune to the effect of this constraint. The correct output [fy.mə̲r.je] would not violate the OCP if the syllable break lies between [r] and [j], but [fum.rje] would, provided the indicated syllabification is the correct one. Such a solution is undesirable to the extent that the arguments that the syllable is irrelevant in accounting for deletion and epenthesis patterns are valid (see chapter 1). Moreover, it is unavailable in the Hungarian case of relative identity avoidance, sketched below and analyzed in more detail in section 4.2.4.

Recall from section 1.2.3.1. that stops may delete under certain conditions in medial position of triconsonantal clusters in Hungarian. First, stop deletion is possible if the following segment is a nasal or a stop, i.e. specified as [-continuant], but is blocked if the following consonant is [+continuant]. Second, deletion takes place only with a preceding [-approximant] consonant (an obstruent or a nasal), but not if the preceding segment is a liquid or a glide. The following data show the effect of these conditions on stop deletion.

(16) STOP DELETION 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'

(17) DELETION BLOCKED IF THE PRECEDING CONSONANT IS [+APPROXIMANT]:

a.	*talpnyaló*	[tɔlpnʲɔlo:]	*[tɔlnʲɔlo:]	'lackey'
b.	*szerbtől*	[sɛrptø:l]	*[sɛrtø:l]	'from (a) Serb'
c.	*sejtmag*	[ʃɛjtmɔg]	*[ʃɛjmɔg]	'cell nucleus'
d.	*bazaltkő*	[bɔzɔltkø:]	*[bɔzɔlkø:]	'basalt stone'

(18) DELETION BLOCKED IF THE FOLLOWING CONSONANT IS [+CONTINUANT]:

a.	*aktfotó*	[ɔktfoto:]	*[ɔkfoto:]	'nude photograph'
b.	*hangsor*	[hɔŋkʃor]	*[hɔŋʃor]	'sound sequence'
c.	*handlé*	[hɔndle:]	*[hɔnle:]	'second-hand dealer'
d.	*centrum*	[tˢɛntrum]	*[tˢɛnrum]	'center'
e.	*kompjúter*	[kompju:tɛr]	*[komju:tɛr]	'computer'

I interpret this pattern in the following way. The motivation for the continuancy condition on the following segment relates to the audibility of the stop release burst: only [-continuant] segments, which involve a complete closure in the oral cavity, may induce a complete masking of the preceding stop burst. The requirement that the preceding consonant be [-approximant] follows from the effect of contrast: deletion only applies in the presence of a reduced contrast in manner of articulation between the stop and the preceding segment, specifically when the two consonants agree in the feature [approximant]. In other words, similarity between the stop and the preceding segment triggers deletion only in contexts where the audibility of the stop burst is threatened, i.e. only if the cues otherwise available to the stop are reduced. The presence of compensatory effects between the two sides of

the stop is clear: if the audibility of the stop burst is not threatened, any level of similarity between the stop and the preceding consonant is tolerated.

It is hard to see how an OCP approach could account for this pattern. Let us adopt an OCP-[approximant] constraint. This constraint is equally violated in [ɔstmɔ] (16b), [ɔktfoto:] (18a), and [hɔndle:] (18c), but only in the first case is deletion observed. This problem cannot be solved by restricting the application of the OCP constraint to tautosyllabic sequences. For this solution to work, we would have to adopt the following conditions: 1) all $C_1C_2C_3$ clusters are syllabified $[C_1.C_2C_3]$ if C_3 is [+continuant] and $[C_1C_2.C_3]$ if C_3 is [-continuant], and 2) the OCP only applies in *coda* clusters, and not in onset ones. Under these conditions, the OCP would be violated in [ɔst.mɔ], which contains a sequence of two [-approximant] consonants in coda position, but not in [ɔk.tfoto:] or in [hɔn.dle:]; in the first case the sequence of [-approximant] consonants appears in onset position, in the second case there is no such tautosyllabic cluster. The problem here is that neither the syllabification rule relating to the continuancy of C_3 nor the restriction to coda clusters is independently justified. In contrast, the solution in terms of relative identity avoidance adopted here has a clear perceptual motivation.

I have argued in this section that the OCP is insufficient as a principle that deals with the desirability of contrast between phonological elements. The approach taken here is more general and is able to account in particular for relative similarity avoidance effects, as opposed to absolute ones. The two types are handled by C(AGREE=F)↔V and C(AGREE=F)→V constraints, respectively. In addition to the French and Hungarian cases just presented, the rest of the chapter provides an analysis of stop deletion in Catalan, English, and Québec French. I take these patterns to also display relative rather than absolute similarity avoidance. In all of them stops delete word-finally but stay before vowel-initial suffixes, e.g. *cold* vs. *colder*. This contrast follows from the absence vs. presence of vocalic cues: similarity between the stop and the preceding consonant is tolerated if the stop otherwise benefits from good transition cues.[8]

[8] As in the French case above, using the syllable as the relevant domain for the application of OCP constraints could save the OCP approach here: [l] and [d] are tautosyllabic in *cold* but heterosyllabic in *col.der*. Alternatively, it could be specified that stops may only delete in absolute word-final position. The fact that neither of these solutions is available in Hungarian shows the crucial character of this pattern in establishing the distinction between absolute and relative similarity avoidance.

4.2. IDENTITY AVOIDANCE: FIRST APPLICATIONS

In this section I present several deletion and epenthesis patterns conditioned by similarity with an adjacent segment on one or more dimensions. The first three cases – Catalan, Black English, and French – were chosen because they involve features pertaining to three different categories: place of articulation, laryngeal setting, and manner of articulation. The following examples – Hungarian and Siatista Greek – show the contribution of contrast in both manner and place of articulation in determining the behavior of consonants. A more complex case – Québec French – is discussed at length in section 4.3.

4.2.1. AGREEMENT IN [PLACE]: CATALAN

In Catalan, as mentioned in section 1.2.1.2, word-final clusters are productively simplified by deletion of the last consonant (Mascaró 1983, 1989; Bonet 1986; Wheeler 1986, 1987; Morales 1995; Herrick 1999). The process can be quite simply described in terms of two parameters. First, only stops can drop, as shown in (20), while fricatives and nasals are stable word-finally, in contexts that are otherwise identical (19).

(19) RETENTION OF WORD-FINAL CONSONANTS OTHER THAN STOPS:

a.	[-rs]:	*curs*	'course'	/curs/	→	[kurs] * [kur]
b.	[-rn]:	*carn*	'meat'	/karn/	→	[karn] * [kar]
c.	[-ls]:	*pols*	'dust'	/pols/	→	[pols] * [pol]
d.	[-lm]:	*balm*	'balm'	/balm/	→	[balm] * [bal]
e.	[-ns]:	*fons*	'bottom'	/fons/	→	[fons] * [fon]
f.	[-ts]:	*pots*	'you can'	/pots/	→	[pots] * [pot]

(20) DELETION OF WORD-FINAL STOPS:

a.	[-rt]:	*fort*	'strong'	/fort/	→	[for]
b.	[-lt]:	*alt*	'tall'	/alt/	→	[al]
c.	[-nt]:	*punt*	'point'	/punt/	→	[pun]
d.	[-st]:	*bast*	'vulgar'	/bast/	→	[bas]

(Wheeler 1987; Morales 1995)

Second, a homorganicity condition applies to consonant deletion: only stops that are homorganic with the preceding consonant may be omitted. Contrast the data in (21) and (22), which contain words ending in heterorganic and homorganic

clusters, respectively. The heterorganic ones surface intact (21), but those in (22) show deletion of the final stop.[9]

(21) RETENTION OF NON-HOMORGANIC STOPS:

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

(22) DELETION OF HOMORGANIC STOPS:

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]

(Morales 1995)

Previous attempts to explain the contrastive behavior of stops, fricatives, and nasals are unsatisfactory. Wheeler (1987) suggests that word-final fricatives do not delete when they follow a stop because a process of affrication takes place, that merges the two consonants into one. Nikièma (1998) and Papademetre (1982) adopt the same idea for Québec French and Siatista Greek, respectively (these two patterns will be described below). This process is not available when a stop follows a fricative, which explains the contrast between /-st/ → [-s] and /-ts/ → [-ts]. This proposal accounts for the deletion facts in obstruent clusters, but fails to explain why stops, but not fricatives, delete after a sonorant.

Morales (1995) suggests filling this gap by using Radical Underspecification. In the account he proposes for the Catalan facts in (19)-(22), the special status of stops with respect to deletion is related to their feature specification. Stops are unspecified

[9]Tha data are more complex than shown in (21)-(22). While clusters in (21) are never reduced, deletion in those in (22) is variable, depending on the type of cluster, the dialect, the morpho-phonological environment, and lexical factors. See Wheeler (1986), Bonet (1986), and Mascaró (1983, 1989). In particular, we observe a correlation between the likelihood of deletion and the degree of similarity in manner of articulation between the stop and the preceding consonant, which is perfectly consistent with the approach to contrast taken here. See Côté (2001) for a more complete analysis of the Catalan pattern, which integrates additional generalizations on manner of articulation.

for manner features, whereas all other segments are specified for at least one such feature ([continuant] for fricatives, [lateral] for /l/, [sonorant] for /r/, and [nasal] for nasals). According to Morales, tautosyllabic segments merge as a result of the OCP if one subsumes the other, that is if their feature specifications are identical to each other or correspond to a subset of each other. Stops being unspecified for manner, their manner specifications, i.e. Ø, are necessarily a subset of those of the preceding segment. This explains why stops can delete (through merger) whatever the preceding consonant is. However, a liquid, a nasal, or a fricative cannot be subsumed by an adjacent segment (unless it is also a liquid, a nasal, or a fricative). The homorganicity requirement follows automatically: if a final stop contains a place specification that is not contained in the previous segment, it cannot be subsumed by this segment and no merger takes place. The relevant contrasts are illustrated in (23). Notice that coronals are assumed to be unspecified for place.

(23) MERGER AND NON-MERGER OF WORD-FINAL STOPS (Morales 1995):

a. Merger takes place:

/n/ + /t/ → /n/ (ex. *punt* [pun])
[nas] Place | Place | [nas] Place

b. Merger does not take place because /s/ is specified for [cont]:

/n/ + /s/ → /ns/ (ex. *fons* [fons])
[nas] Place | [cont] Place

c. Merger does not take place because /k/ is specified for [vel]:

/l/ + /k/ → /lk/ (ex. *calc* [kalk])
[lat] Place | Place | [vel]

This approach yields the correct results for the data presented here because only homorganic clusters can be simplified in this language. So, no place or manner of articulation features ever get deleted. It does not extend, however, to other patterns of final stop deletion, such as those observed in Québec French and English (see section 4.3). As we will see below, non-homorganic clusters do simplify in these languages, which necessarily involves the deletion of place features; and assuming that coronals are unspecified for place is not a solution since non-coronal consonants also delete in non-homorganic clusters in Québec French. So Morales's solution does not generalize to additional data in Québec French and English, which are otherwise similar to the Catalan ones.[10]

This approach also has to stipulate that the OCP only applies to tautosyllabic segments. Stops delete word-finally but not when followed by a vowel-initial suffix, as shown by the contrast between the base form and its diminutive in (24). The stops in the diminutive forms are preceded by a homorganic consonant, yet no deletion takes place. If [puntɛt] is syllabified as [pun.tɛt] and the OCP only applies syllable-internally, no merger takes place since the two consonants pertain to different syllables.

(24) FINAL STOPS IN BASE AND DIMINUTIVE FORMS:

	Base form	*Diminutive*	
a.	[pun]	[puntɛt]	'point'
b.	[baŋ]	[bəŋkɛt]	'bank'
c.	[kam]	[kampɛt]	'field'

I believe all the elements of the Catalan pattern – the restriction to stops, the homorganicity requirement, and the blocking of deletion before vowel-initial suffixes – follow from the perceptual approach advocated here. They correspond to three well-established generalizations, which are encoded in the constraint system developed in chapter 3. Consonants are more likely to delete when not adjacent to a vowel. This is particularly true of stops because of their weak internal cues. Consonants that agree in some feature with an adjacent segment are also more susceptible to deletion than consonants that do not share this feature, hence the homorganicity condition. These three factors are unified in a single markedness constraint (25a), which demands that every stop that agrees in place of articulation with an adjacent segment appear next to a vowel. This constraint inherently dominates the general constraint against consonants that are not adjacent to a vowel C↔V (25b). It crucially interacts with faithfulness constraints militating against consonant deletion (26a-c), inherently ranked as in (26d) (see (29) in section 3.2.3). MAX-C must itself be outranked by all the other faithfulness constraints which could apply here, notably DEP-V.

[10]The merger solution also fails to explain the correlation mentioned in the previous footnote between the likelihood of deletion and the degree of similarity in manner of articulation between the stop and the preceding segment.

(25) RELEVANT MARKEDNESS CONSTRAINTS AND INHERENT RANKING:
a. stop(AGREE=[place]) ↔ V
A stop that agrees in place of articulation with a neighboring segment is adjacent to a vowel.
b. stop(AGREE=[place]) ↔ V >> C ↔ V

(26) RELEVANT FAITHFULNESS CONSTRAINTS AND INHERENT RANKING:
a. MAX-C/__V Do not delete a prevocalic consonant.
b. MAX-C/V__ Do not delete a postvocalic consonant.
c. MAX-C Do not delete a consonant.
d. MAX-C/ __V >> MAX-C/V__ >> MAX-C

The only language-specific ranking between the markedness and faithfulness constraints we need to establish to derive the Catalan pattern is given in (27). This ranking generates the deletion of all and only word-final stops that are homorganic with the preceding segment. This is shown in the tableau in (28).

(27) RANKING SPECIFIC TO CATALAN:
stop(AGREE=[place]) ↔ V >> MAX-C >> C ↔ V

(28) DELETION AND RETENTION OF WORD-FINAL CONSONANTS IN CATALAN:

a. /punt/	MAX-C/__V	MAX-C/V__	stop(AGREE=[place])↔V	MAX-C	C↔V
punt			(t) !		(t)
→ pun				*	
put		* !			
b. /fons/					
→ fons					(s)
fon				* !	
fos		* !			
c. /kalk/					
→ kalk					(k)
kal				* !	
kak		* !			
d. /punt+ɛt/					
→ puntɛt					
punɛt	* !				
putɛt		* !			

Only the faithful form in (28a) [punt] violates the relevant markedness constraint; only it contains a stop that agrees in place with an adjacent segment without being next to a vowel. Simplification therefore occurs and yields the form [pun]. In the other examples the faithful output with the cluster surfaces because the markedness constraint is not violated: in (28b) we have a homorganic cluster but the final consonant is not a stop; in (28c) the final stop is not homorganic with the preceding consonant; in (28d) all consonants are adjacent to a vowel, in conformity with the markedness constraint stop(AGR=[place])↔V.[11]

4.2.2. AGREEMENT IN [VOICE]: BLACK ENGLISH

Final stop deletion in English provides a case similar to Catalan. Only stops delete (ex. *bend* vs. *ben<u>ch</u>*), they do so only following another consonant (*bend* vs. *be<u>d</u>*), and deletion fails to apply before a vowel-initial suffix (*bend* vs. *ben<u>d</u>ing*). As explained in section 1.2.3.3, final stop deletion is favored by agreement in some feature(s) between the members of the cluster, or, in other words, disfavored by the presence of some contrast(s). The likelihood of deletion thus correlates with the degree of similarity between the final stop and the preceding consonant. Interestingly, varieties of English differ on what shared features trigger deletion. In Philadelphia English, for instance, similarity is computed over multiple features; no single feature blocks the deletion of final consonants, as is the case for place of articulation in Catalan. The Philadelphia English pattern will be discussed in conjunction with consonant deletion in Québec French, since both processes are strikingly similar.

In Black and Puerto Rican English, however, the deletion of stops in word-final clusters is closely correlated with agreement in voicing between the members of the cluster (Shiels-Djouadi 1975). Obstruent clusters all agree in voicing (29a), and a voicing contrast between the stop and the preceding consonant is only observed in

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[11] Notice that in the Catalan case we could use the absolute markedness constraint stop(AGR=[place])→V instead of its relative version stop(AGR=[place])↔V.
(i) MAX-C/__V >> MAX-C/V__ >> stop(Agr=[place])→V >> MAX-C
The ranking in (i) yields the same results as that used in (28), since MAX-C/V__ >> stop(Agr=[place])→V crucially prevents the deletion of all consonants that are adjacent to a vowel, irrespective of whether they share place with another consonant. This would force retention of the post-vocalic stop in [pots] (19f), not included in the tableau in (28). In cases of consonant deletion, the retention of consonants adjacent to a vowel can be derived either through the high ranking of MAX-C/V__, as in (i), or the low ranking of C→V constraints, as in (28). It should be clear, however, that the relative freedom between C↔V and C→V enjoyed by cases of consonant deletion does not undermine the distinction drawn in section 4.1.2.2. between absolute and relative identity avoidance, since it does not extend to processes of vowel epenthesis, such as the Lenakel and French ones, in which the choice between C↔V and C→V is strict.

sonorant+obstruent final sequences (29c,e). For Black English, Shiels-Djouadi reports the following percentages of final coronal stop deletion after /l/, /n/, and obstruents:

(29) PERCENTAGE OF FINAL CORONAL STOP DELETION:

a.	O+/t,d/	72%	*Examples*:	post, buzzed
b.	/-ld/	74%		killed, gold
c.	/-lt/	0%		built, bolt
d.	/-nd/	86%		send, find
e.	/-nt/	13%		rent, pinte

The contrast between the cluster /-ld/, which shows agreement in voicing, and /-lt/, which does not, is striking: /d/ is deleted in 74% of the tokens, whereas /t/ is invariably retained. The opposition between /-nd/ and /-nt/ is similar, deletion being slightly more likely with /n/ than with /l/, all else being equal. Interestingly, the frequency of stop deletion in obstruent clusters is very close to that observed for /ld/. So the crucial factor in stop deletion in Black English appears to be agreement in voicing. Idealizing somewhat, we may say that only stops that agree in the feature [voice] with the preceding segment delete. This is completely parallel to the Catalan case, except for the identity of the relevant feature. The crucial markedness constraint is given in (30a), and the established language-specific ranking in (30b). No illustrating tableau is necessary here; the reader may just use the one in (28) and transpose it to the voicing case.

(30) MARKEDNESS CONSTRAINT AND RANKING SPECIFIC TO BLACK ENGLISH:

a. stop(AGREE=[voice]) ↔ V
A stop that agrees in voicing with a neighboring segment is adjacent to a vowel.

b. Ranking specific to Black English:
stop(AGREE=[voice]) ↔ V >> MAX-C >> C ↔ V

4.2.3. AGREEMENT IN [+VOCOID]: FRENCH

We saw in chapter 2 (section 2.3.5.) the role played by the feature [vocoid] in the distribution of schwa. In particular, schwa epenthesis applies to ensure that every consonant that agrees in [+vocoid] with an adjacent segment is adjacent to a vowel. Epenthesis is obligatory at PW-internal morpheme boundaries but optional at PW boundaries. So we have a case where contrast interacts with the prosodic structure to derive the epenthesis facts. The relevant sequences arise with suffixes or words beginning with an /r/+glide cluster (recall that /r/ in this context is considered a

glide). The only such suffix is the 1st/2nd plural conditional ending /-rjɔ̃, -rje/. When this suffix attaches to verb stems ending in a consonant, we get an underlying sequence /Crj/ and schwa insertion is obligatory (31). This contrasts with the situation in (32), which illustrates the absence of schwa when /-rjɔ̃, -rje/ follows a verb stem ending in a vowel. The examples in (33) show that schwa is only optionally inserted in other future and conditional forms containing clusters of three consonants /CCr/, that do not involve sequences of [+vocoid] consonants.

(31) OBLIGATORY SCHWA IN /C+rjV/:

a.	*gâterions*	'spoil+COND.1PL'	/gat+rjɔ̃/	[gatərjɔ̃]
b.	*fumeriez*	'smoke+COND.2PL'	/fym+rje/	[fymərje]

(32) NO SCHWA IN /V+rjV/:

a.	*finirions*	'finish+COND.1PL'	/fini+rjɔ̃/	[finirjɔ̃]
b.	*créeriez*	'create+COND.2PL'	/kre+rje/	[krerje]

(33) OPTIONAL SCHWA IN OTHER /CC+r/ SEQUENCES IN FUTURE/COND FORMS:

a.	*posterais*	'mail+COND.1SG'	/pɔst+rɛ/	[pɔst(ə)rɛ]
b.	*fermerais*	'close+COND.1SG'	/fɛrm+rɛ/	[fɛrm(ə)rɛ]
c.	*adopterais*	'adopt+COND.1SG'	/adɔpt+rɛ/	[adɔpt(ə)rɛ]

At PW boundaries schwa insertion is optional between a consonant and a word beginning in an /r/+glide sequence. Relevant examples are provided in (34).

(34) OPTIONAL SCHWA BEFORE WORD-INITIAL /r/+GLIDE SEQUENCES:

a.	*aime rien*	'like nothing'	/ɛm rjɛ̃/	[ɛm(ə)rjɛ̃]
b.	*Patrick Roy*	(name)	/patrik rwa/	[patrik(ə)rwa]

These facts are derived by means of markedness constraints similar to those used for Black English and Catalan above. The relevant feature is here [vocoid] rather than [place] or [voice]. In addition, the prosodic context has to be specified in the constraints since it affects the application of epenthesis. Consider the markedness constraints in (35), inherently ranked as in (36). These rankings encode the fact that PW-internal consonants and consonants that agree in [+vocoid] with an adjacent segment are less easily tolerated in positions not adjacent to a vowel than consonants at the edge of a prosodic domain, here the PW, and consonants that do not agree in [+vocoid], respectively.

(35) RELEVANT MARKEDNESS CONSTRAINTS:

a. C|ø (AGREE=[+vocoid]) ↔ V
A PW-internal consonant (which is adjacent to no prosodic boundary) that agrees in [+vocoid] with a neighboring segment is adjacent to a vowel.

b. C|ø ↔ V
A PW-internal consonant is adjacent to a vowel.

c. $_{PW}$[C (AGREE=[+vocoid]) ↔ V
A consonant that is preceded by a PW boundary and agrees in [+vocoid] with a neighboring segment is adjacent to a vowel.

d. $_{PW}$[C ↔ V
A consonant that is preceded by a PW boundary is adjacent to a vowel.

(36) INHERENT RANKINGS BETWEEN THE MARKEDNESS CONSTRAINTS IN (35):

a. C|ø (AGREE=[+vocoid]) ↔ V >> C|ø ↔ V
b. $_{PW}$[C (AGREE=[+vocoid]) ↔ V >> $_{PW}$[C ↔ V
c. C|ø (AGREE=[+vocoid]) ↔ V >> $_{PW}$[C (AGREE=[+vocoid]) ↔ V
d. C|ø ↔ V >> $_{PW}$[C ↔ V

The repair used in French to avoid violating these markedness constraints is epenthesis, constrained by DEP-V (37a). In French schwa is inserted at morpheme junctures, never morpheme-internally. This is also the situation found in Chukchi, as analyzed by Kenstowicz (1994b), who proposes that the position of the epenthetic vowel is determined by a CONTIGUITY constraint that requires segments that are contiguous in the lexical representation of a morpheme to also be contiguous in the output. I adopt this position and the corresponding constraint in (37b), with a slightly modified definition from that given in Kenstowicz (1994b: 167). This constraint is unviolated in French.

(37) FAITHFULNESS CONSTRAINTS:

a. DEP-V — Do not insert a vowel
b. CONTIGUITY — Segments contiguous in the lexical representation of a morpheme are contiguous in the output.

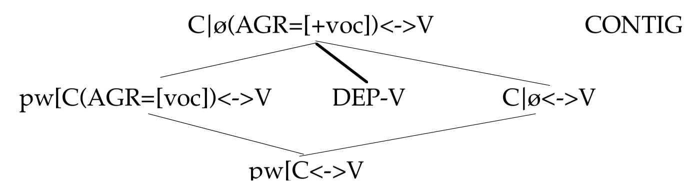
Our task is now to rank DEP-V with respect to the markedness constraints in (36). Epenthesis is obligatory word-internally in /C+rj/ contexts. From this we can infer the ranking in (38). Epenthesis is optional if there is no agreement in vocoid between adjacent consonants (33)[12] or if consonants appear at the edge of a PW (34).

[12]As seen in chapter 2, epenthesis is obligatory in all CCC sequences involving a derivational suffix boundary, as opposed to an inflectional suffix one like the future/conditional ending. Recall

This follows from an undetermined ranking between DEP-V and the constraints in (36b-c). We obtain the mini-grammar in (39), in which the only French-specific ranking we had to establish is the one in (38), indicated with a thick line, the narrow ones representing inherent rankings between markedness constraints. This grammar is implemented in the tableau in (40), omitting the low-ranked constraint $_{PW}$[C ↔ V, which does not play a role in the data discussed in this section.

(38) RANKING SPECIFIC TO FRENCH:
C|ø (AGREE=[+vocoid]) ↔ V >> DEP-V

(39) PARTIAL GRAMMAR OF FRENCH:



(40) (NON-)EPENTHESIS IN SEQUENCES OF GLIDES IN FRENCH:

a. /fym+rje/	CONTIG	C|ø(AGR=[+voc])↔V	$_{PW}$[C(AGR=[+voc])↔V	C|ø↔V	DEP-V
fymrje		(r) !			
→ fymərje					*
fymrəje	* !				
b. /fɛrm+rɛ/					
→ fɛrmrɛ				(m)	
→ fɛrmərɛ					*
fɛrəmrɛ	* !				
c. /fini+rjɔ̃/					
→ finirjɔ̃					
finiərjɔ̃					* !
finirəjõ	* !				*
d. /ɛm rjɛ̃/					
→ ɛm PW[rjɛ̃			(r)		
→ ɛmə PW[rjɛ̃					*
ɛm PW[rəjɛ̃	* !				*

the contrast between *garderie* /gard+ri/ [gardəri] 'daycare' and *garderez* /gard+re/ [gard(ə)re] 'keep+FUT.1SG'. I assume the stricter distribution of consonants across derivational suffix boundaries follows from an additional morphological condition which I do not consider here.

In the first example in /fym+rje/ (40a), the faithful output *[fymrje] fatally violates the constraint C|ø(AGR=[+voc])↔V. The segment [r] agrees in vocoidness with the following consonant [j] and it is not adjacent to a prosodic boundary; the constraint therefore requires that it be adjacent to a vowel, which is not the case in [fymrje]. Epenthesis must apply given the lower ranking of DEP-V, and it does so at the morpheme juncture, in conformity with CONTIGUITY; [fymə̲rje] is therefore prefered over *[fymrə̲je]. In /fɛrm+rɛ/ (40b), the faithful output with a three-consonant sequence [fɛrmrɛ] is tolerated. It violates only the lower-ranked markedness constraint C|ø↔V since the middle consonant [m] does not agree in [+vocoid] with an adjacent segment, making this candidate immune to the effect of C|ø(AGR=[+voc])↔V. Since C|ø↔V and DEP-V are unranked with respect to each other, schwa insertion at the morpheme juncture is also an option in this form. In the form /fini+rjɔ̃/ (40c), the faithful candidate is the only winner: [r] and [j] agree in [+vocoid] but they are both adjacent to a vowel, so none of the relevant markedness constraints is violated. A violation of DEP-V then rules out the candidate with epenthesis [finiə̲rjɔ̃]. Finally, the case in (40d) is similar to that in (40b), except that the relevant markedness constraint is $_{PW}$[C (AGR=[+voc])↔V rather than C|ø↔V, which is also unranked with respect to DEP-V.

4.2.4. INTERACTION OF MANNER AND PLACE: HUNGARIAN AND SIATISTA GREEK

The process of consonant deletion in Hungarian was discussed at length in chapter 1. I now provide a formal analysis of it. I focus exclusively on word-internal cluster simplification and omit the degemination facts presented in the second part of section 1.2.3.1.

The generalizations for cluster simplification are given in (41). Words that meet the conditions for consonant deletion are given in (42); for these two forms are possible, with and without the cluster-medial consonant. In (43)-(45) I provide examples in which simplification is impossible because they fail to meet one of the requirements in (41b-d). I refer the reader to section 1.2.3.1 for additional examples.

(41) a. Only the middle consonant of a three-consonant sequence deletes.
b. Only stops delete; fricatives and affricates never do (43).
c. Stops do not delete if preceded by a [+approximant] segment: glides and liquids (44).
d. Stops do not delete if followed by a [+continuant] segment: glides, liquids, and fricatives (45).

(42) DELETION WHEN ALL THE CONDITIONS IN (41) ARE MET:

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

(43) NO DELETION WHEN THE MIDDLE CONSONANT IS A FRICATIVE OR AFFRICATE:

a.	*szenvtelen*	[sɛnftɛlɛn]	*[sɛntɛlɛn]	'indifferent'
b.	*obskurus*	[opʃkuruʃ]	*[opkuruʃ]	'obscure'
c.	*narancsból*	[nɔrɔndʒbo:l]	*[nɔrɔnbo:l]	'from (an) orange'
d.	*táncdal*	[ta:ndᶻdɔl]	*[ta:ndɔl]	'popular song'

(44) NO DELETION WHEN THE FIRST CONSONANT IS [+APPROXIMANT]:

a.	*talpnyaló*	[tɔlpnʲɔlo:]	*[tɔlnʲɔlo:]	'lackey'
b.	*szerbtől*	[sɛrptø:l]	*[sɛrtø:l]	'from (a) Serb'
c.	*sejtmag*	[ʃɛjtmɔg]	*[ʃɛjmɔg]	'cell nucleus'
d.	*bazaltkő*	[bɔzɔltkø:]	*[bɔzɔlkø:]	'basalt stone'

(45) NO DELETION WHEN THE LAST CONSONANT IS [+CONTINUANT]:

a.	*aktfotó*	[ɔktfoto:]	*[ɔkfoto:]	'nude photograph'
b.	*hangsor*	[hɔŋkʃor]	*[hɔŋʃor]	'sound sequence'
c.	*handlé*	[hɔndle:]	*[hɔnle:]	'second-hand dealer'
d.	*centrum*	[tˢɛntrum]	*[tˢɛnrum]	'center'
e.	*kompjúter*	[kompju:tɛr]	*[komju:tɛr]	'computer'

The first generalization in (41a) has a clear interpretation: only consonants that are not adjacent to a vowel ever get deleted. Only stops delete (41b), and they do so only if followed by a [-continuant] segment (41d). I proposed in sections 3.1.2 and 3.1.3 that the motivations for these restrictions have to do with the weakness of stops' internal cues and the audibility of the stop burst. In addition, a contrast in the feature [approximant] between the stop and the preceding segment blocks deletion (41c). This contrast condition actually generalizes to any adjacent segment (not only the preceding one) since stops may not delete either if followed by a [+approximant] consonant (since all [+approximant] segments are also [+continuant]).

These conditions all ensure that only the least perceptible consonants delete. These factors could in principle be integrated into faithfulness (MAX-C) or markedness (C↔V) constraints, as illustrated in the table in (35) in chapter 3. I use here perceptually-motivated faithfulness constraints. The relevant ones are given in

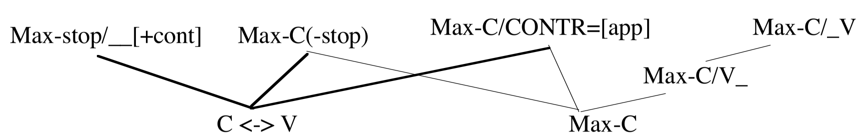
(46), together with the inherent rankings that can be established between them. The ranking in (46f) in particular ensures that if deletion occurs, it necessarily targets the cluster-medial consonant, the one not adjacent to any vowel.

(46) FAITHFULNESS CONSTRAINTS AND INHERENT RANKINGS:
a. MAX-C(-stop)
Do not delete a consonant that is not a stop.
b. MAX-stop/__[+cont]
Do not delete a stop that is followed by a [+cont] segment.
c. MAX-C/CONTRAST=[approximant]:
Do not delete a consonant that contrasts in the feature [approximant] with an adjacent segment.
d. MAX-C(-stop) >> MAX-C
e. MAX-C/CONTRAST=[approximant] >> MAX-C
f. MAX-C/ __V >> MAX-C/V__ >> MAX-C

The derive the facts in (42)-(45), these faithfulness constraints will be ranked with respect to the simple markedness constraint C↔V, which requires every consonant to be adjacent to a vowel. The specific rankings in (47) are established; they ensure that non-stops, stops followed by a [+cont] segment, and consonants that contrast in the feature [approximant] never delete. We obtain the mini-grammar in (48), with inherent rankings indicated with thin lines, specific ones with thick lines. The variability of stop deletion is derived from the indeterminacy of the ranking between MAX-C and C↔V.

(47) RANKINGS SPECIFIC TO HUNGARIAN:
a. MAX-C/CONTRAST=[approximant] >> C ↔ V
b. MAX-C(-stop) >> C ↔ V
c. MAX-stop/__[+cont] >> C ↔ V

(48) PARTIAL GRAMMAR OF HUNGARIAN I:



The tableau below illustrates with one example from each of the four groups of data in (42)-(45) how this grammar generates the correct output in all cases.

(49) STOP DELETION IN HUNGARIAN:

a. /lɔmbdɔ/	Max-C/V__	Max-C/CT=[app]	Max-stop/__[+cont]	Max-C(-stop)	Max-C	C↔V
→ lɔmbdɔ						(b)
→ lɔmdɔ					*	
lɔbdɔ	* !			*		
b./opʃkuruʃ/						
→ opʃkuruʃ						(ʃ)
opkuruʃ				* !		
c. /ʃɛjtmɔg/						
→ ʃɛjtmɔg						(t)
ʃɛjmɔg		* !				
d. /ɔktfoto:/						
→ ɔktfoto:					(t)	
ɔkfoto:			* !			

In (48b-d) deletion of the medial consonant violates a high-ranking faithfulness constraint, which crucially dominates C↔V. The faithful output with the full cluster, which violates the markedness constraint, therefore wins. In /opʃkuruʃ/ (48b), deletion of the medial fricative violates MAX-C(-stop). In [ʃɛjtmɔg] (48c), the medial stop contrasts in [approximant] with the preceding glide, and its deletion entails a violation of MAX-C/CONTRAST=[approximant]. In [ɔktfoto:] (48d), the medial stop is followed by a fricative, a [+continuant] segment, and deleting it leads to the violation of MAX-stop/__[+cont]. In [lɔmbdɔ] (48a), however, deletion of the medial [b] only entails a violation of the lower-ranked MAX-C; this consonant is not subject to any of the higher-ranked faithfulness constraint. Retention of the full cluster violates C↔V. Since MAX-C and C↔V are unranked with respect to each other, we observe optional deletion in this form. If deletion applies, though, it obligatorily targets the cluster-medial consonant because of the inherent ranking in (46f), which rules out the candidates with deletion of the postvocalic or prevocalic consonant *[lɔbdɔ] and *[lɔmbɔ].

We may now integrate the more subtle effect of homorganicity on the likelihood of stop deletion in Hungarian. It appears that when the conditions for deletion are met, not all stops are as likely to be dropped. A medial stop more readily deletes when it agrees in place of articulation with the preceding consonant than when it does not. Compare the two forms in (50), which contrast in the place of articulation of the medial stop – velar in (50a), alveolar in (50b). Both stops may be dropped but deletion is more frequent and natural in *parasztból*, in which the first two consonants of the cluster share the same point of articulation, than in *Recskből*.

(50) EFFECT OF HOMORGANICITY ON THE LIKELIHOOD OF STOP DELETION:

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

This homorganicity condition may be integrated into our system of faithfulness constraints with the constraint in (51a), which is inherently ranked higher than the simple MAX-C constraint (51b). Like MAX-C, this new constraint remains unranked with respect to C↔V, which results in the optionality of deletion. But the inherent ranking in (51b) yields the desired effect on the likelihood or frequency of deletion. There are three possible rankings of the constraints in (51b) and C↔V, given in (52). In two of them MAX-C ranks below C↔V, as opposed to only one for MAX-C/Contrast=[Place]. If we assume that the likelihood of outputs is determined by the proportion of rankings that derive them, deletion is more likely if there is agreement in place. The mini-grammar in (48) is updated as in (53).

(51) ADDITIONAL FAITHFULNESS CONSTRAINT AND INHERENT RANKING:

a. MAX-C/CONTRAST=[Place]

Do not delete a consonant that contrasts in place of articulation with an adjacent segment.

b. MAX-C/CONTRAST=[Place] >> MAX-C

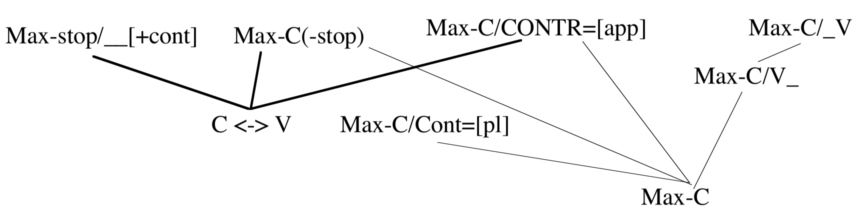
(52) POSSIBLE RANKINGS OF THE CONSTRAINTS IN (51) AND C↔V:

a. **C↔V** >> MAX-C/CONTRAST=[Place] >> MAX-C → Deletion in (50a-b)

b. MAX-C/Contrast=[Place] >> **C↔V** >> MAX-C → Deletion only in (50b)

c. MAX-C/Contrast=[Place] >> MAX-C >> **C↔V** → No deletion

(53) PARTIAL GRAMMAR OF HUNGARIAN II:



Hungarian illustrates a situation where the possibility of consonant deletion is determined by contrast in manner of articulation, in this case the feature [approximant], with contrast in place of articulation playing a secondary role in the likelihood of deletion. Interestingly, the Greek dialect of Siatista provides an example of the opposite situation: both homorganicity and similarity in manner of

articulation play a role, but the former is more important than the latter. Siatista Greek (Papademetre 1982) obligatorily simplifies homorganic triconsonantal clusters but leaves non-homorganic ones unchanged. Relevant examples of this process are given in (54a-b). (Note that these clusters arise from the deletion of high vowels). In addition, cluster simplification is optionally allowed if the members of the cluster do not show a sufficient contrast in manner of articulation. In (54d), the word-initial cluster is composed of three obstruents (a fricative, an affricate, and a stop), a sequence which contains an insufficient contrast in manner of articulation, unlike the stop-fricative-liquid cluster in (54c).

(54) CONSONANT DELETION IN SIATISTA GREEK:

a. No deletion in non-homorganic clusters:

ʃtʲm: /stimoni/ 'spindle' → ʃtʲimoni → [ʃtʲmon]

b. Deletion in homorganic (coronal) clusters:

ʃtʲn: /stinora/ 'on time' → ʃtʲinora → [ʃnora]

c. No deletion in clusters with sufficient dissimilarity in manner:

kʃl: /ksilas/ 'lumberjack' → kʃilas → [kʃlas]

d. Optional deletion in clusters without sufficient dissimilarity in manner:

çtʲp: /xtipo/ 'I hit' → çtʲipo → [çtʲpo]/ [xpo]

What counts as sufficient or insufficient contrast in manner of articulation is not totally clear from Papademetre's description and I will not attempt to provide explicit constraints and a formal analysis for the Siatista Greek case. Note finally that the same hierarchy between homorganicity and similarity in manner of articulation seems to hold in the Indian variety of English described by Khan (1991). Words ending in monomorphemic /-st/, /-nd/, and /-ld/ lose their final stop significantly more often than words ending in /-kt/ and /-pt/, even though the latter are more similar in terms of manner of articulation.[13]

[13]Khan, in fact, does not take place of articulation into consideration. Her conclusion about these facts is that "a preceding stop tends to act as a constraint on final stop deletion, whereas a preceding spirant or sonorant tends to favor deletion" (p. 291). But it appears that all her examples with fricatives and sonorants involve homorganic clusters, whereas two stops cannot share the same place of articulation in this context. Given the words and clusters she has chosen to present in her paper, both my and her conclusions are logically possible. But the facts support the homorganicity analysis. Khan's claim would mean that it is *dissimilarity* in manner of articulation that favors reduction. This is contrary to what we know about cluster simplification in other languages. Yet the other facts she presents on cluster reduction in Indian English completely parallel the known cases. This dialect behaves as expected with respect to agreement in voicing, which favors cluster reduction (although apparently less so than in Black and Puerto Rican English, see section 4.2.2). But more importantly, /-st/ clusters simplify more often than /-ld/ ones. This is inconsistent with the claim that similarity in manner of articulation acts as a barrier to cluster reduction, but is completely predicted under the contrast-based account I propose.

4.3. Cluster simplification in Québec French

In this section I analyze in great detail the complex pattern of word-final cluster simplification in Québec French (QF). I propose that simplification in QF is motivated by two distinct factors: the Sonority Sequencing Principle and the Principle of Perceptual Salience. The SSP is violated in all clusters whose last consonant is more sonorous than the preceding one, for example in *bible* 'bible' /bibl/ or *organisme* 'organism' /ɔrganism/. In all such cases final consonant deletion is observed, but its frequency is proportional to how severely the cluster violates the SSP. Among the clusters that do not violate the SSP, some always surface unreduced (e.g. *parc* 'park' /park/, *éclipse* 'eclipse' /eklips/, while others allow simplification, with more or less regularity (e.g. *piste* 'trail' /pist/, hymne 'hymn' /imn/). I argue that the factor that determines the behavior of clusters is perceptual salience. Only the least salient consonants may delete and frequency of deletion correlates with the relative perceptibility of the consonants. The most important elements in computing perceptibility are contrast and the greater vulnerability of stops. Clusters composed of highly dissimilar segments are stable, those containing highly similar consonants automatically lose the final consonant. But in a subset of clusters involving an average level of similarity or contrast, only final stops delete, unlike other categories of consonants. The relative degree of contrast in a cluster is determined mainly by manner of articulation, but place and voicing also play a substantial role.

The discussion is organized as follows. In the first section I present the possible final clusters in French and the previous analyses of cluster reduction in Québec French that have been proposed. The following section is devoted to clusters that violate the SSP; I first present the facts and suggest an analysis that relies on a (sequential and) gradient definition of the SSP. In section 4.3.3 I turn to the remaining clusters (those that do not violate the SSP). The facts are much more complex but a well-motivated analysis is available in the perceptual framework proposed here. It involves simple faithfulness and markedness constraints dealing with contrast/similarity and manner of articulation, which interact in intricate ways. Finally I discuss the pattern of final coronal stop deletion in Philadelphia English (Guy & Boberg 1997), which shows a striking resemblance with the Québec French one.

4.3.1. Attested final clusters and previous analyses

Modern French displays a large number of word-final consonant clusters. Some of them are survivals of clusters that resulted from apocopes that took place in

Old French; others are more recent and stem from the introduction and borrowing of new words, and from spelling-based reformations that restored consonants which had ceased to be pronounced. But the bulk of modern word-final clusters arose from the loss of word-final schwas in the pronunciation of French in the seventeenth century (see Fouché 1961 for the evolution of consonants in French).

Most final clusters are made up of two consonants. In Standard or general French, all combinations of an approximant[14], a nasal, a fricative, and a stop are attested in these clusters, except for nasal+approximant and fricative+fricative. But exemples of these missing combinations can be found in non-standard or regional dialects, in particular QF, on which this section focuses. Three-consonant clusters are predictably much more limited and there is only one four-consonant cluster.

Table 5 gives the possible word-final sequences of consonants, with examples for each category. This table was established in large part on the basis of the exhaustive list of attested clusters in French provided by Dell (1995). I have omitted from Dell's list two categories of final clusters, and refer the reader to Dell's article for the complete list:

1) clusters only found in one or two rare words, generally borrowed technical terms, which are unknown to both Dell and me (Dell marks words unknown to him with an asterisk);

2) clusters only attested in words used in European varieties of French but unknown in Québec.

But I have added to Dell's list clusters attested in words that pertain to QF but not to Standard or general French. Such words are indicated by italics.[15]

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[14] I use "approximant" instead of "liquid" to refer to /r/ and /l/ together since I consider /r/ to be a glide, at least in this position. I motivated this decision for Parisian French in chapter 2 (section 2.3.2). The same arguments apply to QF.

[15] I adopt the symbol 'r' for the rhotic, irrespective of the actual pronunciation of that sound, which can take different forms in French. In Québec French, the apical [r] is still common, especially among the older generations, but is losing ground to the uvular one, which is considered the norm; see Clermont & Cedergren (1979) and Tousignant et al. (1989), as well as Picard (1987).

Table 5: **Possible word-final clusters in French**

A=approximants S=stops F=fricatives N=nasals

Type	Combinations	Examples
AA	/rl/	perle 'pearl', parle 'speak', Charles
AN	/lm/	calme 'calm', film 'film';
	/rm, rn, rɲ/	arme 'weapon'; corne 'horn'; épargne 'savings'
AF	/lv, lf, ls, lʒ/	valve 'valve'; golf 'golf'; valse 'waltz'; belge 'Belgian'
	/r/ + any F	énerve 'irritate'; surf 'surf'; quatorze 'fourteen'; force 'strength'; orge 'barley'; arche 'arch'
AS	/l/ + any S	bulbe 'bulb'; Alpes 'Alps'; solde 'sale', Donald; révolte 'revolt'; algue 'seaweed'; calque 'tracing'
	/r/ + any S	barbe 'beard'; harpe 'harp'; corde 'cord'; tarte 'pie'; orgue 'organ'; barque 'boat'
NA	/ml/	*jumele* 'pair, twin+PRES (non-standard)'
NN	/mn/	hymne 'hymn', indemne 'safe (of a person)'
NF	/nʃ, nz/	Loanwords: ranch, lunch; *Ben's*
NS	/nd,nt,mp,ɲk,ɲg/	Loanwords: week end, sprint; *bump*; punk; ping-pong
FA	/fl, fr, vr/	pantoufle 'slipper'; chiffre 'number'; livre 'book'
FN	/sm/	enthousiasme 'enthusiasm', tourisme 'tourism'
FF	/vz/	*Reeves* (proper name)
FS	/ft, sp, st, sk/	*shift* 'shift'; *Deraspe* (name); vaste 'vast'; risque 'risk'
SA	/bl, pl, gl, kl, dl/	table 'table'; couple 'couple'; ongle 'nail'; cycle 'cycle'; jodle 'yodel+PRES'
	any S + /r/	chambre 'room'; propre 'clean'; cadre 'frame'; autre 'other'; pègre 'underworld organization'; sucre 'sugar'
SN	/gn, tm, gm, km/	stagne 'stagnates'; rythme 'rhythm'; énigme 'enigma'; drachme 'drachma'
SF	/ps, ts, ks, dʒ, tʃ/	éclipse 'eclipse'; ersatz; taxe 'tax'; Cambodge; sandwich
SS	/pt, kt/	apt 'apt'; directe 'direct'
AFS	/rst/	verste 'verst'
ASA	/ltr, lkr/, /rkl/	filtre 'filter'; sépulcre 'sepulchre'; cercle 'circle'
	/rbr,rpr,rdr,rtr/	arbre 'tree'; pourpre 'purple'; ordre 'order'; Sartre
ASF	/rts, rtʃ, rks/	Loanwords: hertz, quartz; bortsch; Marx
ASS	/lpt/	sculpte 'sculpt+PRES'[a]
FSA	/str, skl/	orchestre 'orchestra'; muscle 'muscle'
SFS	/kst/	texte 'text', mixte 'mixed'
SSA	/ptr, ktr/	sceptre 'scepter'; spectre 'specter'
SFSA	/kstr/	ambidextre 'ambidextrous'

[a] The stem *sculpt-* (in forms of the verb *sculpter* 'sculpt', *sculpteur* 'sculptor', *sculpture* 'sculpture', etc.) is normally pronounced [skylt], without the medial [p]; this is the standard pronunciation indicated in dictionaries. But the spelling-based pronunciation with a [p] is also attested.

Word-final cluster simplification is a widespread and productive process in QF, much more so than in the Northern France variety described in chapter 2, for example. To give an idea of its frequency in QF, Kemp, Pupier & Yaeger (1980: 30) estimate that in everyday conversation more than 80% of the population conserve less than 10% of the final-cluster tokens that are susceptible to simplification. But notice that the majority of cluster tokens attested in speech are of the obstruent+liquid type, which show the greatest propensity to final deletion.

The first description and analysis of cluster reduction in QF that I know of was proposed by Pupier & Drapeau (1973). Subsequent discussions include Kemp, Pupier & Yeager (1980), Walker (1984), Nikièma (1998, 1999), and Thériault (2000). I have also myself investigated this deletion pattern in Côté (1997a,b, 1998).[16] In fact, it is fair to say that the first seed of this dissertation is to be found in this early encounter with consonant deletion in my own speech. Pupier & Drapeau (1973) discuss the relevant data and develop a SPE-type of analysis (in which they integrate some elements of sociolinguistic variable rules). Kemp et al. (1980) focus on the sociolinguistic aspects of this process and adopt for the most part the empirical conclusions and phonological analysis of Pupier & Drapeau (1973). Walker (1984) only provides a partial discussion as part of a general description of the phonology of Canadian French. Nikièma (1998, 1999) proposes an analysis cast in the framework of Government Phonology. Finally, Thériault (2000) sketches an analysis of word-final consonant deletion in the framework of Declarative Phonology; the schematic format of the manuscript and my lack of familiarity with the theoretical framework, however, do not allow me to discuss and assess the proposed analysis.

The present analysis relies on the same basic idea as my previous papers (Côté 1997a,b, 1998), but it includes more facts and it is integrated into a general approach whose underlying motivations and basic elements are more clearly established. A crucial element of these first analyses, however, is abandoned: the idea that consonant deletion may be driven by *numbers* of contrasting features between adjacent elements, irrespective of their nature. This approach to contrast worked for the set of data considered in these earlier papers but does not extend to the additional facts analyzed here. Moreover, as noted above, all features do not have an equivalent effect on perceptibility and it seems now unlikely to me that features can be simply counted in the application of phonological processes.

[16] Côté (1997b) is a reduced version of (1997a). Côté (1998) is written in French and contains a slightly revised analysis.

Two points of comparison between my treatment of cluster simplification in QF and previous ones should be mentioned, one empirical, one theoretical. First, previous investigations suffer from a certain degree of empirical inadequacy. They all fail to consider a small but important group of data, and consequently draw misleading descriptive generalizations with respect to the classes of clusters that can and cannot be reduced. They propose in particular that no consonant can drop after a liquid, and that final fricatives are always stable, two generalizations which are contradicted by the facts. I will get back to this when we discuss the relevant clusters, but this result obviously affects the (a posteriori) empirical adequacy of their analysis. Only Nikièma (1999) partly integrates the empirical results published in Côté (1997a, 1998); we will return shortly to this paper.

Second, independently from this empirical issue, Pupier & Drapeau (1973), Kemp et al. (1980), and Nikièma (1998, 1999) propose a unique simplification rule for QF, whereas I take the process to be driven by two distinct but well-defined factors: sonority (the SSP) and Perceptual Salience. Although the desire to find a unified account is certainly justified, I believe the present analysis gains in naturalness and simplicity (at least from a conceptual point of view, if not in the actual implementation), while being empirically adequate. By contrast, the SPE-type rule posited by Pupier & Drapeau (1973) and Kemp et al. (1980) is extremely complex and makes the process look arbitrary. Moreover, the level of complexity of the rule would be significantly increased if it were to integrate the additional data included here but not taken into consideration in these early studies. As for Nikièma's (1998, 1999) analysis in the framework of Government Phonology, it is conceptually rather simple but it simply fails to account for the data.

Nikièma (1998) relies on Pupier & Drapeau's (1973) description of the facts, which, as noted above, is insufficient. Nikièma (1999) is a published version of the 1998 manuscript, but integrates some additional empirical findings taken from Côté (1997a, 1998). Nikièma's analysis rests on the requirements of Government Licensing and the impossibility in QF for more than one consonant to be properly licensed word-finally. Any additional consonant must then delete, and Nikièma's analysis predicts that all final clusters should behave identically in this respect. All cases of unreduced clusters must then be explained by independent factors. First, consonants generally fail to delete after a liquid. This is explained by the fact that post-vocalic liquids may be syllabified as part of the nucleus rather than the rime. In Nikièma (1998), the retention of post-liquid consonants and the proposed rule of liquid syllabification are taken to be exceptionless. Nikièma (1999) acknowledges cases of stop deletion in /-ld/ clusters, and consequently relaxes this syllabification rule. Liquids may be part of the nucleus or the rime: in the first case deletion of the

following consonant is not expected, in the second case it is. But Nikièma fails to account for the specific behavior of /-ld/, the only liquid-initial cluster which may undergo reduction. The syllabification of liquids is taken to be an idiosyncratic feature of lexical items, which amounts to simply marking final consonant deletability or non-deletability in the lexicon. Second, several types of non-liquid-initial clusters are also stable: nasal+fricative, stop+fricative, and subsets of nasal+stop, fricative+stop, obstruent+nasal clusters. For final stop+fricative sequences, Nikièma suggests (without discussion) that they form single complex segments and should not be considered clusters. But this proposition does not seem to be independently justified, and it still provides no explanation for the other types of unreduced clusters, which the author apparently treats as exceptions. More generally, Nikièma's analysis leaves unexplained the observed contrast between stops and other consonants in their propensity to delete. It is also unable to account for clear distinctions among reduceable clusters as to the automaticity of consonant deletion: simplification is almost categorical for some clusters, but highly variable and lexically-determined for others. It is, I believe, a major advantage of the analysis proposed here to provide a principled account for these facts.[17]

4.3.2. CLUSTER REDUCTION AND SONORITY

The SSP and the sonority hierarchy I adopt among consonants are repeated below, from chapter 1. I take /l/ to be a liquid but consider that /r/ has an unstable sonority value, ranging from that of a fricative to that of a glide. This depends on the context, as in the variety of French described in chapter 2. In the contexts examined in this section, /r/ appears postvocalically or in postconsonantal word-final position. In both cases /r/ is preferably articulated as an approximant and I take it to be a glide. The distinction drawn between /r/ and /l/ has no effect on the role of sonority in cluster reduction but is crucial to my proposal concerning the role of perceptual salience and contrast in section 4.3.3.2.

Sonority Sequencing Principle:	Sonority maxima correspond to sonority peaks.
Sonority hierarchy:	glides (G) > liquids (L) > nasals (N) > obstruents (O)

Clusters that violate the SSP comprise the obstruent+/r,l/, obstruent+nasal and nasal+/l/ sequences. We will look at each of these combinations in turn. I

[17]Nikièma (1999) criticizes Côté (1997a, 1998) at length for not accounting for the data. Strikingly enough, however, he only considers sonority as a motivating factor for cluster simplification in my analysis, and completely disregards the role of phonetic salience, yet the main element of my approach, and the only one discussed in Côté (1998). The "counterexamples" to my analysis brought by Nikièma all fall under the scope of salience and were clearly accounted for in the papers cited. Nikièma's criticism can therefore be dismissed.

consider only final clusters comprised of two consonants. It should be clear after I provide the complete analysis that the proposed generalizations extend automatically to clusters of more than two consonants.

4.3.2.1. Obstruent-approximant clusters

Obstruent+approximant final clusters are by far the most frequent in the language (Malécot 1974; Kemp, Pupier & Yaeger 1980) and their behavior is quite clear. Approximant deletion in these clusters is a well-known process in French. What distinguishes QF from the Parisian varieties described in e.g. Dell (1973/1980/1985) and Tranel (1987b) is the pervasiveness of the phenomenon, which applies almost categorically in all contexts and for all words. Here are a couple of examples of stop+/r/ and fricative+/l/ final clusters in pre-consonantal, pre-pausal, and pre-vocalic position:[18]

(55) O+A FINAL CLUSTERS IN —C, —V, AND —# CONTEXTS:

FA:	—C: *pantoufle bleue*	'blue slipper'	/pãtufl blø/	→ [pãtʊfblø]
	—#: *pantoufle*	'slipper'	/pãtufl/	→ [pãtʊf]
	—V: *pantoufle orange*	'orange slipper'	/pãtufl ɔrãʒ/	→ [pãtʊfɔrãʒ]
SA:	—C: *sucre dur*	'hard sugar'	/sykr dyr/	→ [sʏkdᶻʏr]
	— #: *sucre*	'sugar'	/sykr/	→ [sʏk]
	— V: *sucre arabe*	'Arabic sugar'	/sykr arab/	→ [sʏkarab]

The fact that these clusters simplify systematically in all contexts raises the obvious question of whether clusters are present in the underlying forms. That is, are we dealing here with a synchronic or a historical reduction process? In some cases, the almost automatic deletion of the final consonant has led to a reanalysis of the underlying representation, which has lost the final consonant. For example, *crisse* (swear word) /kris/ derives from *Christ* 'Christ' /krist/. Similar examples include 1. *tabarnac* (swear word) /tabarnak/ < *tabernacle* 'tabernacle' /tabɛrnakl/; 3. *piasse* 'dollar' /pjas/ < *piastre* 'piastre' /pjastr/; 4. *canisse* 'container' /kanis/ < *canistre* /kanistr/. This reanalysis is apparent in derived words in which a vowel-initial suffix is added, such as the infinitive marker /e/ in *crisser* /kris+e/ and the

[18]The phonetic transcriptions of QF include a few allophonic processes that are not part of the phonological system of Parisian French: 1. laxing of high vowels in closed syllables, except before /r,v,z,ʒ/ (with laxing harmony spreading to the left in certain cases), 2. dipthongization of long vowels in closed syllables, 3. affrication of /t/ and /d/ before high front vowels. Note that these processes are irrelevant to the issues addressed here. QF also differs from Parisian French in the quality of certain nasal vowels (ẽ and ã instead of ɛ̃ and ɑ̃), the stability of œ̃ (which does not merge with ɛ̃), and the presence of at least one additional phonemic vowel: /ɜ/, which contrasts with /ɛ/, e.g. *fête* 'holiday' /fɜt/ vs. *fait* /fɛt/ 'done' (with the final /t/ normally pronounced).

adjectival suffix *-ant* /ã/ in *tabarnacant* /tabarnak+ã/. Such changes in underlying forms are obviously favored when words are not related to morphologically derived forms in which the final consonant resurfaces, which point to the important role of the morphology in maintaining these final clusters in lexical representations.

Disregarding these obvious cases of reanalysis, traditional derivational analyses would argue that the final approximant is necessary in underlying representations to get morphologically derived words, like *pantouflard* 'stay-at-home' /pãtuflɑr/ from *pantoufle* and *sucrier* 'sugar bowl' /sykrije/ from *sucre*. But these are not productive derivations, and it is not clear that such words are derived synchronically from the base noun. There is little doubt, however, that a deletion process is synchronically active in verbs of the first conjugation, the most productive one. Consider verb stems ending in an obstruent+approximant cluster. These verbs appear without the final approximant in their bare form, but with the full cluster when followed by a vowel-initial suffix. The bare form is used in the indicative and subjunctive present tense (except in the 2nd plural, as well as the 1st plural in written and formal registers). (56) gives one such example:

(56) STEMS ENDING IN O+A IN THEIR BARE FORM AND FOLLOWED BY A VOWEL:

a.	*cibler*	'target+INFINITIVE'	/sibl+e/	→ [sible]
b.	$ *cible(cibles/ciblent)*	'target+PRES(ENT)'	/sibl/	→ [sɪb]

From now on, I will use regular verbs of the first conjugation as often as possible, as a means to ensure that we are dealing with a synchronic process of deletion. Examples involving such verbs will be preceded by a "$", as in (56b) above (think of these examples as more valuable). Words other than verbs will be added when relevant or when no appropriate verbs are available. I will also omit the context following the cluster (consonant, pause, or vowel). When a cluster is said to simplify, it can be infered that this is possible in all contexts.

Additional examples of final approximant deletion are provided below:

(57) DELETION IN VERBS ENDING IN OBSTRUENT+APPROXIMANT:

a.	FA: $ *livre*	'deliver+PRES'	/livr/	→	[liv]
b.	$ *souffle*	'blow+PRES'	/sufl/	→	[sʊf]
c.	SA: $ *règle*	'solve+PRES'	/rɛgl/	→	[rɛg]
d.	$ *cadre*	'frame+PRES'	/kɑdr/	→	[kaᵁd]

4.3.2.2. Obstruent-nasal clusters

Obstruent+nasal clusters are more complex. They do not behave as systematically as obstruent+approximant and other nasal-final ones. Words ending in /-sm/, the only attested fricative+nasal combination, can be divided into at least two categories. First we find words containing the suffix /-ism/ for which there exists a corresponding form ending in the suffix /-ist/ (58). As we will see, final /-st/ clusters consistently lose their final /t/; if /-sm/ also simplifies, forms like *communisme* 'communism' and *communiste* 'communist' become homophonous. The forms in /-ism/ are usually less frequent than those in /-ist/, and pertain to a somewhat higher level of speech. It appears that speakers tend to maintain the distinction between the two corresponding forms by keeping the final /m/ in /-ism/ (while reducing the /-ist/ cluster), but this is by no means an absolute rule.

(58) WORDS IN /-ism/ WITH A (MORE FREQUENT) CORRESPONDENT IN /-ist/:

a. *tourisme*	'tourism'	/turism/	→	?(?) [turɪs]
b. *communisme*	'communism'	/kɔmynism/	→	?(?) [kɔmynɪs]

Other words in /-sm/ include those not ending in the suffix /-ism/ and words ending in /-ism/ for which there is no corresponding form ending in /-ist/ (e.g. *fanatisme* 'fanatism', *vandalisme* 'vandalism'), or for which this form is much rarer (e.g. *catéchisme* 'catechism' vs. *catéchiste* 'catechist') or semantically not in a direct correspondence relation (e.g. *anglicisme* 'Anglicism' vs. *angliciste* 'Anglicist'). Here we observe no or little incentive to maintain a contrast between the /-sm/ form and another form in the paradigm. In this heterogeneous category, words have very distinct behaviors, depending in part on their frequency. Deletion of the final nasal is generally easy in common words, although not quite as automatic as in the obstruent+approximant group. Only two reasonably common verbs could be found: *fantasmer* 'to have fantasies' (59f) and *enthousiasmer* 'enthuse' (59g).

(59) WORDS IN /-ism/ WITHOUT A (MORE FREQUENT) CORRESPONDENT IN /-ist/:

a. *rhumatisme*	'rhumatism'	/rymatism/	→	[rymatɪs]
b. *orgasme*	'orgasm'	/ɔrgasm/	→	[ɔrgas]
c. *organisme*	'organism'	/ɔrganism/	→	[ɔrganɪs]
d. *catéchisme*	'catechism'	/kateʃism/	→	[kateʃɪs]
e. *anglicisme*	'Anglicism'	/ãglisism/	→	[ãglisɪs]
f. $ *fantasme*	'have fantasies+PRES'	/fãtasm/	→	? [fãtas]
g. $ *enthousiasme*	'enthuse+PRES'	/ãtuzjasm/	→	? [ãtuzjas]
h. *asthme*	'asthma'	/asm/	→	? [as]
i. *schisme*	'schism'	/ʃism/	→	?? [ʃɪs]

As for stop+nasal clusters, they appear in very few words and deletion here seems to be highly lexically determined. Whereas *rythme* (60a) rather easily loses its /m/[19], the final nasal of more learned words such as *dogme* (60b) and *énigme* (60c) does not usually drop. But, according to Pupier and Drapeau (1973: 135), it can delete in *diaphragme* (60d). The small number of words in this category and their character make it hard to draw clear conclusions.

(60) WORDS ENDING IN STOP+NASAL:

a. $ *rythme*	'put rhythm+PRES'	/ritm/	→	[rɪt]
b. *dogme*	'dogma'	/dɔgm/	→	* [dɔg]
c. *énigme*	'enigma'	/enigm/	→	?? [enɪg]
d. *diaphragme*	'diaphragm'	/diafragm/	→	[diafrag]

The majority of words ending in an obstruent+nasal cluster are usually associated with elevated registers, which are themselves associated with a higher rate of cluster retention. This factor may play a role in the behavior of these words. However, the fact that obstruent+nasal clusters do not simplify as easily as obstruent+approximant ones cannot reduce to register differences. Other clusters are rarer than obstruent+nasal ones and part of the same register - for example /-mn/ - and yet simplify almost automatically. This indicates that a phonological factor is also at play here.

4.3.2.3. Nasal-approximant clusters

I have found only one example containing a final nasal+approximant sequence (61). /ʒyml/ is the non-standard present form of the verb *jumeler* [ʒymle] 'to pair, to twin' (the normative one being *jumelle* [ʒymɛl]).[20] When the final cluster /-ml/ arises, the final /l/ is easily dropped in the output. But this being the only relevant form, it is hard to draw any generalization on the behavior of this cluster.[21]

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[19]This judgment agrees with the one given by Pupier & Drapeau (1973), but Thériault (2000) considers deletion to be impossible in this form, which might reflect a change in progress.

[20]The [ɛ] in the present form alternates with Ø in the infinitive (a reflex of an historic schwa, indicated by the written <e>), on the model of *appeler* [apl+e] 'to call' vs. *appelle* [apɛl] 'call, present'. These verbs are analyzed in present-day French as having two stems, e.g. [ʒyml-] and [ʒymɛl-] or [apl-] and [apɛl-] (see Morin 1988). The exact contexts in which each of these stems is used are not of interest here; it suffices to know that the /ɛ/-less one, found in particular in the infinitive and past participle, tends to generalize in non-formal registers in less frequent verbs, and replace the /ɛ/-stem in forms in which the norm prescribes its use, notably in the present tense (singular and 3rd plural). Hence [ʒyml] rather than [ʒymɛl].

[21]We will see that /-lm/ final clusters are also simplified. There are therefore two possible motivations for the deletion of /l/ in /ʒyml/: the SSP and the avoidance of sequences composed of a lateral and a nasal.

I will simply observe that deletion in this unique form is consistent with how SSP violations are treated in other sequences (obstruent+approximant and obstruent+nasal ones).

(61) NASAL+APPROXIMANT CLUSTER:
NL: $ *"jumele"* 'pair, twin+PRES' /ʒyml/ → [ʒʏm]

4.3.2.4. Analysis

On the whole, then, the facts may be characterized as follows: final consonant deletion is highly variable in obstruent+nasal clusters but almost obligatory in obstruent+approximant ones. In both cases, as well as in the only nasal+approximant example, I assume that deletion is motivated by the SSP. The difference between obstruent+approximant and obstruent+nasal sequences follows naturally from the assumption that sonority violations are relative. So the formulation of the SSP and the corresponding constraints should be modified accordingly.

Let us attach a numerical value to each category of consonants in the sonority hierarchy: glides=3 > liquids=2 > nasals=1 > obstruents=0, as is done in Clements (1990). The SSP bans elements that correspond to sonority maxima in the string of segments, but that are not permissible sonority peaks (generally only vowels are). In other words, it states that segments that are not sonority peaks should not have a higher sonority value than all their adjacent segments. For example, the sequence [mls] violates the SSP because [l], not a sonority peak, has a higher sonority value than both [m] and [s]. Equivalently, the difference in sonority value between a non-peak (a consonant) and each of its adjacent segments should not be strictly positive. Taking [mls] again, the difference between [l] and [m] is 2-1=1, that between [l] and [s] is 2-0=2. Both differences are strictly positive, in violation of the SSP. We can compare [mls] with the sequence [lms], which does not violate the SSP. [m] is not more sonorous than [l]. The difference in sonority value between [m] and [l] is 1-2=-1, that between [m] and [s] is 1-0=1; at least one difference is not positive, so the SSP is not violated. Notice that a sequence of two consonants flanked by a vowel on both sides never violates the SSP, since each consonant is necessarily adjacent to at least one segment, the vowel, that is more sonorous than it. The SSP can only be violated in internal sequences of three or more consonants, or in clusters of two consonants at domain edges (where the edge consonant is not adjacent to a vowel).

Violations of the SSP may be relativized by considering the magnitude of the sonority differences between a segment and its neighbors: the lower they are

(provided they are positive), the milder the sonority violation, and the lower-ranked the corresponding constraint. If a consonant is flanked by a consonant on both sides, I take the higher of the two sonority differences to be relevant. This is expressed in the definition in (62a), which projects a family of SSP constraints, inherently ranked as in (62b).

(62) SONORITY SEQUENCING PRINCIPLE (revised formulation):
a. SSP (n):
Let Y be a segment that is not a possible sonority peak (i.e. not a vowel),
X (and Z) its adjacent segment(s)
S(Y), S(X) (and S(Z)) their respective sonority value
S(Y), S(X) (and S(Z)) are not such that S(Y)-S(X)=n>0 (and 0<S(Y)-S(Z)<n)
b. SSP (n) >> SSP (n') iff n>n'

The general constraint in (62a) simply states that the highest sonority difference between a consonant and its adjacent segments should not be equal to *n*, with all sonority differences being strictly positive. Notice that this definition of the SSP allows sonority plateaus. The cluster [mls], for instance, violates SSP(2): 2 corresponds to the sonority difference between [l] and [s], which is higher than that between [l] and [m], both being positive. The cluster [mln] would violate only SSP(1). This sequence incurs a milder violation of the SSP than [mls], which is expressed by the inherent ranking SSP(2) >> SSP(1), derived from (62b). As for the cluster [mrs], it violates SSP(3), since I consider /r/ to be a glide with a sonority value of 3. When a consonant appears domain-initially or -finally, only one sonority difference can be computed; it is it that determines whether the SSP is violated and at what level. This is the situation we find in QF.

Let us apply this proposal to QF word-final clusters. We get a SSP violation if the last consonant has a higher sonority value than its preceding consonant. In obstruent+/l/ clusters (64b) the difference in sonority between the liquid and the obstruent is 2-0=2. These clusters violate SSP(2). In obstruent+/r/ ones (64a), the sonority difference is 3-0=3, in violation of SSP(3). In obstruent+nasal sequences (64c) the difference between the nasal and the preceding consonant is 1-0=1. Only SSP(1) is violated. I assume that final consonant deletion is categorical in obstruent+approximant clusters but variable in obstruent+nasal ones. These results are generated by the rankings in (63). The rankings in (63a-b) are fixed (see (62b) above and section 3.2.3). The one in (63c) ensures that it is the final consonant and not the postvocalic one that deletes in a two-consonant cluster. It is the QF-specific rankings in (63c-d) that drive consonant deletion in final clusters of increasing sonority. Omission of the final consonant violates MAX-C(-stop) (29b in chapter 3) rather than simply MAX-C since the deleted final consonant is never a stop when the SSP is violated. The ranking in (63c) follows from the categorical nature of simplification when SSP(2) (or SSP(3)) is violated. MAX-C(-stop) and SSP(1) are unranked with respect to each other. This indeterminacy yields the variable consonant deletion in obstruent+nasal sequences. Since the deletion of final non-stops is prefered over that of postvocalic consonants, including stops, the ranking in (63d) is also established. This is illustrated in the tableau in (64).

(63) RANKINGS WITH RESPECT TO THE SSP:
a. SSP (3) >> SSP (2) >> SSP (1)
b. MAX-C/V__ >> MAX-C
c. SSP (2) >> MAX-C(-stop)
d. MAX-C/V__ >> MAX-C(-stop)

(64) DELETION IN FINAL CLUSTERS OF INCREASING SONORITY:

a. /O+r/ /livr/	MAX-C/V__	SSP (3)	SSP (2)	MAX-C(-stop)	SSP (1)
-Or [livr]		* !			
→ -O [liv]				*	
-r [lir]	* !				
b. /O+l/ /sufl/					
-Ol [sʊfl]			* !		
→ -O [sʊf]				*	
-l [sʊl]	* !				
c. /O+N/ /ritm/vs./dɔgm/					
→-ON [rɪtm] [dɔgm]					*
→-O [rɪt] *[dɔg]				*	
-N *[rɪm] *[dɔm]	* !				

4.3.3. CLUSTER REDUCTION AND PERCEPTUAL SALIENCE

QF has a fairly complex pattern of cluster simplification when sonority is not violated. But two crucial factors can easily be identified. QF displays the familiar contrast between stops and other consonants, stops deleting in a wider range of contexts. Stops in cluster-final position drop after all types of consonants except /r/, whereas other consonants delete only in restricted contexts, when adjacent to very similar segments. It is then useful to study stop-final and non-stop-final clusters separately. Abstracting away from the stop/non-stop opposition, whether deletion takes place or not is determined by the amount of contrast between the final

consonant and the preceding one. One specific category of consonants, however, never delete: those that follow an /r/.

4.3.3.1. Data

4.3.3.1.1. /r/-initial clusters

/r/+C clusters are unaffected by final consonant deletion. They comprise the sequences /-rl/ (65), /r/+nasal (66), /r/+fricative (67), and /r/+stop (68).

(65) /-rl/ CLUSTERS:
a. $ *parle* 'speak+PRES' /parl/ → [parl] *[par]
b. $ *déferle* 'unfurl+PRES' /defɛrl/ → [defɛrl] *[defɛr]

(66) /r/+NASAL CLUSTERS:
a. $ *ferme* 'close+PRES' /fɛrm/ → [fɛrm] *[fɛr]
b. $ *incarne* 'incarnate+PRES' /ẽkarn/ → [ẽkarn] *[ẽkar]
c. $ *épargne* 'save+PRES' /eparɲ/ → [eparɲ] *[epar]

(67) /r/+FRICATIVE CLUSTERS:
a. $ *énerve* 'enervate+PRES' /enɛrv/ → [enɛrv] *[enɛr]
b. *amorphe* 'flabby+PRES' /amɔrf/ → [amɔrf] *[amɔr]
c. *quatorze* 'fourteen' /katɔrz/ → [katɔrz] *[katɔr]
d. $ *berce* 'rock+PRES' /bɛrs/ → [bɛrs] *[bɛr]
e. $ *émerge* 'emerge+PRES' /emɛrʒ/ → [emɛrʒ] *[emɛr]
f. $ *cherche* 'look for+PRES' /ʃɛrʃ/ → [ʃɛrʃ] *[ʃɛr]

(68) /r/+STOP CLUSTERS:
a. $ *courbe* 'curve+PRES' /kurb/ → [kʊrb] *[kʊr]
b. $ *usurpe* 'usurp+PRES' /yzyrp/ → [ʏzʏrp] *[ʏzʏr]
c. $ *accorde* 'grant+PRES' /akɔrd/ → [akɔrd] *[akɔr]
d. $ *apporte* 'bring+PRES' /apɔrt/ → [apɔrt] *[apɔr]
e. $ *nargue* 'flout+PRES' /narg/ → [narg] *[nar]
f. $ *marque* 'mark+PRES' /mark/ → [mark] *[mar]

Postvocalic /r/, however, is subject to a vocalization/deletion process whereby it becomes a vocalic offglide, which may even reduce to nothing. This is true both when /r/ is in absolute word-final position (69a) and when it is followed by a consonant (69b). I interpret this process as resulting from the merger of /r/ with the preceding vowel, not its deletion. This phenomenon provides support for the classification of /r/ as a glide in this position. It interacts with cluster simplification by effectively reducing the cluster to a single consonant, but is independent of it since it applies also when no cluster is present. /r/-vocalization and final consonant deletion are two distinct processes that I will keep separate. Below I will also extend the vocalization process to /l/.

(69) POSTVOCALIC /r/ VOCALIZATION:

a.	*port*	'harbor'	/pɔr/	→	[pɔʷ]
	pire	'worse'	/pir/	→	[pɪʲ]
b.	*porte*	'door'	/pɔrt/	→	[pɔᵊt]
	parle	'speak+PRES'	/parl/	→	[pæl]

Notice that /r/-vocalization is a sociolinguistically marked process, which may not be shared by all speakers of QF. I will however make the simplifying assumption that it is generally available and optional.

4.3.3.1.2. Other clusters not ending in a stop

These clusters can be grouped into three categories. The largest category comprises all the clusters that are never simplified: approximant+fricative, nasal+fricative, and stop+fricative. Two clusters are reduced by deletion of the second consonant: nasal+nasal and fricative+fricative. Finally, the cluster /-lm/ is exceptional in that it is simplified by the omission of the non-final liquid. I review each of these groups in turn.

The situation for all fricative-final clusters with the exception of fricative+fricative ones is rather simple. Liquid+fricative (70), nasal+fricative (71) and stop+fricative (72) clusters always surface intact.[22]

(70) LIQUID+FRICATIVE CLUSTERS:

a.	$ *valse*	'waltz+PRES'	/vals/	→	[vals] *[val]
b.	*belge*	'Belgian'	/bɛlʒ /	→	[bɛlʒ] *[bɛl]

[22]In the following two words the final fricative may be omitted:

(i)	*biceps*	'biceps'	/bisɛps/	→	[bisɛp(s)]
	chips	'potato chips'	/tʃips/	→	[tʃɪp(s)]

I think that these words in fact do not illustrate the phonological deletion of a fricative, but a morphological analysis in which the final *s* is interpreted as a plural marker, which is not normally pronounced in French. It is worth noting that these words are almost exclusively used in the plural, and the last one is indeed an English borrowing that contains a plural marker.

(71) NASAL+FRICATIVE CLUSTERS:

a.	$ *lunche*	'have a snack+PRES'	/lɔnʃ / →	[lɔnʃ] *[lɔn]
b.	*Banff*	(town)	/banf/ →	[banf] *[ban] *[bam][23]
c.	(Mercedes) *Benz*		/bɛnz/ →	[bɛnz] *[bɛn]

(72) STOP+FRICATIVE CLUSTERS:

a.	$ *boxe*	'do boxing+PRES'	/bɔks/	→	[bɔks] *[bɔk]
b.	*laps*	'lapse'	/laps/	→	[laps] *[lap]
c.	*ersatz*	'ersatz'	/ɛrzats/	→	[ɛrzats] *[ɛrzat]

Nasal+nasal and fricative+fricative clusters regularly lose their final consonant in all words, admittedly few, that end in one of these underlying sequences.

(73) NASAL+NASAL CLUSTERS:

a.	*hymne*	'hymn'	/imn/	→	[ɪm]
b.	*indemne*	'safe'	/ẽdɛmn/	→	[ẽdɛm]

(74) FRICATIVE+FRICATIVE CLUSTERS:

Reeves ⇒ [riv]

The example in (74), unfortunately the only one I have found of this type, deserves a few comments. First, this example of fricative deletion is important because it has previously been assumed that fricatives, unlike approximants, nasals and stops, never delete in final clusters. This generalization was proposed by Pupier & Drapeau (1973), and subsequently adopted by Kemp, Pupier & Yaeger (1980), Nikièma (1998), and Thériault (2000). It was based on the behavior of fricatives after consonants other than fricatives, like those in (70)-(72), but fricative+fricative clusters were not considered by these authors since they cannot be found in general French, in both the native and borrowed lexicon. But if we examine the pronunciation of (originally) English names by QF speakers, we note that the one I have found that ends in a fricative+fricative cluster loses its final consonant (74). This example is unexpected according to the generalization that fricatives never delete, but it is predicted in the contrast- and perception-based approach developed here. Note that the relation between the English and QF forms is not that between an underlying and a surface representation. This is why I adopt a different notation in the case of borrowings, which I will use throughout the discussion on QF. The pronunciation in QF is given in square brackets; I use double arrows to represent the adaptation process in the receiving language.

[23]This word may also be pronounced [bãf] with deletion of the nasal consonant and transfer of the nasality onto the preceding vowel. See also the examples in (85)-(87).

Finally, the cluster /-lm/, the only non-/r/-initial sonorant combination, is exceptional in that it is the /l/ that disappears rather than the final nasal (75). No other clusters, including the other /l/-initial ones, may lose a non-final consonant.

(75) /-lm/ CLUSTERS:

a.	$ *filme*	'film+PRES'	/film/	→	[fɪ(:)m]
b.	$ *calme*	'calm+PRES'	/kalm/	→	[ka(:)m]

I suggest that these forms involve not the deletion of /l/ but, as in the case of /r/ above, its merging with the preceding vowel. In support of this interpretation, I notice that the vowels in (75) are optionally lengthened. Lengthening, however, is impossible in similar forms not containing an underlying liquid. Consider in this respect the following pair of sentences.

(76) OPTIONAL LENGTHENING WITH /l/ DELETION:

a. *Les enfants sont calmes* /... kalm/ → [... ka(:)m]
'The children are calm'

b. *J'ai acheté une CAM* /... kam/ → [... kam] *[ka:m]
'I bought a CAM (Carte-Autobus-Métro = pass for public transportation)'

Unlike /r/-vocalization, however, /l/-vocalization is not generally available in postvocalic position. We can make sense of this distinction if we assume that the more sonorous or vowel-like the consonant, the more easily it fuses with the preceding vowel. /r/ being higher in the sonority hierarchy, it vocalizes quite freely, whereas /l/-vocalization is limited to contexts where it is needed to avoid marked clusters, here combinations of laterals and nasals /lm/. I will get back to this contrast in the analysis in section 4.3.3.2.

4.3.3.1.3. Other clusters ending in a stop

The final category we have to consider comprises stop-final clusters. These are more complicated and necessitate an elaborate discussion. In particular, clusters differ on whether they display lexical effects in the cluster reduction process. Some sequences may be simplified (and most generally are) in all the words ending in the relevant combination. For other clusters, however, deletion is lexically determined, being possible for only a subset of the words. This contrast was also observed for obstruent+approximant vs. obstruent+nasal final sequences. Relevant factors in these lexical effects include frequency and register: the more frequent and the less learned a word, the more likely it is to get simplified. I consider this lexical variability

to be a property of the clusters themselves, because the clusters that do not display any lexical variation are always reduceable, irrespective of the frequency, register, etc. of the word.

Stops can appear after all types of consonants, in addition to /r/ (see section 4.3.3.1.1.): /l/, nasals, fricatives, and stops. Stop+stop clusters are easily simplified in all the relevant words:

(77) STOP+STOP CLUSTERS:

/-pt/:	a.	$ *adopte*	'adopt+PRES'	/adɔpt/	→	[adɔp]
	b.	$ *capte*	'capt+PRES'	/kapt/	→	[kap]
	c.	$ *accepte*	'accept+PRES'	/aksɛpt/	→	[aksɛp]
/-kt/:	d.	$ *"paquete"*[24]	'pack+PRES'	/pakt/	→	[pak]
	e.	$ *concocte*	'concoct+PRES'	/kɔ̃kɔkt/	→	[kɔ̃kɔk]
	f.	$ *collecte*	'collect+PRES'	/kɔlɛkt/	→	[kɔlɛk]

Unlike stop+stop clusters, fricative+stop, nasal+stop, and /l/+stop ones must be broken down into more specific categories. Among fricative+stop clusters, /-st/ should be distinguished from /-sp/, /-sk/, and /-ft/. /-st/ final clusters are quite systematically reduced, without distinctions among different lexical items (78).[25] They behave like the stop+stop clusters above.

(78) /-st/ CLUSTERS:

a.	$ *existe*	'exist+PRES'	/ɛgzist/	→	[ɛgzɪs]
b.	$ *poste*	'mail+PRES'	/pɔst/	→	[pɔs]
c.	$ *reste*	'stay+PRES'	/rɛst/	→	[rɛs]

By contrast, final deletion in /-sp/, /-sk/, and /-ft/ applies freely in some lexical items but is blocked or clearly disfavored in others. Compare the words in (79a) vs. (79b) for /-sp/, (80a-c) vs. (80d-f) for /-sk/[26], and (81a-d) vs. (81e) for

[24]This is the present form of infinitive *paqueter*, a (non-standard) verb related to *paquet* 'parcel'. The form that could be expected according to the standard paradigm is *paquette* [pakɛt]; this form is totally impossible. See the form "*jumele*" in (61) and the related footnote.

[25]Pupier & Drapeau (1973) mention that stop deletion after fricatives is accompanied by compensatory lengthening of the fricative. This claim requires further investigation, as I do not see any systematic difference between underlyingly word-final fricatives and word-final fricatives derived by cluster reduction.

[26]*Presque* 'almost' /prɛsk/ and *jusque* 'until, up to' /ʒysk/ could be added to the list of non-simplifiable words. But these two words are exceptional in QF in that they trigger schwa insertion when followed by a consonant-initial word, e.g. *presque partout* 'almost everywhere' /prɛsk partu/ → [prɛskəpartu]. Unlike better known European varieties of French, such as that described in chapter 2, QF does not generally allow schwa insertion between words, except in clitic groups.

/-ft/. The cluster /-ft/ does not occur in the native French lexicon and is found only in loanwords from English. As we will see in more detail below, the greater likelihood of deletion in /sp, sk, ft/ as opposed to /st/ follows from the amount of contrast within the cluster.

(79) /-sp/ CLUSTERS:

a.	*Deraspe*	(proper name)	/dœrasp/	→	[dœras][27]
b.	$ *crispe*	'shrivel+PRES'	/krisp/	→	?? [krɪs]

(80) /-sk/ CLUSTERS:

a.	*casque*	'cap'	/kask/	→	[kas]
b.	*disque*	'disk'	/disk/	→	[dɪs]
c.	$ *risque*	'risk+PRES'	/risk/	→	[rɪs]
d.	$ *masque*	'mask+PRES'	/mask/	→	?? [mas]
e.	$ *brusque*	'be brusk+PRES'	/brysk/	→	?? [brʏs]
f.	*fisc*	'Treasury'	/fisk/	→	* [fɪs]

(81) /-ft/ CLUSTERS:

a.	*draft*	⇒	[draf]
b.	*lift*	⇒	[lɪf]
c.	*Kraft* (food company)	⇒	[kraf]
d.	*shift*	⇒	[ʃɪf][28]
e.	*loft*	⇒	?(?) [lɔf]

Nasal+stop clusters are found only in borrowings from English. They are always homorganic, but the final stop may be voiced or voiceless. Clusters with a voiced stop[29] may always be simplified (82), whereas the behavior of clusters with a voiceless stop is more variable, here again depending on the lexical item. Forms with a deletable final stop are given in (83), others with a stable cluster appear in (84).

(82) /-nd/ CLUSTERS:

a.	*weekend*	⇒	[wikɛn]
b.	*band*	⇒	[ban]
c.	*stand* (Noun)	⇒	[stan]
d.	*blind* (Noun)	⇒	[blan]

(83) /-mp, -nt, -ŋk/ CLUSTERS WITH STOP DELETION:

a.	*pimp*	⇒	[pɪm]	
b.	*cent*	⇒	[sɛn]	
c.	*peppermint*	⇒	[papœrman] / [paparman]	
d.	*drink* (Noun)	⇒	[drɪɲ]	
e.	*sink* (Noun)	⇒	[sɪɲ]	
f.	*lipsync*	⇒	[lɪpsɪɲ]	
g.	*skunk*	⇒	[skɔɲ]	(Bergeron 1980)

(84) /-mp, -nt, -ŋk/ CLUSTERS WITH STOP RETENTION:

a.	$ *bump* (N. and V.)	⇒	[bɔmp], * [bɔm]	(infin. [bɔmp+e])
b.	$ *jump* (N. and V.)	⇒	[dʒɔmp], * [dʒɔm]	(infin. [dʒɔmp+e])
c.	$ *sprint* (N. and V.)	⇒	[sprɪnt], ?? [sprɪn]	(infin. [spint+e])
d.	$ *bunt* (V.)	⇒	[bɔnt], * [bɔn]	(infin. [bɔnt+e])
e.	*punk*	⇒	[pɔɲk], * [pɔɲ]	
f.	$ *dunk* (V.)	⇒	[dɔɲk], * [dɔɲ]	(infin. [dɔɲk+e])

There is another strategy available when borrowing words ending in a nasal+stop cluster, which consists in nasalizing the preceding vowel, with concomittant loss of the nasal consonant. The result contains a single word-final stop, and no cluster to simplify. This process was frequent in the adaptation of old borrowings but seems to be no longer productive. So I do not take it to be part of the synchronic grammar of QF.

(85) /-nd/ CLUSTERS WITH VOWEL NASALIZATION:

a.	*band*	⇒	[bɛ̃d]	(Bergeron 1980)
b.	*stand* (N.)	⇒	[stɛ̃d]	(Bergeron 1980)

[27]Interestingly, this name is also often pronounced [dœraps], with metathesis of /p/ and /s/, which allows the retention of both consonants. But metathesis is not a productive phenomenon in QF, unlike the Lithuanian and Singapore English cases mentioned in the appendix to chapter 3.

[28]Interestingly, this word is often reanalyzed as *chiffre* 'number' /ʃifr/, also normally pronounced [ʃɪf]. So in hypercorrected speech, the pronunciation [ʃɪfr] for *shift* can be heard.

[29]The only cluster with a voiced stop is /-nd/, since English does not have words ending in [ŋg] and [mb]. Some words spelled <-Vng> are pronounced [Vɲ] in QF and either [Vɲ] or [Ṽg] in European varieties, but there is no reason to believe that there is a final cluster /ŋg/ in the underlying representation of these forms. The pronunciation with the final stop is probably orthographic.

(i)	a.	*ping pong*	QF: [pɪɲpɔɲ]	EF: [piɲpɔ̃g]
	b.	*big bang*	QF: [bɪgbaɲ]	EF: [bigbɑ̃g]
	c.	*gang*	QF: [gaɲ]	EF: [gɑ̃g]
	d.	*jogging*	QF: [dʒɔgɪɲ]	EF: [dʒɔgiɲ]

(86) /-mp, -nt, -ŋk/ CLUSTERS WITH VOWEL NASALIZATION:

a.	*dump* (N. and V)	⇒	[dɔ̃p]	
b.	*swamp*	⇒	[swɔ̃p]	
c.	*tramp*	⇒	[trẽp]	(Rogers 1977)
d.	*stamp*	⇒	[stẽp]	(Bergeron 1980)
e.	*bunk*	⇒	[bɔ̃k]	(Bergeron 1980)
f.	*crank* (N. and V.)	⇒	[krẽk]	(Gendron 1967)
g.	*skunk*	⇒	[skɔ̃k]	(Bergeron 1980)

For some words both simplification strategies are used: *band*, *stand*, and *skunk* are attested with final deletion in (82b-c) and (83g) and nasalization in (85) and (86g). For some words ending in a voiceless stop, the final cluster may be retained or reduced by nasalization (87). The two forms in (87a) coexist in Québec with the same meaning.[30] The example in (87b) is more interesting since the forms have two different meanings, both corresponding to the English *tank*: The form with the cluster [taŋk] and the simplified one with a low nasal vowel [tãk] refer to the military vehicle,[31] whereas the form with a mid nasal vowel corresponds to the container in a car for holding gas. The verb *tinquer* /tẽk+e/ 'tank up+INF', always pronounced [tẽke], derives from this last form. Notice that the nasal vowel in this verb is stable throughout the paradigm and is not "undone" when a vowel-initial suffix is added. That is, we do not get [tẽk] for the noun or the bare form of the verb and *[taŋke] or *[tɛŋke] with the infinitive suffix /-e/, even though these forms are phonotactically perfectly acceptable, e.g. in *bingo* 'bingo' [bɪŋgo], *caneton* 'young duck' [kantɔ̃], or *camping* [kampɪŋ]. The same holds for the verbs *dumper* [dɔ̃pe] and *cranker* [krẽke], derived from *dump* and *crank* in (86a and 86f). This suggests that the nasal vowel is present in the underlying representation.

(87) /-mp, -nt, -ɲk/ CLUSTERS WITH STOP RETENTION OR VOWEL NASALIZATION:

a.	*jump*	⇒	[dʒɔmp] / [dʒɔ̃p]	
b.	*tank*	⇒	military vehicle:	[taŋk] / [tãk]
			container for gas:	[tẽk]

Finally, the liquid /l/, like /r/ in section 4.3.3.1.1, can be followed by any stop /d, t, b, p, g, k/. The final stop fails to delete in all of these combinations, with the

[30]The two forms may be regional variants. The Montréal speakers I know use the form with the cluster, whereas others from (ville de) Québec prefer the reduced one.
[31]The form with the cluster is native to Québec, whereas I believe that the one with a low nasal vowel is a borrowing from the standard pronunciation used in Europe.

notable exception of the cluster /-ld/. The examples in (88) illustrate the retention of the two consonants in /l/+stop clusters other than /-ld/.

(88) /l/+STOP CLUSTERS OTHER THAN /-ld/:

/-lt/:	a.	$ *révolte*	'revolt+PRES'	/revɔlt/	→	[revɔlt]
	b.	$ *"pellete"*	'shovel+PRES'	/pɛlt/	→	[pɛlt][32]
	c.	$ *insulte*	'insult+PRES'	/ẽsylt/	→	[ẽsʏlt]
/-lb/:	d.	*bulbe*	'bulb'	/bylb/	→	[bʏlb]
/-lp/:	e.	$ *disculpe*	'exculpate+PRES'	/diskylp/	→	[diskʊlp]
	f.	$ *palpe*	'touch+PRES'	/palp/	→	[palp]
/-lg/:	g.	*algue*	'seaweed'	/alg/	→	[alg]
	h.	$ *divulgue*	'divulge+PRSE'	/divylg/	→	[divʏlg]
/-lk/:	i.	$ *calque*	'make a tracing+PRES'	/kalk/	→	[kalk][33]

Some words ending in /-ld/ behave like those in (88) and always retain their final cluster (89). But many other words behave differently and may lose their final stop, in particular proper names (90) and borrowings from English (91).

(89) /-ld/ CLUSTERS WITH STOP RETENTION:

a.	$ *solde*	'put on sale+PRES'	/sɔld/	→	[sɔld] *[sɔl]
b.	*tilde*	'tilde'	/tild/	→	[tɪld] *[tɪl]

(90) /-ld/ CLUSTERS WITH STOP DELETION – PROPER NAMES:

a.	*Léopold*	(first name)	/leopɔld/	→	[leopɔl] / [leɔpɔl]
b.	*Donald*	(first name)	/donald/	→	[donal]
c.	*Romuald*	(first name)	/rɔmyald/	→	[rɔmyal]
d.	*Raynald*	(first name)	/renald/	→	[renal]

(91) /-ld/ CLUSTERS WITH STOP DELETION – LOANWORDS:

a.	(Glenn) *Gould*		⇒	[gu:l] / [gʊl]
b.	*windshield*		⇒	[wɪnʃi:l]
c.	*McDonald*	(fast food chain)	⇒	[makdonal] / [makdɔnal]

The most interesting example attesting to the deletion of the final /d/ is the one in (90a). The name *Léopold* has often been confused with *Léo-Paul*, which has never contained a final /d/. Both spellings have been used to refer to the same

[32]Again, [pɛlt] is a reanalyzed form of an earlier [pɛlɛt]. See examples (61) and (77d) and the corresponding footnotes.
[33]Note that the common word *quelque* 'some' is usually pronounced [kɛk] in QF and does not seem to have a cluster in its underlying representation.

individual, as can be seen in genealogical documents, and a statistical study of Christian names given in Québec simply considers them to be two variants of the same name (Duchesne 1997).

The possibility of stop deletion after /l/ is noteworthy since it was assumed by Pupier and Drapeau (1973), Kemp, Pupier & Yaeger (1980), Walker (1984), Nikièma (1998), Papen (1998), and Thériault (2000) that nothing could drop after a liquid, so that all liquid+stop clusters were stable. This generalization was established on the basis of words such as those in (88) and (89), but these authors did not consider the items in (90) and (91).

4.3.3.1.4. Synthesis

It is now time to synthesize all the data given so far, which yield a very complex pattern. The clusters that do not violate the SSP can be divided into three categories, based on whether cluster simplification is possible and whether it displays lexical effects. The first category comprises clusters which may be reduced in all lexical items (class 1). The second category includes clusters that can be simplified only in a subset of the relevant lexical items (class 2). The clusters that are always retained form the third category (class 3). Simplification is achieved by deletion of the final consonant in all cases but one; in the cluster /-lm/ the lateral merges with the preceding vowel. I disregard at this point the possibility of vocalization of /r/, whose application extends beyond cluster simplification.

The clusters in each of these categories are given in (92):

(92) CLASS 1. REDUCTION POSSIBLE FOR ALL LEXICAL ITEMS:

1. /-vz/:	*Reeves*			⇒	[riːv]
2. /-mn/:	*hymne*	'hymn'	/imn/	→	[ɪm]
3. /-lm/:	$*calme*	'calm+PRES'	/kalm/	→	[kam]
4. Stop+Stop clusters:					
/-pt/:	$*accepte*	'accept+PRES'	/aksɛpt/	→	[aksɛp]
/-kt/:	$*collecte*	'collect+PRES'	/kɔlɛkt/	→	[kɔlɛk]
5. /-st/:	$*existe*	'exist+PRES'	/ɛgzist/	→	[ɛgzɪs]
6. /-nd/:	*band*			⇒	[ban]

CLASS 2. REDUCTION POSSIBLE FOR A SUBSET OF LEXICAL ITEMS:

1. /-ld/:	*Léopold*	(name)	/leopɔld/	→	[leopɔl]
vs.	$*solde*	'put on sale+PR'	/sɔld/	→	* [sɔl]
2. /-sp/, /-sk/, and /-ft/ clusters:					
/-sp/:	*Deraspe*	(name)	/dœrasp/	→	[dœras]
vs.	$*crispe*	'shrivel+PRES'	/krisp/	→	?? [krɪs]
/-sk/:	*casque*	'cap'	/kask/	→	[kas]
vs.	*masque*	'mask'	/mask/	→	?? [mas]
/-ft/:	*draft*			⇒	[draf]
vs.	*loft*			⇒	?(?) [lɔf]
3. /-nt/, /-mp/, and /-ɲk/ clusters:					
/-nt/:	*cent*			⇒	[sɛn]
vs.	*sprint*			⇒	?? [sprɪn]
/-mp/	*pimp*			⇒	[pɪm]
vs.	*djompe*			⇒	* [dʒɔm]
/-ɲk/	*drink* (Noun)			⇒	[drɪɲ]
vs.	*punk*			⇒	* [pɔɲ]

CLASS 3. NO REDUCTION:
1. All /r/-initial clusters
2. All /l/-initial clusters, except /-ld/
3. All fricative-final clusters, except /-vz/

The results may be characterized in a more compact way, but it is useful for that purpose to establish the feature specifications I adopt for the QF consonants. These consonants are given in (93) by manner of articulation, place of articulation, and, for obstruents, voicing. I only give the glide version of /r/, which is the relevant one in this analysis. I put /r/ in the uvular category, even though it is not the only articulation of this sound in Québec. Place of articulation for the rhotic is irrelevant in the analysis to come.

(93) CONSONANT INVENTORY IN QUÉBEC FRENCH:

		Labial	Coronal		Palatal/velar	Uvular
Stops	-vc	p	t		k	
	+vc	b	d		g	
Fricatives	-vc	f	s	ʃ		
	+vc	v	z	ʒ		
Nasals		m	n		ɲ	
Liquids			l			
Glides		w			j ɥ	r

To express voicing and place contrasts I use the standard features [voice], [labial], [coronal], and [velar]. The uvular place of articulation of the rhotic plays no role and I leave it aside. For manner of articulation, as mentioned in the preceding chapters, I use Clements's (1990) major class features [sonorant], [approximant], and [vocoid], with the specifications given in (94). To distinguish between stops and fricatives, I use a feature [noisy], which is specified only for obstruents.

(94) CONSONANT SPECIFICATIONS FOR MANNER OF ARTICULATION FEATURES:

	Stops	Fricatives	Nasals	Liquids	Glides
Noisy	–	+			
Sonorant	–	–	+	+	+
Approximant	–	–	–	+	+
Vocoid	–	–	–	–	+

The feature [noisy] used here corresponds to an acoustic/auditory version of [continuant], which is defined in articulatory terms. The reason why I make this distinction is the following. So far I have used the feature [continuant] in the context of the generalization that stops prefer to be followed by a [+continuant] segment. The phonetic motivation for it was based on the audibility of the release burst, which is favored if the stop is followed by a segment that does not block the flow of air escaping through the oral cavity. Such segments correspond to the class of [+continuant], defined as the segments that do not involve a total occlusion in the oral cavity. This is obviously an articulatory definition, one that has become standard. It applies to all segments, which are all specified for this feature (not only obstruents), with stop and nasal consonants being unambiguously treated as [-continuant] (the liquids are more controversial, see e.g. van de Weijer 1995; Kaisse 1998). The unification of stops and nasals under the specification [-continuant] has proved useful in many phonological contexts other than the one described here, notably place assimilation among these segments.

Yet in other contexts nasals and other sonorants fail to participate in continuancy distinctions, which are limited to obstruents. Cases of continuancy dissimilation, for instance, involve only obstruents, e.g. in Modern Greek (Kaisse 1988, cited in Rice 1992) or Yucatec Maya (Straight 1976; Lombardi 1990; Padgett 1992).[34] I believe such cases involve an acoustic/perceptual dimension rather than an

[34] Continuancy dissimilation is also attested in the pronunciation of English word-final obstruent clusters by native speakers of Japanese, Korean, and Cantonese (languages which prohibit tautosyllabic consonant clusters). Eckman (1987) reports that tri-consonantal clusters are typically reduced so as to produce bi-consonantal ones consisting of a stop and a fricative, but not two stops or two fricatives.

articulatory one. Acoustically a major distinguishing factor among consonants is sonorancy, which can be defined according to the presence or absence of formant structure. Obstruents are then characterized by the presence or absence of noise during closure, and this is what the feature [noisy] refers to. This definition excludes sonorants from consideration. To the extent that I consider cluster simplification to be motivated by acoustic/perceptual factors, it is coherent that I use features that refer to meaningful acoustic/perceptual dimensions. Now, if the tension in the use of continuancy based on whether all segments or only obstruents reflect the existence of two quite distinct dimensions, one also expects the corresponding use of two different features.

The feature specifications of French consonants now being established, we can take a different look at the pattern of cluster reduction in QF and propose the generalizations in (95). For the purpose of the formal analysis I will be developing, I suppose that cluster reduction is obligatory for clusters of class 1, optional or variable for clusters of class 2, and prohibited for clusters of class 3.

(95) GENERALIZATIONS ON FINAL CLUSTER SIMPLIFICATION IN QF:

a. *General rule*: /r/-initial clusters never simplify. These are the clusters that contain a contrast in [vocoid].

b. *Other sonorant-final clusters:* Simplification is obligatory (/lm, mn/). These are the clusters that agree in [son].

c. *Other obstruent-final clusters:* They behave according to the degree of similarity between the two consonants:

i. Simplification is obligatory for clusters that agree in [noisy] (/vz, pt, kt/).

ii. Clusters that do not agree in [noisy] may be reduced only if they end in a stop, subject to the following rules:

- If the stop agrees in [approximant], [place], and [voice] with the preceding consonant, deletion is obligatory (/st, nd/).
- If the stop agrees in [approximant] but contrasts in either [place] or [voice] with the preceding consonant, deletion is variable (/sp, sk, ft, mp, nt, ŋk/).
- If the stop agrees in [vocoid], [place], and [voice] with the preceding consonant, deletion is variable (/ld/).
- If the stop agrees in [vocoid] but contrasts in [place] and/or [voice] with the preceding consonant, deletion is excluded (/lt, lb, lp, lg, lk/).

4.3.3.2. Analysis

The analysis I propose closely follows the generalizations above. It rests on several constraints concerned with contrast or similarity between a consonant and its adjacent segments. These constraints interact with other faithfulness constraints dealing with the weaker resistance of stops to deletion and the merging of approximants with the preceding vowel.

4.3.3.2.1. The constraints and their inherent rankings

The backbone of the analysis is formed by a series of markedness constraints penalizing similarity in manner of articulation.

(96) RELEVANT MARKEDNESS CONSTRAINTS:
- a. C (AGR=[+son] ∧ [-vocoid]) ↔ V
  A consonant that agrees in [+son] and [-vocoid] with a neighboring segment is adjacent to a vowel.
- b. C (AGR=[noisy]) ↔ V
  A consonant that agrees in [noisy] with a neighboring segment is adjacent to a vowel.
- c. C (AGR=[-approx]) ↔ V
  A consonant that agrees in [-approx] with a neighboring segment is adjacent to a vowel.
- d. C (AGR=[-vocoid]) ↔ V
  A consonant that agrees in [-vocoid] with a neighboring segment is adjacent to a vowel.
- e. C ↔ V
  A consonant is adjacent to a vowel.

These constraints are inherently ranked as follows:

(97) INHERENT RANKINGS AMONG MARKEDNESS CONSTRAINTS:
- a. C(AGR=[noisy])↔V >> C(AGR=[-app])↔V >> C(AGR=[-voc])↔V >> C↔V
- b. C(AGR=[+son] ∧ [-vocoid])↔V >> C(AGR=[-vocoid])↔V >> C↔V

These rankings follow from the general ranking schema C(AGR=F∧G)↔V>>C(AGR=F)↔V (3c). The one in (97b) is transparent in this regard. To derive (97a), it suffices to notice that consonants that agree in [-approx] necessarily also agree in [-vocoid] since the set of [-approx] segments is a subset of the set of [-vocoid] ones. The constraint C (AGR=[-app])↔V could be equivalently

rewritten as C(AGR=[-app]∧[-voc])↔V, which automatically dominates C(AGR=[-voc])↔V. The same reasoning applies to C(AGR=[noisy])↔V vs. C(AGR=[-app])↔V: segments that agree in noisiness are all obstruents, that is [-sonorant], [-approximant], and [-vocoid]. C(AGR=[noisy])↔V is then equivalent to C(AGR=[noisy]∧[-son]∧[-app]∧[-voc])↔V, which automatically dominates C(AGR=[-app])↔V.

In the context of final clusters in QF, the inherent rankings in (97) serve to encode the generalization that the more contrast in manner of articulation there is between the word-final consonant and the preceding segment, the more likely deletion or coalescence is. When the amount of contrast is minimal, that is when the two consonants are highly similar, deletion targets all types of consonants; when the final consonant contrasts substantially with the preceding one, no deletion takes place. With an intermediate degree of similarity in manner of articulation, only the weaker consonants, i.e. stops, may delete.

To derive these results, the constraints in (96) interact with two series of faithfulness constraints that deal with the two processes that are attested to avoid final clusters: consonant deletion and coalescence with the preceding vowel. The MAX-C constraints, given in (98), are concerned with deletion. These constraints all dominate the general MAX-C constraint.

(98) MAX-C CONSTRAINTS:
- a. MAX-C/CONTRAST=[place]
  Do not delete a consonant that contrasts in place of articulation with an adjacent segment.
- b. MAX-C/CONTRAST=[voice]
  Do not delete a consonant that contrasts in voicing with an adjacent segment.
- c. MAX-C(-stop)
  Do not delete a consonant that is not a stop.
- d. MAX-C/V__
  Do not delete a postvocalic consonant.

I assume merging or coalescence between adjacent segments violates uniformity constraints (McCarthy & Prince 1995) (99a). I suggest more specifically a series of constraints of the type in (99b), against output vowels corresponding to another segment in addition to themselves in the input. These constraints may be specified for the type of segments that vowels merge with, as in (100).

(99) UNIFORMITY CONSTRAINTS:

a. UNIFORMITY
No element in the output has multiple correspondents in the input.

b. UNIFORMITY-V
No vowel in the output corresponds to itself and another segment in the input.

(100) SONORITY-RELATIVE UNIFORMITY-V CONSTRAINTS:

a. UNIFORMITY-V [-sonorant]
No vowel in the output corresponds to itself and a [-sonorant] segment in the input.

b. UNIFORMITY-V [-approximant]
No vowel in the output corresponds to itself and a [-approximant] segment in the input.

c. UNIFORMITY-V [-vocoid]
No vowel in the output corresponds to itself and a [-vocoid] segment in the input.

I propose that the more vowel-like or sonorous a segment is, the more easily it may coalesce with an adjacent vowel. This effect is obtained with the following fixed ranking, which encodes the idea that the fusion of an obstruent (-son) with a vowel is less easily tolerated than that of a nasal (-approximant) or a liquid (-vocoid); the merging of a glide, including postvocalic /r/ in French, with a vowel only violates the general constraint UNIF-V, since glides are not relevant to any of the higher-ranked constraints in (100). See the inherent ranking in (101).

(101) INHERENT RANKING AMONG UNIFORMITY-V CONSTRAINTS:
UNIF-V [-son] >> UNIF-V [-app] >> UNIF-V [-vocoid] >> UNIF-V

These are all the constraints that we need in order to derive the QF pattern. I repeat below the inherent rankings that have been established so far within the three series of constraints.

(102) INHERENT RANKINGS ESTABLISHED:

a.

C(AGR=[noisy])↔V
|
C(AGR=[+son]∧[-vocoid])↔V   C(AGR=[-approx])↔V
\ |
C(AGR=[-vocoid]) ↔ V
|
C ↔ V
|
C → V

b. MAX-C/V__   MAX-C(-stop)   MAX-C/CONT=[voice]   MAX-C/CONT=[pl]

MAX-C

c. UNIF-V [-son]
|
UNIF-V [-approx]
|
UNIF-V [-vocoid]
|
UNIF-V

4.3.3.2.2. /r/-initial clusters

Let us now see how these constraints interact and what work they do to yield the QF deletion pattern. Consider first /r/-initial clusters, composed of a [+vocoid] segment /r/ followed by a [-vocoid] one. These clusters do not involve agreement in any of the manner features in (94) and the final consonant only violates the general constraint C↔V. Consonant deletion, which incurs at least a violation of MAX-C, is unattested, so we derive the ranking MAX-C >> C↔V (103a). Examples showing the stability of /r/-initial clusters were given in (65)-(68). The process of /r/-vocalization, however, is always an option. This process induces a violation of UNIFORMITY-V. It follows that the ranking between UNIFORMITY-V and C↔V remains undetermined (103b). The partial rankings given in (103) are illustrated in the tableau in (104).

(103) RANKINGS SPECIFIC TO QF (/r/-INITIAL CLUSTERS):

a. MAX-C >> C ↔ V

b. C ↔ V and UNIFORMITY-V are crucially unranked.

(104) NO DELETION AND /r/ VOCALIZATION IN /-rC/ CLUSTERS:

(66a) /fɛ$_1$r$_2$m$_3$/	MAX-C	C ↔ V	UNIFORMITY-V
→ fɛ$_1$r$_2$m$_3$		(m)	
fɛ$_1$r$_2$	* !		
→ fɛ$_{12}$m$_3$			*
(68d) /apɔ$_1$r$_2$t$_3$/			
→ apɔ$_1$r$_2$t$_3$		(t)	
apɔ$_1$r$_2$	* !		
→ apɔ$_{12}$t$_3$			*

4.3.3.2.3. Clusters composed of highly similar segments

At the other extreme, consider the clusters that violate the highest-ranked markedness constraints C(AGR=[+son]∧[-vocoid])↔V and C(AGR=[noisy])↔V (96a-b), that is clusters whose members are highly similar in terms of manner of articulation. These clusters include /lm/, /mn/, fricative+fricative, and stop+stop. In the case of /lm/ the /l/ obligatorily merges with the preceding vowel (75), in violation of UNIFORMITY-V [-vocoid]. In the other three cases the final consonant automatically deletes (73, 74, 77).

Stop deletion violates MAX-C, but the omission of nasals and fricatives violates the higher-ranked MAX-C(-stop). Nasals and obstruents do not merge with a preceding vowel: deletion of the following consonant is always preferable. MAX-C(-stop) therefore ranks between UNIFORMITY-V[-approximant] and UNIFORMITY-V[-vocoid]. These facts allow us to derive the additional rankings in (105), applied to one example of each type of cluster in (106). Deletion of the postvocalic consonant is never an option; this would violate MAX-C/V__, which dominates MAX-C(-stop), as determined in (63d). Deletion of the final consonant is therefore necessarily less costly. This is not indicated in (105)-(106).

(105) RANKINGS SPECIFIC TO QF (HIGHLY SIMILAR SEQUENCES):

a. C(AGR=[+son]∧[-vocoid])↔V ; C(AGR=[noisy])↔V >> MAX-C(-stop) >> UNIFORMITY-V (-vocoid)

b. UNIFORMITY-V (-son) >> UNIFORMITY-V (-approx) >> MAX-C(-stop)

(106) DELETION AND MERGER IN HIGHLY SIMILAR SEQUENCES:

(75b)/ka$_1$l$_2$m$_3$/	C(AGR=[+son] ∧[-voc])↔V	C(AGR= [noisy])↔V	UNIF-V [-son]	UNIF-V [-approx]	MAX-C (-stop)	UNIF-V [-vocoid]	MAX-C
ka$_1$l$_2$m$_3$	(m) !						
ka$_1$l$_2$					* !		
→ ka$_{12}$m$_3$						*	
(73a) /ɪ$_1$m$_2$n$_3$/							
ɪ$_1$m$_2$n$_3$	(n) !						
→ ɪ$_1$m$_2$					*		
ɪ$_{12}$n$_3$				* !			
(74) /ri$_1$v$_2$z$_3$/							
ri$_1$v$_2$z$_3$		(z) !					
→ ri$_1$v$_2$					*		
ri$_{12}$z$_3$			* !				
(77b) /ka$_1$p$_2$t$_3$/							
ka$_1$p$_2$t$_3$		(t) !					
→ ka$_1$p$_2$							*
ka$_{12}$t$_3$			* !				

About the loss of /l/ before nasals, it is worth mentioning that this process is not limited to QF. It is attested in other dialects of French, e.g. Louisiana French (Papen & Rottet 1997: 77), and in other languages, e.g. English (see the pronunciation of *calm*, *salmon*, etc.) and Korean (ex. /kulm/ → [kum] 'to starve'; Kenstowicz 1994b). Flemming (1995) notes that laterals and nasals have similar acoustic signals. This observation is consistent with the general claim made here that cluster simplification is motivated by the desire to avoid adjacent segments that do not show a sufficient amount of perceptual contrast.

Before moving on to the next set of clusters, I would like to comment on the proposed account for reduction in nasal+nasal, fricative+fricative, and stop+stop clusters, in regard of the SSP. The absence of any contrast in manner of articulation is what I think motivates deletion of the final segment in these clusters. But one could suggest that they are simplified for sonority reasons. Some languages are said to disallow sonority plateaus, that is sequences of segments with the same level of sonority. There is evidence that this is not the correct explanation, at least for QF. There is some indeterminacy in the sonority hierarchy between stops and fricatives. Either fricatives are more sonorous than stops (e.g. Steriade 1982), or the two types of consonants are equal in sonority (e.g. Clements 1990; Zec 1995), as I have assumed here. But both options lead to the conclusion that QF does allow sonority plateaus, and that we have to come up with a different explanation for the reduction of N+N, F+F, and S+S clusters.

If fricatives are more sonorous than stops, stop+fricative word-final clusters should be disfavored by the SSP, more so than stop+stop, fricative+fricative, and fricative+stop clusters. The reality is quite different. Stop+fricative sequences are precisely the least marked obstruent clusters and among the most stable word-finally. Morelli (1997, 1999) replicates this result for word-initial obstruent clusters: her typological survey of these clusters shows that stop+fricative clusters are clearly more marked than fricative+stop ones word-initially. This suggests that the SSP is not at play in comparing obstruent clusters, which is why positing sonority distinctions among obstruents is unjustified here.

If fricatives and stops are equal in sonority, all obstruent clusters are expected to be ruled out if sonority plateaus are disallowed. Since such clusters are commonplace in QF, it cannot be the case that these languages do not tolerate sonority plateaus. So some other factor must crucially be involved in the simplification of fricative+fricative and stop+stop clusters, an argument that can be extended to nasal+nasal ones.

The irrelevance of sonority plateaus in cluster simplification in QF is also supported by the fact that the clusters with sonority plateaus that do simplify do so more categorically than obstruent+nasal ones (section 4.3.2.2), which are worse in terms of sonority. According to the SSP, obstruent+nasal clusters should in fact be more marked. It turns out that the same principle of perceptual salience can account for the simplification of all the clusters other than obstruent+sonorant and nasal+liquid ones (which unambiguously violate the SSP). This allows us to dispense entirely with sonority plateaus in QF. This point being made, we are now ready to proceed to the analysis of the remaining obstruent-final clusters.

4.3.3.2.4. Clusters composed of moderately similar segments

We have so far accounted for /r/-initial clusters, all the sonorant-final clusters, and those that agree in noisiness. We are left with all the obstruent-final clusters other than F+F and S+S. Let us first look at the clusters that automatically simplify through deletion of the final consonant: /st/ (78) and /nd/ (82). These are clusters whose members agree in [-approximant], place of articulation, and voicing. They contain a moderate amount of contrast in manner of articulation and no contrast in other dimensions. The word-final consonant in these sequences violates the

constraint requiring every consonant that agrees in [-approx] with an adjacent segment to appear next to a vowel: C(AGR=[-approx])↔V (96c). The final consonant is a stop, whose deletion violates the general MAX-C constraint. This leads to the ranking C(AGR=[-approx])↔V >> MAX-C.

Crucially, clusters containing the same amount of contrast but with a final consonant other than a stop are not reduced. This applies to the clusters /ts/ (72c), the mirror image of /st/, and /nz/ (71c). These final fricatives equally violate C(AGR=[-approx])↔V, yet they never delete. Deletion of the fricative would entail a violation of the higher-ranked MAX-C(-stop), which is concerned with consonants other than stops. We can then establish that MAX-C(-stop) outranks C(AGR=[-approx])↔V. We obtain the ranking in (107a).

Some stop-final clusters other than /st/ and /nd/ also violate C(AGR=[-approx])↔V but are only variably reduced. These are /sp, sk, ft/ (79)-(81) and /mp, nt, ŋk/ (83)-(84). /sp, sk, ft/ crucially differ from /st/ in being composed of heterorganic consonants. /mp, nt, ŋk/ and /nd/ are distinguished by the presence vs. absence of a voicing contrast. The members of these clusters are less similar than /st/ and /nd/ because they contain an additional contrast. I suggest that deleting a final stop that contrasts in place of articulation or voicing with an adjacent segment violates MAX-C/CONTRAST=[place] (98a) or MAX-C/CONTRAST=[voice] (98b), respectively. These constraints, which inherently dominate MAX-C, remain unranked with respect to C(AGR=[-approx])↔V, since the final clusters are either retained or reduced by final deletion. The ranking in (107a) is accompanied by the crucial unrankedness in (107b). This is illustrated in (108) with nasal+stop and fricative+stop clusters which do and do not agree in voicing or place of articulation. These clusters contrast with stop+fricative ones (108c).

(107) RANKINGS SPECIFIC TO QF (MODERATELY SIMILAR SEQUENCES):
a. MAX-C(-stop) >> C(AGR=[-approx])↔V >> MAX-C
b. MAX-C/CONTRAST=[place], MAX-C/CONTRAST=[voice] and C(AGR=[-approx])↔V are crucially unranked.

(108) DELETION AND RETENTION IN MODERATELY SIMILAR SEQUENCES:

/rɛst/ (78c)	MAX-C(-stop)	C(AGR=[-approx])↔V	MAX-C/CONT=[place]	MAX-C/CONT=[voice]	MAX-C
rɛst		(t) !			
→ rɛs					*
/ɛrzats/ (72c)					
→ ɛrzats		(s)			
ɛrzat	* !				
/fisk/ (80f) vs. /risk/ (80c)					
→ fɪsk vs. rɪsk		(k)			
fɪs vs. → rɪsk			*		*
/band/ (82b)					
band		(d) !			
→ ban					*
/sprint/ (84c) vs. /driŋk/ (83d)					
→ sprɪnt vs. drɪŋk		(t,k)			
sprin vs. →drɪŋ				*	

The final category of clusters we have to consider is the /l/+obstruent one. Here /ld/ optionally loses its final stop (89)-(91), but the other combinations are stable, whether ending in a fricative (70) or a stop (88). In terms of manner of articulation, /l/+obstruent clusters violate C(AGR=[-vocoid])↔V (96d), which is ranked lower than C(AGR=[-approx])↔V. The non-deletion of final fricatives results from the relatively high ranking of MAX-C(-stop), as seen above. Coalescence of /l/ with the preceding vowel is also excluded, which we can account for by positing UNIFORMITY-V (-vocoid) >> C(AGR=[-vocoid])↔V. The only consonant that may delete is /d/, which agrees in both place and voicing with the preceding lateral. Deletion in this case violates only the lowest-ranked MAX-C, which remains crucially unranked with respect to C(AGR=[-vocoid])↔V. All the other /l/+stop clusters involve a contrast in place and/or voicing. Deletion would lead to a violation of MAX-C/CONTRAST=[place] and/or MAX-C/CONTRAST=[voice]. We conclude that the following ranking must hold:

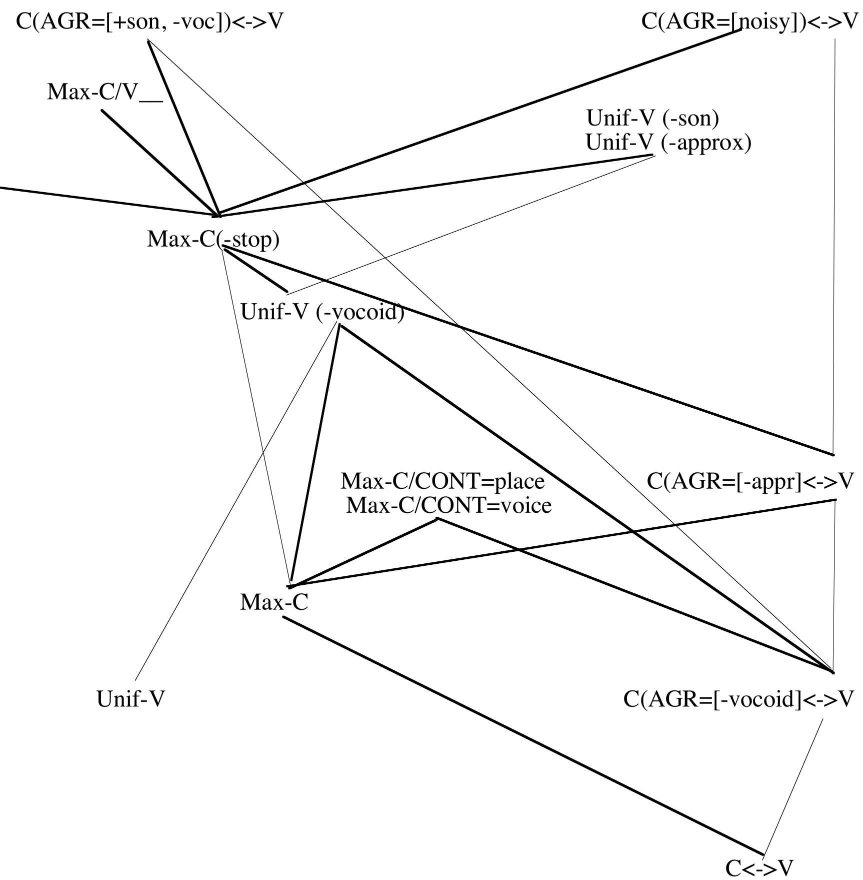
(109) RANKINGS SPECIFIC TO QF (/l/+OBSTRUENT CLUSTERS):
MAX-C/CONT=[place] ; MAX-C/CONT=[voice] ; UNIFORMITY-V (-vocoid) >> C(AGR=[-vocoid])↔V ; MAX-C

(110) DELETION AND RETENTION IN /l/+OBSTRUENT CLUSTERS:

/sɔ$_1$l$_2$d$_3$/ (89a) vs. /leopɔ$_1$l$_2$d$_3$/ (90a)	MAX-C (-stop)	MAXC/CONT=[place]	MAX-C/CONT=[voice]	UNIFOR-V (-vocoid)	C(AGR=[vocoid])↔V	MAX-C
→ sɔ$_1$l$_2$d$_3$ vs. leopɔ$_1$l$_2$d$_3$					(d)	
sɔ$_1$l$_2$ vs. → leopɔ$_1$l$_2$						*
sɔ$_{12}$d$_3$ / leopɔ$_{12}$d$_3$				* !		
/va$_1$l$_2$s$_3$/ (70a)						
→ va$_1$l$_2$s$_3$					(s)	
va$_1$l$_2$	* !					
va$_{12}$s$_3$				* !		
/revɔ$_1$l$_2$t$_3$/ (88a)						
→ revɔ$_1$l$_2$t$_3$					(t)	
revɔ$_1$l$_2$			* !			*
revɔ$_{12}$t$_3$				* !		
/divy$_1$l$_2$g$_3$/ (88h)						
→ divʏ$_1$l$_2$g$_3$					(g)	
divʏ$_1$l$_2$		* !				*
divʏ$_{12}$g$_3$				* !		

The final constraint ranking for cluster simplification in QF is given in (111). Thin lines indicate inherent rankings; thick ones indicate rankings that were established empirically and are specific to QF.

(111)



This grammar contains four zones of variability:

1. Indeterminate ranking between UNIFORMITY-V and C↔V yields variable /r/-vocalization.[35]

2. Indeterminate ranking between SSP(1) and MAX-C(-stop) yields variable final deletion in obstruent+nasal clusters.

3. Indeterminate ranking between C(AGR=[-app])↔V, MAX-C/CONTRAST=[Place], and MAX-C/CONTRAST=[voice] yields variable final deletion in [sk, sp, ft] and [mp, nt, ŋk].

[35]UNIFORMITY-V is also unranked with respect to C→V since vocalization is also possible with simple post-vocalic /r/. This is not indicated in the graph.

4. Indeterminate ranking between C(AGR=[-vocoid])↔V and MAX-C yields variable final deletion in [-ld].

4.3.3.3. A similar pattern: Philadephia English

Philadelphia English presents a pattern of word-final consonant deletion that is strikingly similar to the QF one. Word-final stop deletion in English depends on a number of factors, among others the phonological environment and the morphological status of the final stop. Focusing on the nature of the preceding segment on final coronal stop deletion, Guy and Boberg (1997) observe that /t, d/ delete more frequently in natural speech after the segments in (112a) and least frequently (practically never) after those in (112c), the segments in (112b) forming an intermediate category.

(112) a. stops (*act*);
coronal fricatives (*wrist*);
/n/ (*tend*, *tent*)
b. /l/ (*cold*, *colt*);
non-coronal fricatives (*draft*);
non-coronal nasals (*summed*)
c. /r/ (*cart*)

This hierarchy is extremely similar to the one given in (92) for QF, although the number of possible consonant combinations is much smaller since we are dealing only with word-final coronal stop deletion. As in QF, /r/-initial clusters never simplify (class 3) and clusters that agree in noisiness lose their final stop most frequently (/pt, kt/, class 1). More similarity in manner of articulation favors deletion: stops that agree in [-approximant] with the preceding consonant delete more readily, all else being equal, than stops that only agree in [-vocoid]. Compare in this respect /nd, nt/ (112a) with /ld, lt/ (112b). Contrast in place of articulation between the two segments has in both languages an inhibiting effect on deletion: /st/ reduces more frequently than /ft/ in Philadelphia English, and /nd, nt/ more frequently than /md/. Voicing contrasts seem to have a more categorical effect on the likelihood of deletion in QF than in Philadelphia English, but they do act in the expected direction in the latter language as well. In QF /nd/ and /ld/ fall into different categories from /nt/ and /lt/ in terms of the likelihood of final stop deletion. In PE, /nd/ and /ld/ fall into the same broad groups as /nt/ and /lt/, but Guy & Boberg (1997) confirm that the clusters that agree in [voice] /nd, ld/ reduce more often than those whose members do not share the same value for that feature.

The generalizations that apply to the PE facts in (112) closely replicate those obtained for QF. This convergence is all the more interesting since these generalizations are based on distinct types of data. Guy & Boberg work in a variable rule sociolinguistic approach and use only actual frequencies based on real speech corpora, whereas I give a large part to introspective judgments. I believe this simultaneously supports the validity of speakers' judgments and strengthens the evidence for the role of syntagmatic contrast in consonant deletion.

4.4. CONCLUSIONS

This chapter has discussed the role of similarity/contrast between adjacent segments in deletion and epenthesis processes. Identity avoidance has long been established as a meaningful factor in phonology, embedded in particular in the OCP. The perceptual approach developed here improves upon the OCP in several ways, and it can be usefully characterized by means of a comparison with the OCP. First, it integrates similarity avoidance within a more general framework based on the notion of perceptibility, and provides a motivation for it. Similarity correlates with modulation in the acoustic signal, which is a major component of segment perceptibility. Second, our constraint system straightforwardly accounts for the gradient nature of identity avoidance: the more similarity a certain segmental configuration involves, the more marked it is. This contrasts with the categorical formulation of the OCP. Third, we have uncovered the existence of relative identity avoidance phenomena, whereby the degree of similarity that a segment tolerates with an adjacent segment is dependent upon the quality and quantity of perceptual cues otherwise available to that segment. The perceptual-cue approach can naturally handle such phenomena, whereas the OCP only deals with absolute identity avoidance, whereby a specific level of similarity is prohibited between two adjacent segments, irrespective of the context in which they appear.

A range of deletion and epenthesis patterns involving similarity avoidance were analyzed, showing the relevance of manner of articulation, place of articulation, laryngeal setting, and combinations of these dimensions in the computation of contrast. A major portion of the chapter was devoted to the detailed description and analysis of word-final cluster reduction in Québec French, which derives from intricate interactions between different levels of contrast, the distinct behavior of stops vs. other consonants, possible coalescence between vowels and a following approximant segment, and the SSP.