CHAPTER 3

CASE STUDIES

3.1 Introduction

In this chapter, I present two case studies: Modern Greek and Lushootseed-Nisqually. Both languages represent examples of *harmonically complete* systems. An example of an *harmonically incomplete* language will be provided in Chapter 4.

In the case of Modern Greek, I show a case in which the harmonic upper bound FS for ill-formed clusters actually corresponds to the optimal candidate. In other words, Modern Greek is a language that repairs ill-formed clusters by neutralization to the unmarked structure, i.e. FS clusters. Moreover, I will argue that a unified account of the various phonological processes affecting obstruent clusters is the result of one single constraint ranking established for the language.

The second case study is Lushootseed-Nisqually. This language is interesting for the purposes of the dissertation because it shows a different type of repair strategy for the ill-formed clusters. In particular, in Nisqually, ill-formed obstruent clusters are repaired by obstruent syllabicity; which I argue is completely predictable from simple interactions of syllable structure constraints with the constraints relevant to obstruent clusters.

3.2 Case study I: Modern Greek

3.2.1. Introduction

The analysis of Modern Greek that I present in this section exemplifies a grammar of a *Type 1* language, i.e. a language in which only FS clusters are well-formed. This is despite the fact that FS are not the only clusters that occur in the language. I claim that FS are the only clusters admitted by the constraint ranking defining obstruent clusters. All other types of obstruent clusters that occur in the language are argued to be ill-formed with respect to constraint hierarchy defining obstruent clusters. They, however, are allowed to surface, because they best satisfy independent constraint that have priority over the latter hierarchy.

Moreover, I show that a number of apparently unrelated phonological processes affecting obstruent clusters can be explained as a single process of neutralization to the unmarked FS. In particular, one of the processes affecting obstruent clusters in Modern Greek provides crucial evidence for the activity of the constraint *SO. The Modern Greek data also provides evidence for recent models of lexicon stratification (Fukazawa 1997, 1999), Fukazawa, Kitahara and Ota (1998) and Itô and Mester (1998).

I will first provide a discussion of the current language situation and a description of the Modern Greek sound system and surface phonotactics patterns.

3.2.2 Lexical Strata in Modern Greek

Modern Greek (Joseph and Philippaki-Warburton (1987), Kaisse (1989)) consists of two separate but co-existing lexical strata: *katharevousa* and *dimotiki*. *Katharevousa* is a sort of artificial archaic language which has mostly been used by conservative administrations and attempts to preserve an older state of the language by borrowing many words from Ancient Greek. *Dimotiki* represents, instead, the spoken common language. The two strata differ, among other things, in the types of obstruent clusters they allow. Whereas *katharevousa* permits a richer system of obstruent clusters due to its closer connection with Ancient Greek, in *dimotiki* voiceless obstruent clusters must disagree in continuancy. The only voiceless obstruent clusters found in the *dimotiki* vocabulary are, therefore, FS and SF types. When clusters agreeing in continuancy arise in the *dimotiki* lexicon due to morphological processes or borrowings from classical sources, they generally undergo some type of dissimilation. I will argue that the different processes affecting obstruent clusters in *dimotiki* are all driven by a single stratum-specific process: neutralization to the unmarked FS.

In the next section, I will briefly review the obstruent system of Modern Greek and provide information on relevant syllabification.

3.2.3 Modern Greek obstruent system and syllable structure

The chart in (1) representing the obstruent phonemes of Modern Greek is based on Joseph and Philippaki-Warburton (1987).

(1)

	Bilabial	Inter-dental	Dental	Velar
Stops Simple	p (b)		t (d)	k (g)
Fricatives Non-sibilant	f v	θ ð		x ɣ
Sibilant			s z	
Affricates Sibilant			(ts) (dz)	

The parentheses around some of the elements in the chart indicate that their phonemic status is not agreed upon by most Greek linguists. As for [ts] and [dz], I follow Householder (1964) and Joseph and Philippaki-Warburton (1987) in analyzing them as simple consonants.

Modern Greek as a whole allows for a variety of clusters both in initial and medial position. Besides core clusters of the form Obstruent+Sonorant, the language also has a rich system of obstruent clusters mainly due to the co-existence of the two sub-lexicons, *katharevousa* and *dimotiki*. The spoken language, depending on the register and social context, may, in fact, contain words of both systems that are no longer perceived as belonging to two separate language forms. For this reason, not only do we find clusters of the type FS and SF, in which the two members differ in continuancy, but also clusters of the type FF and SS, because they are well-formed in the *katharevousa* sub-lexicon (Joseph and Philippaki-Warbuton, 1987). Examples of all the four types of clusters are given below:

(2) FS: spiti house
stiθos chest
skilos dog
ftano I arrive
xtizo I build

SF: psari fish
tsai tea
ksenos stranger

FF: sfiri hammer
sθenos strength
sxima shape
fθinoporo autumn

SS: pteriɣa wing of building

In general, therefore, given the richness of the system of obstruent clusters, Modern Greek could be classified as a *Type 6* language. However, discussion of the processes affecting obstruent clusters will show that this classification is inaccurate in this case. I will argue, instead, that regardless of the presence of SS, SF and FF clusters, Modern Greek is indeed a *Type 1* language, i.e. a language in which only FS clusters are well-formed with respect to the hierarchy defining obstruent clusters. Within the *dimotiki* stratum, there is crucial evidence that

dimotiki SF[1] clusters are indeed ill-formed with respect to the obstruent cluster constraints. In other words, although a restricted number of SF clusters are allowed to surface in the *dimotiki* sub-lexicon, I argue that *SO dominates faithfulness, thus making SF clusters in general ill-formed with respect to the hierarchy presented in the previous chapter.

Another important feature of Modern Greek is syllabification of medial clusters. According to Setatos (1974) and Joseph and Philippaki-Warburton (1987), Modern Greek tends to follow the Onset Maximization Principle in most circumstances. Obstruent clusters in medial position are mostly syllabified as tautosyllabic onset clusters if the onset is an acceptable word initial cluster. So, for example, the lexical item [efxaristo] (meaning "thank you") is syllabified as [e.fxa.ri.stó] rather than [ef.xaris.tó]. In case the medial cluster is the result of affixation, however, syllabification may either coincide with the morpheme boundary or follow onset maximization. For example the word [ek+této] "expose", may be syllabified as either [ek.té.to] or [e.kté.to]. It is exactly because of languages such as Modern Greek, in which medial obstruent clusters are ambiguously syllabified heterosyllabically, that I have chosen to talk about obstruent clusters in terms of syllable onset and coda rather than word-

[1] FF and SS clusters are also ill-formed with respect to the hierarchy of obstruent cluster constraints in the *dimotiki* lexicon. Their occurrence in the language will be shown to depend on different principles that the ones that allow certain SF clusters to surface.
[2] According to Setatos (1974) the main reason for preferring the form [e.fxa.ri.stó] is because this word may also occur in casual speech without the initial [e].

initial and final positions. For the sake of simplicity, I assume that all medial obstruent clusters follow the Onset Maximization Principle.

3.2.4 Dimotiki Obstruent Clusters

As discussed previously, Modern Greek consists of two co-existing lexicons which show different patterns of occurrence of obstruent clusters. The *katharevousa* sub-lexicon allows all four types of obstruent clusters. The obstruent clusters that occur in the *dimotiki* lexicon are either of the FS or SF type[3]. Of these latter, however, only clusters consisting of a stop followed by /s/ are found. In the analysis I propose, I argue that SF clusters are in general ill-formed in the *dimotiki* sublexicon with respect to the constraints defining the typology of obstruent clusters, just like FF and SS are. The reason for treating SF clusters in general as ill-formed is because they undergo the same neutralization process as FF and SS clusters. However, I will show that, among the SF clusters, STOP+s clusters constitute a privileged subset of SF clusters in this language and are therefore allowed to surface

In the following sections, I will first argue that SF clusters in general are bad, i.e. ill-formed with respect to the hierarchy defining obstruent clusters, in the *dimotiki* sublexicon. Their ill-formedness entails that the constraint *SO

[3] This restriction may only hold for voiceless obstruent clusters. Voiced FF clusters occur in Modern Greek as well, e.g. [vðela] leech, [vɣazo] I take out, [zvino] erase. These words most likely belong to the *katharevousa* lexicon, which may explain why they are not affected by the same processes as the voiceless clusters.

dominates faithfulness. I will then show that, although ill-formed on the manner dimension, a subset of SF clusters can surface thanks to a constraint that preserves the feature [strident], which, itself, outranks *SO. I then consider the neutralization process affecting the marked obstruent clusters, SF, FF and SS. I argue that the neutralization process to the unmarked FS corresponds to the repair strategy to prevent ill-formed clusters from surfacing in Modern Greek. This is shown to result from the ranking of *Type 1* languages.

3.2.4.1 Neutralization of SF Clusters and their Ill-formedness

In this section I argue that, although a restricted subset of SF clusters occurs in *dimotiki*, these types of clusters, in general, are ill-formed with respect to the constraint system defining obstruent clusters. There are two arguments supporting their ill-formedness. Firstly, unlike FS in which any fricative in the language can precede a stop, e.g. /sp st sk ft xt fk/, in the case of SF clusters only /s/ can follow a stop, e.g. /ps ks/ but */px kf/. Secondly, when SF clusters are created via morpheme concatenation, except when the fricative is /s,z/, they are neutralized to the unmarked FS (Kaisse, 1989). This process is shown in the data below:

(3) /paralei**p+θ**ika/ → [paralei**ft**ika] I was neglected
/kataðio**k+θ**ika/ → [kataðio**xt**ika] I was pursued
/ple**k+θ**ika/ → [ple**xt**ika] I was knitted

The process exemplified in (3) is quite unexpected if SF clusters are indeed considered well-formed in the language. Unlike FF and SS clusters which undergo a similar process that could easily be justified as a dissimilation process, in the case of SF clusters the process in (3) could not be analyzed as dissimilation. The segments affected do not, indeed, share the same value for the feature [continuant]. On the other hand, it could not be explained as a metathesis process due to the fact that the place features are not metathesized either. Such a process would be hard to justify if SF clusters were considered well-formed with respect to the obstruent cluster constraints.

I argue, therefore, that this process, which I characterize as neutralization to the unmarked FS, is evidence that SF clusters are ill-formed in the *dimotiki* sub-lexicon with respect to the constraints defining obstruent clusters. This process defines the repair strategy for ill-formed clusters. It results from the constraint ranking that makes SF clusters ill-formed with respect to the constraint hierarchy defining obstruent clusters. The relevant ranking is given below:

(4) *SO >> Ident(cont)

Recall that also FF and SS are ill-formed in *dimotiki*. The fact that FF and SS are ill-formed means that all three markedness constraints dominate Ident(cont) in the *dimotiki* sub-lexicon. An input containing an SF cluster can, therefore, only surface as an FS cluster regardless of its faithfulness violations. A summary of the ranking is shown in the following tableau:

(5)

/plek+θika/	*SO	OCP[+]	OCP[-]	Ident(cont)
a. plekθika	*!			
b.☞ plextika				**
c. plexθika		*!		*
d. plektika			*!	*

In the above tableau, the FS cluster best satisfies the constraint system because it incurs two minimal violations of the Ident(cont) constraint. The SF cluster that arises from morpheme concatenation is therefore repaired via simultaneous changing of the feature [continuant] values on both segments in the cluster. The ill-formed SF cluster is hence neutralized to the well-formed FS, i.e. the unmarked obstruent cluster (candidate b).

As shown, the neutralization process that affects SF clusters arising from affixation shows that SF clusters are indeed ill-formed in Modern Greek. If they were well-formed there would be no reason why this process should apply. It must still be kept in mind however, that a restricted subset of SF clusters, i.e. STOP+s clusters, is not only found in monomorphemic words but is also the product of affixation. I argue later in the chapter that this clusters indeed constitute a "protected" subset of SF clusters because of a special faithfulness constraint on the feature [strident].

In the next section, I focus on the dissimilation processes affecting FF and SS clusters that arise in the *dimotiki* sub-lexicon because of morpheme

concatenation or borrowing from the *katharevousa* sub-lexicon. I argue that such dissimilation processes can also be interpreted as neutralization of ill-formed clusters to the unmarked FS. I show that they follow from the same type of interaction that motivates neutralization of SF clusters.

3.2.4.2 Neutralization of FF

The first process is a dissimilation process that applies to a sequence of two non-strident fricatives and creates an FS clusters. In this case the second fricative becomes a stop. The process applies to monomorphemic words of Postclassical Greek origin as shown in the data in (6), as well as in morphologically complex words resulting from affixation of a fricative-initial suffix to a fricative-final stem, as shown in the data in (8):

(6) Fricative dissimilation in Postclassical Greek words

Postclassical		Dimotiki	
sxolio	→	**sk**olio	”chool”
xθes	→	**xt**es	“yesterday”
fθinos	→	**ft**inos	“cheap”

(7) Fricative dissimilation from morpheme concatenation

/ɣrá**f+θ**ike/ → [ɣrá**ft**ike] ”it has been written”

/filá**x+θ**ike/ → [filá**xt**ike] ”it has been honored”

The data in (6) and (7) show that the process applies to both word-initial as well as medial clusters, which, as stated earlier, could either be syllabified as an onset cluster or a coda-onset cluster. However, the fact that both (6) and (7) show the same type of change, suggests also that the clusters in (7) are tautosyllabic onsets. I will refer to this process as follows:

(8) Neutralization of FF

FF → FS

I argue that this process is motivated by the ranking that defines the ill-formedness of FF clusters, as given below:

(9) OCP[+cont] >> Ident(cont)

This ranking accounts for the neutralization process of FF clusters in monomorphemic and well as morphologically complex words, respectively in tableaux (10) and (11):

(10)

/xθes/	OCP[+cont]	Ident(cont)
a. xθes	*!	
b. ☞ xtes		*

In tableau (10), the Postclassical Greek borrowing containing an ill-formed cluster surfaces in Modern Greek as a cluster of a fricative and a stop because of the minimal violation incurred by the unfaithful candidate (b).

(11)

/ɣráf+θika/	*SO	OCP[+cont]	Ident(cont)
a. ɣráfθika		*!	
b.☞ ɣráftika			*
c. ɣráptika	*!		*

In tableau (11), the neutralization process is shown to occur when the offending cluster is formed via morpheme concatenation. The optimal candidate (b) contains an FS cluster. Note also that due to the ranking *SO >> Ident(cont), candidate (c) is not a possible surface form for an input containing an FF cluster.

3.2.4.3 Neutralization of SS

The second process is a dissimilation process that affects sequences of two stops and creates an FS cluster. The process applies to words from Classical Greek origin with such clusters, as well as to clusters arising due to morpheme concatenation as shown in the following examples.

(12) Stop dissimilation in Classical Greek words

Classical		Dimotiki	
he**pt**a	→	he**ft**a	”seven”
ktizo	→	**xt**izo	”I build” (ktizo in Katharevousa)
o**kt**o	→	o**xt**o	“eight”
pteron	→	**ft**ero	“wing”

(13) Stop Dissimilation from morpheme concatenation

/ple**k+t**a/ → [ple**xt**a] ”knitwear”

/le**p+t**a/ → [le**ft**a] ”money”

I will refer to this process as in (14) below:

(14) Neutralization of SS:

SS → FS

The dissimilation process observed with sequences of two stops follows from the same type of interaction between the markedness constraint relevant to SS clusters and the faithfulness constraint. This is shown in the following tableau:

(15)

/ktizo /	OCP[-cont]	Ident(cont)
a. ktizo	*!	
b. ☞ xtizo		*

In tableau (15) an input containing a cluster of two stops shows neutralization to the unmarked FS due to the fact that the violation incurred by the candidate containing an unfaithful cluster of the type FS is a lesser violation than the one incurred by the faithful candidate containing an SS candidate.

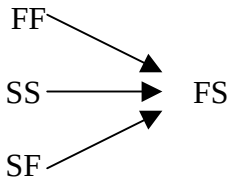
An SS cluster resulting from affixation undergoes the same type of neutralization due to its ill-formedness in the *dimotiki* sub-lexicon, as shown in the tableau below:

(16)

/plek+ta/	*SO	OCP[-cont]	Ident(cont)
a. plekta		*!	
b. ☞ plexta			*
c. plekta	*!		*

The three processes just described produce the same output, i.e. a sequence of the FS type. In linear phonology terms, this is a clear case of *conspiracies*, i.e. different rules with the same phonotactic function (Kisseberth 1970). In the case of Modern Greek the conspiracy consists in the fact that three separate rules converge to create the same effect, i.e. neutralization of the marked types of obstruent clusters, i.e. FF, SF and SS, to the unmarked type FS. This situation is schematically represented in (17):

(17)



The phonological processes observed in the *dimotiki* lexical stratum strongly suggest that *dimotiki* is, indeed, a *Type 1* grammar, i.e. a grammar in which only FS clusters are well-formed obstruent clusters. The ranking that accounts for the neutralization processes observed is therefore the same as the one defining *Type 1* languages:

(18) OCP[+cont], OCP[-cont], *SO >> Faithfulness

This ranking, where all the markedness constraints dominate Faithfulness, ensures that only the unmarked FS clusters will be able to surface due to the fact that such clusters do not violate any of the markedness constraints. However, when ill-formed clusters arise in the language because of borrowings from other sources or morphological processes as in the case of Modern Greek, then the ill-formed clusters are repaired in some way. The repair strategy depends on which faithfulness constraint is lower ranked. In the *dimotiki* grammar, the repair strategy does not delete or add anything in the ill-formed sequences, but rather changes input values of the feature continuant so as to neutralize the ill-formed sequences to FS. The relevant constraint that accounts for the neutralization process is Ident(cont). Interaction of this constraint with the markedness constraints introduced previously provides a unified account of the three main processes affecting obstruent clusters in *dimotiki*.

To conclude, the three processes affecting obstruent clusters in *dimotiki* all follow from the assumption that the language is, in fact, a *Type 1* language. The ranking in which the three markedness constraints dominate faithfulness directly accounts for neutralization of all the marked types of clusters to the unmarked type FS. The constraint system proposed for obstruent clusters allows us to provide a unified account of the three processes just described.

3.2.5 STOP+s Clusters

We need now to explain the behavior of STOP+s clusters. I have shown that SF clusters are ill-formed with respect to the hierarchy defining obstruent clusters and are repaired into the unmarked FS when created by affixation. Monomorphemic words within the *dimotiki* lexicon are not neutralized to FS sequences if the SF cluster consists of a stop followed by /s/. The following words constitute regular *dimotiki* phonotacics:

(19) : psari ”fish”
tsai ”tea”
ksenos ”stranger”

Moreover, STOP+s clusters are even created, if in a sequence of two fricatives, the second one is a strident, i.e. /s/ or /z/. In this case the first fricative becomes a stop and the strident does not change. The process is illustrated in the following examples[4]:

(20) /ɣrá**f+s**o/ → [ɣrá**ps**o] “I write” (Perfective non-past)
/ðiale**ɣ+s**o/ → [ðiale**ks**o] “I write” (Perfective non-past)

As pointed out by Kaisse (1989), clusters such as the ones in the first two examples arise quite frequently since both future and simple past active morphemes in Modern Greek begin with /s/ and a large number of roots ends in

[4] In Modern Greek obstruent clusters must agree in voicing. This explains the devoicing of /ɣ/ in [[ðiale**ks**o].

fricatives. The question is then, given the constraint ranking of Modern Greek, how do we account for the occurrence of this particular subset of SF clusters in such a grammar? In other words, we need to explain why an FF cluster in which the second member is a sibilant surfaces as an SF cluster rather than the expected FS cluster. For example, given underlying /ɣrá**f+s**o/, we would expect it to surface as [ɣrá**f+t**o] rather than [ɣrá**ps**o], as shown in tableau (21):

(21)

/ɣráf+so/	*SO	OCP[+cont]	Ident(cont)
a. ɣráfso		*!	
b. ☛ ɣráfto			*
c. ✝ ɣrápso	*!		*

Tableau (21) shows that candidate (c), which is the desired output, loses because of its violation of dominant *SO. The system thus would falsely predict that, also in this case, an FS cluster should be the output of the process regardless of the segmental composition of the cluster. In order to prevent candidate (b) from surfacing as the optimal output for an input such as the one in (21), I propose that a correspondence constraint of the Ident(F) family (McCarthy & Prince 1995) is active in the grammar of Modern Greek. This constraint preserves input /s,z/ even if it would result in a violation of the *SO constraint. According to Lombardi (1995), the relevant feature that distinguishes these two sounds from all

other fricatives in Modern Greek is [strident][5]. I assume that only fricatives are specified for this feature, whereas stops are not (Lombardi 1995). The constraint is formulated according to the general schema of Ident(F) constraints (McCarthy and Prince 1995):

(22) Ident(strident)

Let α be a segment in S1 and β be any correspondent of α in S2. If α is [γstrident], then β is [γstrident].

I am assuming that this constraint is violated under the following two circumstances[6]:

(a) [αstrident] → [βstrident]

(b) [αstrident] → [∅strident]

With this additional constraint we can easily explain the presence of [ps] and [ks]

[5] Greek has both / θ, ð/ and /s,z/. These sounds are described as apico-interdental and apico-dental. Lombardi (1995) argues that since both sounds are apical, they cannot be distinguished by this property. If these sounds are not distinguished by the feature [strident], then an additional place distinction must be introduced, so that a distinction between interdental and dental would be possible. Moreover, if an apical/laminal distinction at various places of articulation is kept, the system would predict an apicodental/apicointerndental contrast in the stops. But such a contrast is never observed. Lombardi concludes, therefore, that there is no real reason why fricatives should show more distinctions than stops and consequently the distinguishing feature is [strident].

[6] McCarthy and Prince (1995) distinguish between two types of assessment violations for Ident(F). In the case of binary features there is a violation if (a) +F → -F or (b) –F → +F. In the case of privative features violations are assessed in the following two cases: F →∅or ∅→ F (see Lombardi 1999 for discussion). Here we are evaluating a binary feature which is only specified for certain segments types. For this reason there is a combination of the two types of evaluation. Note also that the constraint is violated if ∅ → [αstrident]. This situation is not relevant for the case at hand.

clusters in Modern Greek regardless of their violation of the *SO constraint. The interaction is shown in the following tableau:

(23)

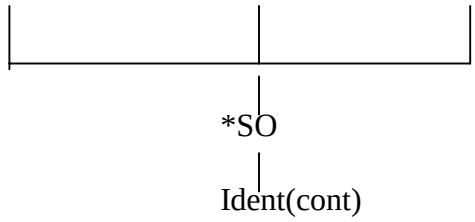
/ɣráf+so/ [+strid]	Ident(strident)	OCP[+cont]	*SO	Ident(cont)
a. ɣráfso [+strid]		*!		
b. ɣráfto	*!			*
c. ɣrápso [+strid]			*	*

Candidate (c) is now the optimal candidate regardless of the fact that it violates *SO. Candidate (a) fails because of its violation of OCP[+continuant], whereas candidate (b), containing an unmarked FS cluster, loses because of the fact that the [+strident] feature associated with the segment /s/ in the input, is not present in either segments of the output. The fricative [f] is a [-strident] segment, whereas [t] is not specified for the feature at all because I am assuming stops are unspecified for stridency. In other words, there is no correspondent of /s/ in candidate (b) that carries the feature [+strident]. Regardless of the fact that this candidate corresponds to an unmarked FS cluster, it is not optimal because of the absence of a [+strident] segment in the output. Notice also that OCP[+cont] must

crucially dominate *SO in order for (c) to be optimal. On the other hand, from this tableau no relative ranking between Ident(strident) and OCP[+cont] can be determined.

I have shown, so far, that Modern *dimotiki* Greek is a *Type 1* language in terms of the typology of obstruent clusters. Moreover, I have argued that one particular type of SF clusters, i.e. STOP+s, are notwithstanding allowed to surface under duress by Ident(strident). The constraint ranking for *dimotiki* Greek is therefore summarized as follows:

(27) Ident(strident) OCP[-cont] [OCP+cont]



The constraint ranking in (27) accounts only for the phonotactics and phonology of obstruent clusters in the *dimotiki* lexical stratum. However, nothing has been said, so far, for the clusters allowed in the *katharevousa* sub-lexicon and how the two lexical-strata can co-exist in Modern Greek as a whole. Lexicon stratification is potentially a problem because the two lexical strata show different phonotactics and phonologies that cannot obviously result from a single constraint ranking. In what follows I will describe how the model of lexicon stratification independently proposed by Fukazawa (1997, 1999), Fukazawa, Kitahara and Ota

(1998) and Itô and Mester (1998) can handle diaglossic languages in a straightforward way.

3.2.6 Lexicon Stratification and Modern Greek

In the vast majority of languages, the lexicon at large can be partitioned into separate sub-lexicons based on etymology. A fairly standard partitioning is the one between the native vocabulary and one or more separate loanword lexicons. These different sub-lexicons usually show different phonotactic restrictions or undergo stratum-specific phonological processes. Fukazawa (1997, 1999), Fukazawa, Kitahara and Ota (1998) and Itô and Mester (1998) independently propose to model lexicon stratification, and hence the stratum-specific phonologies, by arguing that faithfulness constraints can be relativized to each individual stratum, and ranked independently with respect to the various markedness constraints active in a given grammar. Under this model, the co-existing but different phonotactics and phonologies of the *katharevousa* and *dimotiki* sub-lexicons of Modern Greek could be explained by relativizing the Ident(cont) constraint to the two different lexical strata of Modern Greek. In other words, the grammar of Modern Greek would consist of two separate Ident(cont) constraints, one applying only to words in the *dimotiki* sub-lexicon (Ident(cont)^{dimotiki}), and another to words of the *katharevousa* sub-lexicon (Ident(cont)^{katharevousa}). The relevant ranking of these constraints would be as in (25) below:

(25) Ident(cont)^{katharevousa} >> Markedness >> Ident(cont)^{dimotiki}

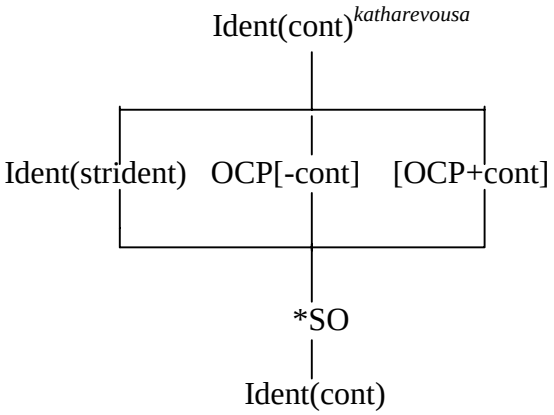
However, making use of an indexed faithfulness constraint, i.e. Ident(cont)^{dimotiki} to capture the core behavior may miss the important generalization that this constraint is actually the general constraint of the language at large. In other words, in the case at hand, obstruent clusters neutralization in a lexical item from a third source will not be triggered by low ranking Ident(cont)^{dimotiki} because such a lexical item is not part of the *dimotiki* lexicon. The situation of languages such as Modern Greek can best be described by assuming that there are two Ident(cont) constraints. One Ident(cont) constraint is the general one, which applies throughout the language regardless of etymology. The other Ident(cont) constraint is, instead, a special constraint that only applies to words of the *katharevousa* sub-lexicon. Under this view then, the ranking that will give rise to the asymmetry between the two lexicons, will follow directly from the fact that the two constraints stand in a special (Ident(cont)^{katharevousa}) to general (Ident(cont)^{dimotiki}) relationship, and the effects of the special can only be seen when the special dominates the general. With this ranking than any borrowed lexical item with an ill-formed cluster will undergo neutralization to the unmarked FS except words of the *katharevousa* sub-lexicon. In tableau (26), a common colloquial *katharevousa* word containing an SS cluster does not undergo neutralization to the unmarked FS because it is protected by the special Ident(cont)^{katharevousa} which dominates the relevant markedness constraints.

(26)

/pteriɣa/ *kath.*	Ident(cont)*kath.*	OCP[-cont]	Ident(cont)
a. fteriɣa	*!		*
b. ☞ pteriɣa		*	

Tableau (26) shows that a *katharevousa* lexical item containing an ill-formed cluster in Modern Greek can survive neutralization due to the effect of high ranking Ident(cont)*katharevousa*. In other words, high ranking Ident(cont)*katharevousa* will allow all types of obstruent clusters to surface in Modern Greek, as long as they are part of the *katharevousa* sub-lexicon. Borrowings from other sources will not enjoy the same privilege because they are only subject to the low ranking general Ident(cont). The constraint ranking for modern Greek can be therefore summarized in (27) below.

(27)



To conclude, Modern Greek exemplifies a grammar of *Type 1* in which ill-formed clusters are repaired by neutralization to the unmarked FS. This results

from the interaction of the markedness constraints with the faithfulness constraint Ident(cont). Interestingly, on the surface Modern Greek could be classified as a less restrictive type of language with respect to the obstruent cluster typology. However, a number of phonological processes affecting obstruent clusters in this language lead to the conclusion that Modern Greek is necessarily a *Type 1* language. Moreover, the Greek data provides crucial evidence for the activity of *SO, the new constraint proposed in this typology.

3.3 Case Study II: Lushootseed-Nisqually

3.3.1 Introduction

Lushootseed-Nisqually (Hoard 1978) is one of the southern dialects of Lushootseed, a Native American language of the Salish family spoken in the vicinity of Seattle, Washington state. This language represents an interesting system in that it exemplifies a different type of repair strategy for ill-formed clusters than the ones considered in Chapter 2. In particular, in Nisqually ill-formed obstruent clusters are repaired by obstruent syllabicity. I will first discuss onset obstruent clusters and obstruent syllabicity in Lushootseed-Nisqually. I will argue that not only the system I propose can account for the well-formedness of all obstruent clusters except SS clusters in Nisqually, but also that obstruent syllabicity, i.e. the repair strategy to avoid SS clusters to surface, is completely predictable from basic syllable structure constraints and the system of constraints proposed for obstruent clusters.

3.3.2 Obstruent Clusters and Syllabic Obstruents in Nisqually

Nisqually's obstruent inventory is given in Chart (28)[7].

[7] The chart is based on a limited set of data provided in Hoard (1978). /k/ and /g/ do not occur in the data. I assume that the lack is just an accident of the data, since all the closely related dialects (Snyder 1968; Hess 1977; Urbanczyk 1996) contain such segments. Moreover, the absence of these segments would be odd given that the language contains a velar rounded and glottalized series. The other dialects also contain the voiced affricates /dz dʒ/ and the voiceless lateral affricate /tɬ/. The data provided in Hoard, however, does not contain such segments at all. I will therefore not include them in the chart.

(28)

	Bilabial	Alveolar	Alveolo-palatal	Velar	Uvular	Glottal
Stops Simple	p b	t d		k g	q	ʔ
Rounded				k^w g^w	q^w	
Glottalized	p’	t’		k^w’	q’ q^w’	
Fricatives Non-sibilant				x x^w	χ $χ^w$	h
Sibilant		s	ʃ			
Lateral		ɬ				
Affricates Sibilant		c	č			
Glottalized		c’	č’			

This language contains sequences of up to three adjacent obstruents. Of these, only FS, SF and FF sequences may be tautosyllabic onset clusters.

(29) Examples of well-formed onset obstruent clusters[8]

- FS:
  - a) [sk^w]á . wəlʔ “stealhead”
  - b) [ɬq’]á.čiʔ “one-armed man”

- SF:
  - c) [t$χ^w$]áq^w’ “Mt. Rainier”
  - d) [q^w’$χ^w$]á.čiʔ “fingernail”
  - e) sčát.[qɬ]əb “mountain lion”

- FF:
  - f) [sχ]á.χəlč “sword fern”

[8] Note that the data provided in Hoard does not contain sequences consisting of either the velar or uvular fricatives as the leftmost element in the clusters. However, there is no reason to believe that such clusters are disallowed given the quite unrestricted clustering possibility. In addition, such clusters do occur in the northern dialects.

In contrast, sequences of two stops are never parsed into the same syllable. These sequences are always parsed into two separate syllables. One of the stops is parsed as a syllabic stop and the other will be parsed as either the onset of the following syllable (30a,b) or the coda of the preceding one (30c).

(30) Examples of syllabification of sequences of two stops

a) ṭ.qá.čiʔ "eight"

b) ç'.bálʔ.qid "mink"

c) ɬə́q'.ṭ "wide"

Note that affricates pattern with stops since they never occur in the same syllable with another stop. This follows straightforwardly from the treatment of affricates proposed in Lombardi (1990) as shown in section 3.3.1.2 below.

Sequences of three obstruents never form tautosyllabic clusters regardless of whether they contain adjacent stops or not. These sequences are also split into separate syllables. When in word initial or final position, these sequences form heterosyllabic syllables with either syllabic fricatives or fully released syllabic stops as syllable nuclei. This is shown in (31) below:

(31) Examples of syllabification of sequences of three obstruents

a) č’ə́č’.qs̱ “mosquito”

b) tx̱^{w}.c’ɪ́χ “stingy”

c) tx̱^{w}.sə́ . bəd “bee”

d) sq^{w}ə́ɬ.ps̱ “cutthroat trout”

e) t’ə́q.t̓’.qəc “vine maple”

f) tág^{w}.tx̱^{w} “moon”

g) ʔu.č’i.lə.pal.bs̱t “He saddled his horse”

The data shown in (29), (30) and (31) lead to the conclusion than within the Typology of Onset Obstruent Clusters, Nisqually is a *Type 4* language. In *Type 4* languages, FS, SF, FF sequences are well-formed surface onset clusters, whereas SS are ill-formed and cannot surface as tautosyllabic clusters. I propose that the syllabification patterns observed in Nisqually are forced by the constraint ranking established for *Type 4* languages. Obstruent syllabicity is the repair strategy adopted to prevent ill-formed clusters from surfacing as tautosyllabic onsets. This results from the interaction of the constraints on obstruent clusters and the Peak Hierarchy (Prince and Smolensky 1993). This hierarchy, together with the Margin Hierarchy, has been proposed to account for what segments can be possible peaks or onset/codas in a language.

3.3.3 The Analysis

3.3.3.1 2-Obstruent Sequences

Based on the data provided in the previous section, Nisqually is a *Type 4* language. Grammars for languages like Nisqually, that allow tautosyllabic sequences of FS, SF and FF but disallow SS clusters, have the following constraint ranking:

(32) OCP[-cont] >> Faith >> OCP[+cont] , *SO

This constraint ranking assures that FS, SF and FF clusters are well-formed, thus are able to surface tautosyllabically. This same ranking also assures that SS clusters are ill-formed outputs and can never surface as tautosyllabic. Nisqually repairs sequences that would lead to violations of high ranked OCP[-cont] by syllabifying the two stops into different syllables. If these sequences occur either word initially or finally, one of the stops will acquire syllabicity and constitute a syllable peak.

Prince and Smolensky (1993), in their Typology of Onset and Nucleus Inventories, distinguish between *willing* and *coercible* peaks. Willing peaks are peak-preferring tenable peak segments, whereas coercible peaks are those margin-preferring segments that can be forced to be parsed as peaks by higher ranking syllable structure constraints. Under the Containment Model (Prince and Smolensky 1993), the necessary and sufficient condition for a segment α to be a coercible peak is that

(33) PARSE, FILL^{Nuc} >> *P/α >> *M/α

Ranking PARSE above *M/α ensures that α be a possible surface onset segment in the language. The fact that α is a margin-preferring segment is captured by the domination relation *P/α >> *M/α. For α to be forced to surface as a peak, it is necessary that a syllable structure constraint, in this case $FILL^{Nuc}$, dominate the anti-association constraints.

Following this line of reasoning, Nisqually's obstruents are coercible peaks. They are margin-preferring segments coerced in the peak by the higher ranking constraint OCP[-cont].

Under Correspondence Theory (McCarthy and Prince 1995), Condition (33) can be reinterpreted as (34) to apply to Nisqually.

(34) MAX-IO, DEP-IO >> *P/Ob >> *M/Ob[9]

In (34) MAX-IO and DEP-IO take the place of PARSE and $FILL^{Nuc}$ respectively. DEP-IO should be understood as actually $DEP\text{-}IO^{Nuc}$. As in the Parse/Fill model, distinguishing between $DEP\text{-}IO^{Nuc}$ and $DEP\text{-}IO^{Ons}$ seems necessary in order to be able to derive the "Extended CV Syllable Structure Typology" (see Prince and Smolensky (1993), chapter 6). *P/Ob and *M/Ob are composite constraints that refer to the natural class of obstruents. These constraints encapsulate the sets of anti-association constraints for the members

[9] *M/Ob will not be discussed here since it is ranked at the bottom of the hierarchy and is always violated.

of the class of obstruents[10]. In particular, *P/Ob abbreviates the universal ranking *P/Stop >> *P/Fricative proposed in Prince and Smolensky.

In the case of Nisqually, obstruent syllabicity is forced by the syllable structure constraint OCP[-cont], which must dominate the anti-association constraint against parsing an obstruent as a peak. The ranking OCP[-cont] >> *P/Ob will satisfy the necessary condition for obstruent syllabicity to be possible. The interaction between the two constraints is shown in the following tableau.

(35)

/tqáčiʔ/	OCP[-cont]	*P/Ob
a. .tqá.čiʔ	*!	
b. .tq.á.čiʔ	*!	*
c.☞ .ṭ.qá.čiʔ		*

Candidates (a) and (b) violate OCP[-cont] since in both forms the two input stops are tautosyllabic. The only difference between the two candidates being that in candidate (a) the two obstruents are in the onset, whereas in candidate (b) the first obstruent is parsed as the onset of a syllable whose peak is a syllabic stop In contrast, the winning candidate avoids violation of the syllable structure

[10]In Prince and Smolensky (1993), it is assumed that the two classes of segments have different sonority values, with fricatives been more sonorous than stops. Based on sonority, they propose universal rankings of anti-association constraints, that can be encapsulated as *P/Stop >> *P/Fricative to account for core syllabification in Imdlawn Tashlhiyt Berber (Dell and Elmedlaoui 1985, 1988, 1989; Prince and Smolensky 1993; Clements 1997). This view can be reconciled with the present work by assuming that some intrinsic property of these segments other than "sonority" may be responsible for making fricatives better peaks that stops. Determining what this property may be is, however, outside the scope of the dissertation.

constraints against tautosyllabic stops by breaking the sequence into two different syllables, the first of which consists of a syllabic stop. Recall from Chapter 2, that the three markedness constraints, i.e. OCP[-cont], OCP[+cont] and *SO, range over tautosyllabic but not heterosyllabic clusters.

Given that Nisqually is a *Type 4* grammar, OCP[-cont] must be ranked higher than all the faithfulness constraints (Indent(cont), MAX-IO and DEP-IO) to disallow sequences of two stops to surface faithfully as tautosyllabic clusters. The faithfulness constraints are unranked with respect to each other since neither deletion, epenthesis or feature specification changing is adopted as a repair strategy to resolve inputs that would lead to ill-formed outputs. Moreover condition (34) requires that MAX-IO and DEP-IO be ranked above the anti-association constraints, therefore the following constraint ranking can be established:

(36) OCP[-cont] >> Ident(cont), MAX-IO, DEP-IO >> *P/Ob >> *M/Ob

Tableau (37) shows the interaction of the faithfulness constraints with *P/Ob.

(37)

/tqa ~/	Ident(cont)	MAX	DEP	*P/Ob
a. ☞ t.qa ~				*
b. qa ~		*!		
c. tə.qa.~			*!	
d. .sqa ~	*!			

Any violation of the faithfulness constraints is worse than parsing one of the stops as a peak. Obstruent syllabicity is therefore less costly than either deletion (candidate b) or insertion (candidate c) of a segment to break up the input sequence; or changing the feature specifications of the segments and turning the input sequence into the unmarked cluster type, i.e. a FS cluster (candidate d).

The constraints that penalize clusters of the form FF and SF, i.e. OCP[+cont] and *SO must be dominated by the anti-association constraint *P/Ob to assure that these sequences can surface as tautosyllabic clusters rather than being split into separate syllables with syllabic obstruents. The following two tableaux show an input containing a sequence of two fricatives and one containing a stop and a fricative respectively.

(38)

/sχáχəlč/	*P/Ob	OCP[+cont]
a. ☞ sχá.χəlč		*
b. s̩.χá.χəlč	*!	

Tableau (38) shows that an input sequence of two fricatives will surface as an onset cluster. This is possible because the ban against two tautosyllabic fricatives is outranked by the anti-association constraint that disallows to parse an obstruent as a peak. It is therefore better to parse the sequence as an onset cluster rather than splitting it in two separate syllables.

(39)

/tχ^{w}áq^{w}'/	*P/Ob	*SO
a. ☞ tχ^{w}áq^{w}'		*
b. t.χ^{w}áq^{w}'	*!	

In (39) an input sequence of the form SF is shown. This case also shows that a violation incurred by parsing one of the obstruents as a peak is worse than parsing the sequence as a tautosyllabic cluster.

3.3.3.2 Sequences Containing Affricates

Affricates[11] are allowed to form clusters with fricatives but not with other stops, as shown in the following examples:

(40) (a) [ʃč]áb.ḳ "cloud"

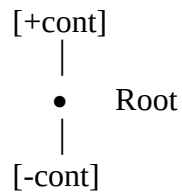
(b) ç'.bálʔ.qid "mink"

This restriction follows from Lombardi's 'unordered affricate' (1990). Lombardi proposes that affricates are composed of [-cont] and [+cont] specifications which are unordered at underlying representation and throughout the phonological derivation, although they are ordered phonetically. She argues that these

[11] If the voiced affricates mentioned in footnote 3 are part of the phonemic inventory of the language, the rest of the data provided suggests that they should occur in clusters. This expectation is based on the observation that voiceless affricates freely combine with other obstruents and that Nisqually, unlike the dialect described in Urbanczyk (1996), seems to allow clusters with different voicing specifications.

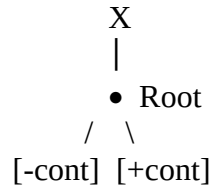
segments are represented with the different values of [cont] on separate tiers, as in (41)[12]:

(41)



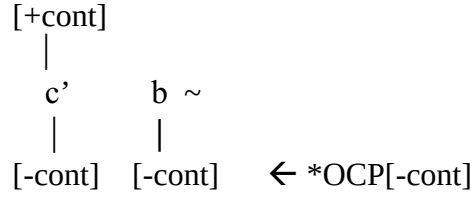
as opposed to the representation in (42) in which both specifications are on the same tier (Sagey 1986 among others):

(42)



The representation in (41), unlike the one in (42), correctly predicts that a sequence that contains an affricate and a stop (40b) is syllabified as an heterosyllabic sequence. OCP[-cont] prohibits a tautosyllabic sequence of two [-cont] specifications. Only under Lombardi's proposal the two specifications for [-cont] in a sequence containing an affricate followed by a stop would be adjacent and hence subject to OCP[-cont] as illustrated below:

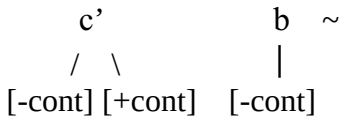
(43)



[12] Lombardi (1990) concludes that [+cont] and [-cont] are actually two separate privative features [continuant] and [stop]

If, on the contrary, the [-cont] and [+cont] specifications for an affricate are on the same tier, then the two [-cont] specifications of the sequence would not be adjacent and there would be no OCP violation. We would incorrectly predict such a sequence to surface as a tautosyllabic cluster. This is illustrated in (44) below:

(47)



Under Lombardi's proposal, a sequence containing a fricative and an affricate (therefore two adjacent [+cont] specifications), will still be able to surface tautosyllabically, as in the case of any sequence of two fricatives, because of the ranking *P/Ob >> OCP[+cont]. This ranking allows [+cont] sequences to form tautosyllabic clusters rather than requiring a syllable break between the two.

3.3.3.3 3-Obstruent sequences

Clusters consisting of three consonants are never allowed, regardless of whether they consist of three obstruents or of segments with decreasing sonority values. I therefore assume an undominated constraint that bans three consonant clusters all together. The constraint is formulated as in (45):

(45) *3-C (Three consonant clusters are disallowed)[13]

[13]The nature of this constraint is quite unclear at the moment.

As a consequence of such a more general restriction on complex syllables, three obstruent clusters are ill-formed regardless of their form. When the sequence, however, contains sub-sequences that form well formed clusters themselves, the question arises of how they are broken up into smaller tautosyllabic syllables. If the input sequence contains a sub-sequence with two adjacent stops, SSF for example, then high ranking OCP[-cont] will force a syllable break between the two stops, S.SF. An example of a medial sequence containing three obstruents is given in tableau (46).

(46)

/čátqłəb/	OCP[-cont]	*P/Ob	*SO
a. ☞ čát.qłəb			*
b. čátq.łəb	*!	*	
c. čát.q.łəb		*!	

Tableau (46) shows that, in the case of a medial sequence, the system will select as the optimal candidate the candidate with no violation of OCP[-cont] and no syllabic obstruents, given the fact that both the constraint that penalizes obstruent syllabicity and the one that penalizes tautosyllabic sequences of two stops are ranked above *SO.

If, however, both sub-sequences form well-formed clusters, then there will be a question as to how three obstruent sequences are syllabified. In particular, given a sequence of the form SFF, for example, in which both sub-sequences SF and FF form well-formed clusters, what determines the optimal

output form? As an example consider an input sequence such as the one given in tableau (47):

(47)

/tx^{w}sə~/	*P/Ob	OCP[+cont]	*SO
a. ɸ tx̣^{w}.sə~	*		*
b. t̩.x^{w}sə~	*	*	

The input in tableau (47), can be syllabified as either candidate (a) or candidate (b). Given the constraint ranking established so far and assuming the encapsulated *P/Ob, both candidates are assigned equal marks. Candidate (a), which is the actual output form (backwards hand) and hence should win, is no different in terms of better or worst constraint violations from candidate (b), which should lose in the competition[14]. The violations on OCP[+cont] and *SO are equal because the two constraints are not ranked with respect to each other. As a matter of fact, there is no ranking argument for these two constraints in the language as a whole. However, *P/Ob is a cover constraint for the fixed hierarchy "*P/Stop >> *P/Fricative". Given that these two ranked constraints dominate OCP[+cont] and *SO in the constraint system, evaluation of the candidate set by the higher ranked anti-association constraints will always take precedence over the lower

[14] Candidate (b), unlike candidate (a), also violates the syllable structure constraint Onset. The interaction of syllable structure constraints will be shown later in the analysis.

ranked structural constraints.[15]

The problem in tableau (47) is actually not a problem once *P/Ob is substituted with the sub-hierarchy *P/Stop >> *P/Fricative, as shown in (48):

(48)

/txʷsə~/	*P/Stop	*P/Fricative
a. ☞ tx̣ʷ.sə~		*
b. t̩.xʷsə~	*!	

Candidate (a) now turns out to be the winner, given the fact that it contains a syllabic fricative rather than a syllabic stop, thus better satisfying the Peak Hierarchy. However, obstruent syllabicity in Nisqually, cannot always be explained in terms of better satisfaction of the Peak Hierarchy. As a matter of fact, not all inputs containing a stop and a fricative will surface with a syllabic fricative rather than a syllabic stop. This situation is exemplified in tableau (49), where an input sequence containing a fricative and two stops surfaces with a syllabic stop rather than a syllabic fricative.

[15] Bruce Morén and Edward Keer suggested that ranking OCP[+cont] above *SO would pick the right candidate in tableau (47). However, such a solution would fail to account for the data in tableau (48) on the following page because OCP[+cont] and *SO would apply vacuously to both candidates.

(48')

/scqá~/	*P/Stop	*P/Fricative	OCP[+cont]	*SO
a. wrong winner ☛ s̩c.qá~		*		
b. desired winner ✝ sc̩.qá~	*!			

(49)

/scqá~/	*P/Stop	*P/Fricative
a. Wrong winner: ☛ ṣc.qá~		*
b. Desired winner: ✟ ṣc.qá~	*!	

In (49), the fixed constraint ranking of the Peak Hierarchy will pick the wrong optimal winning candidate. The candidate that contains a syllabic fricative incorrectly wins over the one that contains a syllabic stop (an affricate in this case). Candidate (a), however, is more marked in terms of syllable structure than (b). Candidate (a) has a coda consonant but lacks an onset, thus violating both NOCODA and ONSET, whereas candidate (b) has an onset but lacks a coda, thus satisfying both syllable structure constraints. This situation in shown in tableau (50).

(50)

/scqá~/	ONSET	NOCODA	*P/Stop	*P/Fricative
a. ṣc.qá~	*!	*		*
b. ☞ sc̣.qá~			*	

Tableau (50) shows that either ONSET or NOCODA must crucially dominate the Peak Hierarchy in order to prevent candidate (50a) to win. The question, however, is which of these two constraints is the active constraint in this portion of Nisqually grammar? I propose that ONSET, rather than NOCODA, is active in determining the locus of syllabicity in obstruent sequences. As a matter of fact,

NOCODA in Nisqually must necessarily be ranked low or at least lower than the Peak Hierarchy given the fact that the language allows simple as well as complex obstruent codas. Tableau (51) shows an input form in which an obstruent sequence is syllabified as a coda cluster.

(51)

/qədx^{w}/	ONSET	*P/Fricative	NOCODA
a. qə.dx̩^{w}		*!	
b. ☞ qədx^{w}			*
c. qəd.x̩^{w}	*!	*	

Candidate (51b) wins because it only violates low ranked NOCODA, as opposed to candidates (54a) and (54c) that do not incur any violations of NOCODA but lose on the higher ranked constraints. Note also that if NOCODA were ranked above *P/Fricative candidate (54a) would incorrectly win.

The ranking in which ONSET dominates the Peak Hierarchy and NOCODA is dominated by the Peak Hierarchy, while completely disactivating NOCODA, also makes ONSET responsible for determining the locus of syllabicity in ill-formed obstruent clusters. Given this ranking, the Peak Hierarchy is also inactive in determining which one of the obstruents will acquire syllabicity. Another example of ONSET's activity in determining the locus of syllabicity is given in tableau (52).

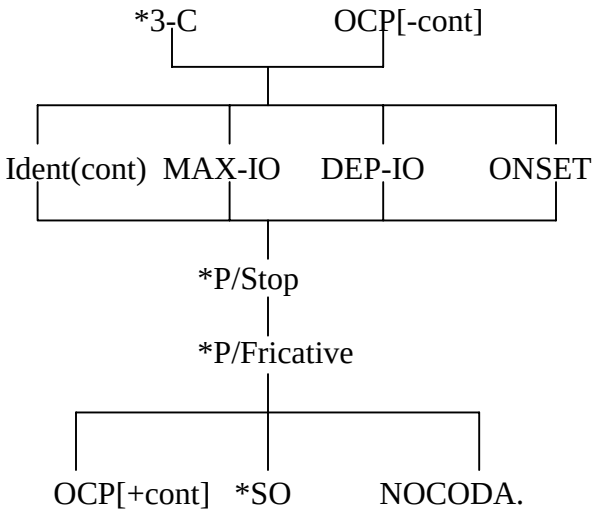
(52)

/sxlá/	ONSET	*P/Fricative
a. ṣ.xlá	*!	*
b. ☞ sx̣.lá		*
c. ṣx.lá	*!	*

In (52), both candidates (a) and (c) lack an onset, thus both incurring fatal violations of ONSET. Therefore, the winning candidate is the candidate in which the second fricative acquires syllabicity in order to satisfy some higher ranked constraint, in this case undominated *3-C.

The constraint ranking[16] for Nisqually is therefore as follows:

(53)



[16] The ranking between the higher ranked structural constraints and the faithfulness constraints follows from the typology, although it cannot be established in this particular case. The data provided does not allow to provide a ranking argument for ONSET with respect to the faithfulness constraint.

This constraint hierarchy predicts that onsets in Nisqually will contain maximally two consonants and they will be of the form FS, SF and FF. Sequences of two SS, as well as input sequences containing three consonants, will never be able to surface as tautosyllabic clusters given the constraint ranking. ONSET ranked above the Peak Hierarchy makes obstruent syllabicity completely predictable.

To conclude I have shown that cluster well-formedness in Nisqually can be explained in light of the Typology proposed in this dissertation. The constraint ranking established cross-linguistically directly accounts for the well-formed as well as ill-formed clusters of the language in syllable onsets. Interaction of this hierarchy and the Peak Hierarchy accounts for obstruent syllabicity in the environments where it is observed. Finally, ONSET is argued to be the sole force in determining the locus of syllabicity in sequences that would lead to ill-formed outputs.