5 *Quechua and Obolo: the role of syllable edges*

5.1 Introduction

The CC·EDGE constraints penalize correspondence across domain edges. The analysis of Kinyarwanda in Chapter 3 showed how one such constraint, CC·EDGE-(Stem), has two related effects: both inhibiting harmony across the stem edge, and favoring dissimilation for consonants that straddle the stem edge. CC·EDGE constraints can also refer to prosodic domains rather than morphological ones, like CC·EDGE-(σ).

(1) CC·EDGE-(σ): 'if two Cs correspond, they are contained in the same syllable'.
For each distinct pair of output consonants, X and Y, assign a violation if:
a. X and Y are in the same surface correspondence class
b. X is inside some syllable Σ_i
c. Y is not inside the syllable Σ_i

CC·EDGE-(σ) can participate in both harmony and dissimilation systems. It therefore has consequences for both, summarized in (2).

(2) Effects of CC·EDGE-(σ) in harmony and dissimilation

a. Syllable-bounded harmony	(example: Obolo)
b. Cross-syllable dissimilation	(example: Cuzco Quechua)

Prohibiting correspondence across an edge both impedes harmony and causes dissimilation; these effects are complementary in the same way as the stem-bounded harmony and cross-edge dissimilation produced by CC·EDGE-(Stem), seen in Chapter 3. Thus, in a harmony system, CC·EDGE-(σ) gives rise to syllable-bounding: harmony that holds only within the syllable, because consonants in different syllables may not correspond. In dissimilation, CC·EDGE-(σ) leads to cross-syllable effects: consonants are prohibited from corresponding only when they are separated by the edge of a syllable, so the result is dissimilation which occurs only for consonants in different syllables.

In this chapter, I show how analyses based on this constraint explain syllable-bounded nasal harmony in Obolo, and cross-syllable laryngeal

https://doi.org/10.1017/CBO9781139683586.006 Published online by Cambridge University Press

dissimilation in Cuzco Quechua. These patterns involve interactions based on different features, but both of them feature the same limit on correspondence. Together, they show that both of the consequences of CC·EDGE-(σ) are attested. This is an important result for the generalizability of the Surface Correspondence Theory of Dissimilation: because CC·EDGE-(σ) prohibits correspondence across syllable edges, it can produce tautomorphemic dissimilation. This allows the SCTD to handle dissimilation patterns which are not obviously conditioned by morphological edges, like the root-internal dissimilation we find in Cuzco Quechua. The analysis of Quechua is presented in §5.2, and the Obolo analysis in §5.3.

5.2 CC·EDGE-(σ) in dissimilation: Cuzco Quechua

The Cuzco variety of Quechua exhibits a pattern of laryngeal dissimilation involving epenthetic glottal stops and glottalized consonants (ejectives) (Parker and Weber 1996; see also Parker 1969; Parker 1997; Mannheim 1991; MacEachern 1999; Gallagher 2011). Root-initial syllables in Cuzco Quechua always have an onset on the surface; roots that are underlyingly vowel-initial appear with an initial epenthetic consonant (Parker and Weber 1996). Typically, the epenthetic consonant is a glottal stop (3). However, if a root contains an ejective, then [h] is epenthesized instead of [ʔ] (4).

(3) /asikuj/ → [ʔasikuj] 'to laugh' cf. *[asikuj]; [ʔ] epenthesized

(4) /ajk'a/ → [hajk'a] 'how many?' cf. *[ʔajk'a]; [h] instead of [ʔ]

Parker and Weber (1996) note that these generalizations about the distribution of [h] and [ʔ] can be understood as dissimilation: the epenthetic consonant is [h] only where epenthesis of [ʔ] would result in two [+constricted glottis] consonants in the same root. The treatment of [ʔ] and [h] as epenthetic is not crucial: the point of interest is that they alternate based on a principle of non-agreement with a [+constricted glottis] consonant in the root. This interpretation is supported by a corresponding static restriction against the co-occurrence of two ejectives in roots. A parallel co-occurrence restriction also prohibits roots with two aspirated consonants; this is not relevant for the [ʔ] ~ [h] alternation, but can be explained in a parallel way, as dissimilation of [+spread glottis].

The laryngeal dissimilation effects in Cuzco Quechua have previously been interpreted as holding throughout the root;[1] however, independent

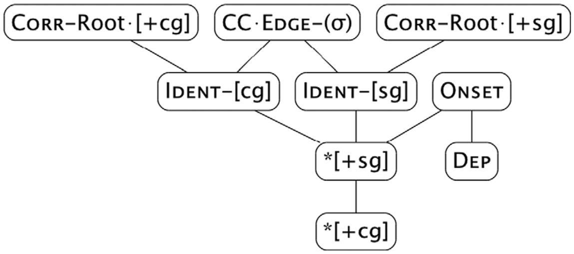
[1] See Carenko (1975), Parker and Weber (1996), Parker (1997), MacEachern (1999), Gallagher (2011), among others.

conditions on syllables mean that the dissimilation is only actually evident as a restriction against glottalic consonants *in different syllables.* Glottal stops occur only word-initially, and ejectives occur only in simplex onsets (Parker and Weber 1996; Mannheim 1991); as such, there is no way for a licit syllable to contain two constricted glottis consonants, irrespective of dissimilation. This means that the dissimilatory pattern can be characterized – with total accuracy – as a ban against glottalic consonants in different syllables of the same root. Thus, it can be analyzed as cross-syllable dissimilation.

In the SCTD, dissimilation occurs because of constraints that limit correspondence. In Cuzco Quechua, the pertinent correspondence requirement is based on [+constricted glottis] (henceforth [+c.g.]), the feature that characterizes ejectives and the glottal stop. The crucial limit on correspondence takes the form of an extreme locality restriction, imposed by CC·Edge-(σ): correspondence may not span across the edge of a syllable. The closest that two glottalic consonants can permissibly be in Quechua is in two adjacent syllables. This is not close enough for correspondence between them to satisfy CC·Edge-(σ) though: the limit on correspondence is so strict that it cannot be met without breaching the rules of syllable shape in Quechua. The result is a generalized ban on *any* co-occurrence of glottalized consonants in the same root.

The ranking obtained for Cuzco Quechua is shown in (5). This ranking is composed of several sub-systems, each responsible for different portions of the Quechua pattern. The ranking Onset»Dep is responsible for the occurrence of epenthesis in vowel-initial roots. The quality of the epenthetic consonant is determined by *[+s.g.]»*[+c.g.], favoring the [+c.g.] consonant [ʔ] as the usual choice for epenthesis. These general markedness constraints are dominated by Ident-[c.g.] and Ident-[s.g.], so that underlying aspirates and ejectives are generally allowed to occur in the language.

(5) Crucial ranking conditions for Cuzco Quechua:



https://doi.org/10.1017/CBO9781139683586.006 Published online by Cambridge University Press

The surface correspondence part of the analysis works in the following way. CORR-Root·[+c.g.] demands correspondence within the root among the [+constricted glottis] segments, while CC·EDGE-(σ) prohibits correspondence across syllable edges. Both of these constraints dominate faithfulness – IDENT-[±c.g.]. The result is that two [+c.g.] consonants may not co-occur in different syllables in the output. Since Cuzco Quechua does not allow ejectives in codas, this derives the static prohibition against roots with multiple ejectives. The ban on roots with multiple aspirates is explained in the same manner: the constraints CORR-Root·[+s.g.] and IDENT-[±s.g.] are ranked in the same configuration as their counterparts that refer to [+c.g.]. Since the IDENT constraints dominate both *[+s.g.] and *[+c.g.], this entails that the correspondence-based restrictions also overrule the default choice of epenthetic consonant – they can reverse the typical preference for epenthetic [ʔ] over [h].

The structure of the argument is as follows. First, §5.2.1 lays out the specific Cuzco Quechua generalizations to be explained and shows how they are interpreted using the surface correspondence theory, based on the guiding idea that limiting correspondence favors dissimilation. Second, §5.2.2 presents the data in more detail, and shows how the facts support the generalizations that the proposal aims to capture. Finally, §5.2.3 shows how the analysis derives these generalizations.

5.2.1 The theory, as applied to Cuzco Quechua

5.2.1.1 Background: phonological overview of Cuzco Quechua

Cuzco Quechua is a Quechuan language spoken principally in Cuzco, Peru. The consonant inventory of the language is given in (6). The [+constricted glottis] segments are {p' t' tʃ' k' q' ʔ} – the ejectives and the glottal stop. The [+spread glottis] segments are {pʰ tʰ tʃʰ kʰ qʰ h} – the aspirated consonants and the glottal fricative. All of these laryngeally marked consonants occur only in onsets, never codas (Parker and Weber 1996:72; see also Rowe 1950; Carenko 1975; Mannheim 1991; MacEachern 1999; Gallagher 2011). They also occur only in roots, never in affixes (Parker and Weber 1996:72; Mannheim 1991:177). The glottal stop occurs only word-initially, as the result of epenthesis (MacEachern 1999:31; Rowe 1950; Mannheim 1991; Parker and Weber 1996). Other segments in parentheses are marginal and/or have other distributional restrictions, noted below.

(6) Cuzco Quechua consonant inventory (after Parker and Weber 1996:70)

	Bilabial	Alveolar	Palatal or post-alveolar	Velar	Uvular	Glottal
Stop	p (b) p' p^h	t (d) t' t^h	tʃ tʃ' $tʃ^h$	k (g) k' k^h	q q' q^h	(ʔ)
Fricative	(ɸ)	s	ʃ	(x)	(χ)	h
Nasal	m	n	ɲ			
Liquid		l r	ʎ			
Glide	w		j			

Cuzco Quechua syllables are CV(C) in the native lexicon (MacEachern 1999:29); some Spanish loanwords also have CCV(C) syllables. The fricatives [ɸxχ] arise from lenition of /pkq/ in codas (MacEachern 1999:32; Mannheim 1991); /t/ also lenites to [s] in codas, but not all instances of [s] are derived by this lenition. Voiced stops occur only in Spanish loanwords (Parker and Weber 1996:71 fn. 3). Roots are primarily CV(C)CV in shape on the surface (Gallagher 2011:283).

5.2.1.2 Target generalizations and crucial Input–Output mappings

The target generalizations for Cuzco Quechua are summarized in (7) (compiled from previous work by Parker 1969; Carenko 1975; Parker and Weber 1996; Parker 1997; Mannheim 1991; MacEachern 1999; Gallagher 2011). The generalizations in (7a–b) concern the alternation in epenthesis. The generalization in (7c) is about the static co-occurrence restrictions.

(7) Cuzco Quechua – target generalizations
  a. [h] is epenthesized before initial vowels only if the root contains a [+c.g.] consonant
  b. [ʔ] is epenthesized before initial vowels otherwise
  c. A root may contain one [+c.g.] or [+s.g.] consonant, but not two of them *[+c.g.]~[+c.g.], *[+s.g.]~[+s.g.], in either order

The scope of the analysis is these three generalizations: they comprise the dissimilation pattern observed. There are several other generalizations worth mentioning, but which the present analysis will not try to explain. As noted above, all of the spread glottis and constricted glottis consonants have

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distributional restrictions: they only occur in onsets, and the glottal stop is also limited to root-initial position. There is also an ordering restriction: ejectives and aspirates are always the leftmost stop/affricate in a root (Carenko 1975: 10; Parker and Weber 1996: 72; MacEachern 1999; Gallagher 2011). Thus, plain stops may occur after an ejective or aspirated consonant, but not before – ✓[p'ata] is a licit root, but *[tak'a] is not. The co-occurrence of an aspirate and an ejective in the same root is also prohibited (Parker and Weber 1996; MacEachern 1999; Gallagher 2011). This is not a generalization about all constricted glottis and spread glottis segments though: roots may contain an ejective and [h], or an aspirate and [ʔ] (MacEachern 1999; Gallagher 2011; Rowe 1950; Carenko 1975; Parker and Weber 1996; see discussion in §5.2.2).

The target generalizations are illustrated in full by the five representative input–output mappings in the table in (8). These examples are from Parker and Weber (1996), and Parker (1997).

(8) Representative input–output mappings (boldface indicates notable Cs)

	Input	*Observed output*	*Structural configuration*	*Remarks*
a.	asi**k**uj 'to laugh'	**ʔ**asi**k**uj	**ʔ**-v(C)**C**v(CvC)	No ejectives or aspirates; Epenthesis of initial [ʔ]
b.	u**k^h**u 'inner'	**ʔ**u**k^h**u	**ʔ**-v(C)**C^h**v(CvC)	Aspirate, no ejectives; Epenthesis of initial [ʔ]
c.	aj**k'**a 'how many?'	**h**aj**k**'a	**h**-v(C)**C'**v(CvC)	Ejective, no aspirates; Epenthesis of [h], not [ʔ]
d.	**q'**a**t'**a (hypothetical)	**q'**a**t**a	**C'**v(C)**C**v(CvC)	MSC: roots with two or more ejectives are banned
e.	**q^h**a**t^h**a (hypothetical)	**q^h**a**t**a	**C^h**v(C)**C**v(CvC)	MSC: roots with two or more aspirates are banned

The three vowel-initial inputs in (a)–(c) show the conditioning of epenthetic segments by the laryngeal specification of consonants in the root. Quechua roots may have no aspirates or ejectives (a); or one aspirated stop (b); or one ejective (c). The word-initial epenthetic consonant is [h] in the last case (c), but otherwise is [ʔ] (a,b).

The roots in (d) and (e) are hypothetical inputs; they represent gaps in the Quechua lexicon – there are no roots containing sequences of two ejectives

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[*C'…C'] or two aspirates [*C^h…C^h]. Since this is a static restriction, the observable data does not reveal how the grammar of Cuzco Quechua treats underlying forms like these. The output mappings shown in (d) and (e) are posited to guarantee that inputs with the illicit sequences are changed to licit surface forms. These specific output forms are the only outputs consistent with the constraint ranking needed to produce the (observably) correct output forms in (a)–(c). They are also the same mappings conventionally assumed in previous analyses of the Cuzco Quechua co-occurrence restrictions (see Parker 1997; MacEachern 1999; Gallagher 2011; among others).

5.2.1.2 SCorr representations and the candidate space

For the [ʔ]~[h] dissimilation in epenthesis, the space of relevant candidates is defined by three dimensions: epenthetic consonant, laryngeal features in the root, and surface correspondence structure.

The choice of epenthetic consonant may be either [h] or [ʔ], or there can be no epenthesis at all. The epenthesis dimension thus splits the candidate space into three sections.

With respect to laryngeal features, there is another three-way split: a consonant in the root may be either [+c.g.] (an ejective, like [k']), or [+s.g.] (an aspirated stop like [k^h]), or neither (e.g. a plain stop like [k]). An underlying stop in a root may map to any of these three possibilities. Since multiple instances of [+c.g.] and/or [+s.g.] never co-occur in roots in Cuzco Quechua, these three classes of candidates exhaust the space of possible winners; other candidates could be considered, but they are guaranteed not to be the right outputs for this language.

Finally, surface correspondence adds a further binary split to the set of relevant candidates. Because the quality of the epenthetic segment is determined by the laryngeal features found in the root, and because at most one consonant is distinguished as being [+c.g.] or [+s.g.], we only need to consider correspondence between the epenthetic consonant and one consonant of the root. The only laryngeally significant consonant in the root is the one ejective or aspirated consonant in the root, or a plain stop if neither of those is present. This root consonant either corresponds with the epenthet, or it does not: a two-way choice. Other consonants in the root behave as inert in the pattern, and they are assumed not to correspond with the interacting pair.

Discerning these three relevant dimensions of the candidate space leads to a small and well-defined set of candidates for consideration. This is illustrated by the table in (9), which shows the space of considered candidates for the input

/ajk'a/ 'how many?' The ejective /k'/ in this root is the laryngeally significant consonant; it may surface as either [k'], [kʰ], or [k], represented by the three columns in the table. In each case, the epenthetic consonant may be [ʔ], [h], or [Ø] (no epenthesis). When there is an epenthetic consonant, it may or may not correspond with the stop in the root. The checkmarks (✓) denote candidates that match the output form for this word observed in the data. Candidates in shaded cells are harmonically bounded. Thus, there are fifteen possible candidates, but only seven of them are possible winners, and only one of those is consistent with the data.[2] The glide [j] is irrelevant, so it is omitted from the surface correspondence structures here.

(9) Space of candidates considered for the input /ajk'a/ 'how many?'

	Root [k']	Root [k]	Root [kʰ]
No epenthesis (no correspondence)	aj.k'a {k'}	aj.ka {k}	aj.kʰa {kʰ}
Epenthetic [ʔ], no correspondence	ʔaj.k'a {ʔ}{k'}	ʔaj.ka {ʔ}{k}	ʔaj.kʰa {ʔ}{kʰ}
Epenthetic [ʔ], with correspondence	ʔaj.k'a {ʔ k'}	ʔaj.ka {ʔ k}	ʔaj.kʰa {ʔ kʰ}
Epenthetic [h], no correspondence	haj.k'a (✓) {h}{k'}	haj.ka {h}{k}	haj.kʰa {h}{kʰ}
Epenthetic [h], with correspondence	haj.k'a (✓) {h k'}	haj.ka {h k}	haj.kʰa {h kʰ}

The rightmost column represents mapping ejective /k'/ to aspirated [kʰ]; these candidates always lose because they are doubly marked and unfaithful. The constraint *[+c.g.] favors mapping ejectives to non-ejectives, but no constraint favors mapping them to aspirated stops (this violates both faithfulness for [±c.g.], and markedness in the form of *[+s.g.]). That is, the general markedness constraints favor reduction to the least marked choice (i.e. plain stops), not to another marked structure. The other harmonically bounded candidates are ruled out for reasons of surface correspondence: these candidates exhibit

[2] There is a tangential – though highly significant – point to be made here about the candidate set in surface correspondence theory in general. Since candidates can differ only in their surface correspondence structure, the surface correspondence theory exponentially increases the number of candidates made available by GEN. However, the space of relevant candidates increases by much less. In this case, the space of candidates consistent with the data increases by just one, and the subset of those that are possible optima does not increase at all. The vast majority of candidates differing only in their surface correspondence structure are harmonically bounded.

dissimilation, but with correspondence between the dissimilating consonants. This configuration is harmonically bounded in general: dissimilation happens in response to limits on correspondence, so it is favored only when it facilitates *non*-correspondence.

Since the correspondence interaction is between two consonants, there are two candidates that are segmentally consistent with the output form observed. For the input /ajk'a/, both of these have the output form [hajk'a]; the only difference between them is whether there is [h]~[k'] correspondence or not. Determining which correspondence structure the output has is a matter of choosing between these two candidates; this is straightforward to do, because one of them is harmonically bounded. Since this output form exhibits dissimilation, and dissimilation builds on non-correspondence, the winner must be the non-correspondent candidate.

5.2.2 Quechua data and generalizations

5.2.2.1 Supporting data for [ʔ]~[h] in epenthesis

Cuzco Quechua requires every syllable to have an onset, as noted above. For roots that are underlyingly and/or historically vowel-initial, this onset requirement results in the epenthesis of either [ʔ] or [h]. The choice between these options is the primary alternation of interest here, and the factual basis for it is presented below.

5.2.2.1.1 [ʔ]-epenthesis is the norm The descriptive observation made by Parker and Weber (1996: 71 fn. 6) is that 'whenever a vowel-initial word is pronounced in isolation, it is preceded by a phonetic [ʔ]'. This epenthesis is illustrated by the examples below. In (10), we observe it before roots with no [+s.g.] or [+c.g.] segments; in (11), before roots containing an aspirated stop, and in (12) before roots containing /h/. (Root boundaries are not explicitly marked; all of these examples are single roots.)

(10) Epenthesis of [ʔ] before vowel-initial roots with no ejectives or aspirates:

a. /asikuj/	→	[ʔasikuj]	'to laugh'	(Parker and Weber 1996)
b. /eqo/	→	[ʔeqo]	'sickly child'	(MacEachern 1999)
c. /aknu/	→	[ʔaxnu][3]	'red-violet color'	(MacEachern 1999)
d. /oqʎu/	→	[ʔoqʎu]	'shapely, plump'	(MacEachern 1999)
e. /akʎaj/	→	[ʔakʎaj]	'choose'	(Rowe 1950)

(11) Epenthesis of [ʔ] before vowel-initial roots containing an aspirated stop:

a. /uk^hu/	→	[$ʔuk^hu$]	'inner'	(MacEachern 1999)

[3] Coda stops regularly spirantize to fricatives (MacEachern 1999: 31), hence the /k/→[x] in (10c).

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b. /aq^{h}a/ → [ʔaq^{h}a] ‘Andean corn liquor’ (MacEachern 1999)
c. /ask^{h}a/ → [ʔask^{h}a] ‘enough’ (Rowe 1950)
d. /usk^{h}u/ → [ʔusk^{h}u] ‘cotton’ (Rowe 1950)

(12) Epenthesis of [ʔ] before vowel-initial roots containing an [h]
a. /ahoja/ → [ʔahoja] ‘wild duck’ (MacEachern 1999)
b. /uhu/ → [ʔuhu] ‘cough’ (MacEachern 1999)

The epenthesis of [ʔ] is demonstrably synchronic: it is observed from synchronic alternations. Parker and Weber (1996: 80) report that the underlying roots analyzed as vowel-initial appear with an inserted [ʔ] when they are phrase-initial or in isolation, but not when phrase-medial. This means the underlying vowel-initial forms can be observed synchronically, when roots are in phrase-medial contexts.

5.2.2.1.2 [h]-epenthesis is conditioned by ejectives The base-level descriptive observation that Parker and Weber (1996:72) make is that: ‘Words containing glottalized stops always begin with a consonant. Whenever an ejective occurs in a reflex of a Proto-Quechua root that began with a vowel, in Cuzco Quechua the word begins instead with [h].’[4]

The epenthesis of [h] is illustrated by forms like those in (13): these roots were historically vowel-initial, but the modern surface forms systematically have an initial [h]. This is not the case for all historical vowel-initial roots, only those containing ejectives. Note also that Cuzco Quechua *does* have roots with non-epenthetic [h]; the examples below are forms where the [h] is known to be inserted on historical grounds.

(13) Historical evidence for epenthesis of [h] before V-initial roots with ejectives
a. /ajk’a/ → [hajk’a] ‘how many?’ (< PQ **ajka*) (Parker and Weber 1996)
b. /isp’a/ → [hisp’a] ‘urinate’ (< PQ **išpa*) (Parker and Weber 1996)
c. /asp’i/ → [hasp’i] ‘scratch the earth’ (< PQ **aspij*) (Mannheim 1991)
d. /amawt’a/ → [hamawt’a] ‘learned person’ (< PQ **amawta*) (Mannheim 1991)
e. /anuk’a/ → [hanuk’a] ‘to wean’ (cf. Ayac. *anuka*) (Parker 1969)[5]

[4] Unlike epenthesis of [ʔ], insertion of [h] is not limited to phrase-initial contexts (Parker and Weber 1996: 80). I will treat [h]-epenthesis as happening at the same level of analysis as insertion of [ʔ], following the same lines as previous work by Parker (1997) and others. This is not crucial to the analysis of the dissimilatory [ʔ]~[h] alternation.

[5] The comparable forms given by Parker (1969) are from Ayacucho Quechua; these provide evidence that the [h] in the Cuzco forms was not there historically.

f. /uk'utʃa/	→ [huk'utʃa]	'mouse'	(cf. Ayac. *ukuča*)	(Parker 1969)
g. /uq'u/	→ [huq'u]	'wet'	(cf. Ayac. *uqu*)	(Parker 1969)

Insertion of [h] is also found in vowel-initial Spanish loanwords that contain ejectives (14) (Carenko 1975:12; Parker and Weber 1996). This is significant because the Spanish source words are known to have initial vowels, irrespective of the history of Quechua. We can be certain that the initial [h]s in (14) were added in Cuzco Quechua, even without assuming anything about Proto-Quechua.

(14) [h]-epenthesis in vowel-initial Spanish borrowings with ejectives

a. /asut'i/	→ [hasut'i]	'whip'	(< Spanish *azote*)	(Parker and Weber 1996)
b. /atʃ'a/	→ [hatʃ'a]	'axe'	(< Spanish *hacha*)	(Parker and Weber 1996)

Variation provides evidence that the [h]-epenthesis pattern in modern Cuzco Quechua is synchronically active (Parker and Weber 1996:79). Some words have variation between ejectives and non-glottalized consonants; this ejective ~ non-ejective variation gives rise to predictable variation between initial [h] and [ʔ] (15). The epenthetic consonant is [h] only in the variants where the root has an ejective; in the forms with no ejectives, we find epenthetic [ʔ] instead of [h]. Thus, the quality of the epenthetic consonant alternates synchronically according to whether there is an ejective in the root, even in roots that vary between ejective and non-ejective forms. Since this is synchronic variation, it shows that the conditioning of the epenthetic consonant holds synchronically, not just as the remnant of a historical change.[6]

(15) Correlation between initial [h]-epenthesis and ejectives in synchronic variation

a. [haʎp'a]	~ [ʔaʎpa]	'dirt, ground, land'[7]	(Parker and Weber 1996)
b. [husut'a]	~ [ʔusuta]	'sandal (sp. type)'	(Parker and Weber 1996)
c. [hutʃ'uj]	~ [ʔutʃuj]	'small'	(Carenko 1975)
d. [hiʎap'a]	~ [ʔiʎapa]	'lightning'	(Carenko 1975)
e. [hirq'i]	~ [ʔirqi]	'child'	(Mannheim 1991)
f. [hatʃ'ij]	~ [ʔatʃʰiw]	'(to) sneeze'	(Mannheim 1991)

We can be certain that the [h]~[ʔ] variation in (15) is driven by the ejective ~ non-ejective variation, and not the other way around. The occurrence of [h] is

[6] The forms in (15) are variation within Cuzco Quechua, but see Carenko (1975: 11) for numerous examples of the same pattern in cross-dialectal variation; for example, Cuzco [hank'u] ~ Bolivian Quechua [anku] 'tendon'.

[7] Neither Carenko nor Parker and Weber include initial [ʔ] in their transcriptions of these forms, but their descriptions of the glottal stop's distribution unambiguously state that one is there.

not contingent on the presence of an ejective (Carenko 1975:11; Parker and Weber 1996:73). There are numerous words that have [h] and have no ejectives (16).

(16) Examples of [h] in roots with no ejectives

a. /hutʃa/	→ [hutʃa]	'guilt, sin'	(Parker and Weber 1996)
b. /huk/	→ [huχ]	'one'	(Rowe 1950)
c. /hatun/	→ [hatun]	'big, large'	(Carenko 1975)
d. /hiti/	→ [hiti]	'retreat'	(Carenko 1975)
e. /sehe/	→ [sehe]	'barn, grain loft'	(Parker and Weber 1996)
f. /muhu/	→ [muhu]	'seed'	(Parker and Weber 1996)

So, it is plainly not the case that [h] somehow causes a later consonant in the root to become an ejective. If it were, the form in (16a) would be [hutʃʼa] rather than the observed [hutʃa]. The distribution of [h] is not predictable *except* as dissimilatory selection of an epenthetic consonant. This means that the synchronic variation in (15) represents variation in the ejective, which in turn means that the dissimilatory [h]~[ʔ] alternation is enforced synchronically.

5.2.2.2 Static co-occurrence restrictions

Previous literature has identified static co-occurrence restrictions on ejectives and aspirates in Quechua (Mannheim 1991; Parker and Weber 1996; Parker 1997; MacEachern 1999; Gallagher 2011). These are summarized in (17). First, ejectives and aspirates may occur only once per root: no root may contain two ejectives (17a), or two aspirated consonants (17b). Additionally, [h] never occurs with aspirated consonants (17c). The co-occurrence of two [h]s is limited to only two, possibly onomatopoeic, examples (MacEachern 1999: 31). [ʔ] also may not co-occur with an ejective or another [ʔ], but these observations are somewhat trivial – they are entailed by [ʔ] arising only from root-initial epenthesis in roots with no ejectives.

It is also the case that roots may not contain both an ejective and an aspirated consonant (17d). As noted above, I make no attempt to explain this here. The focus of the analysis is on dissimilatory patterns like (17a–c); the ejective-aspirate ban (17d) is obviously not dissimilatory in nature, as ejectives and aspirates share no laryngeal features (though cf. Gallagher (2011) for a different view based on a feature [long VOT], posited to characterize aspirates and some ejectives). Note also that (17d) holds only for ejectives and aspirates: there is crucially not an absolute ban on [+s.g.]~[+c.g.] co-occurrence, because [h] is [+s.g.] and *does* co-occur with ejectives (which are [+c.g.]). The analysis also does not aim to explain the generalization that an ejective or aspirate is always the leftmost stop or affricate in a root (17e).

(17) Cuzco Quechua Co-occurrence restrictions:

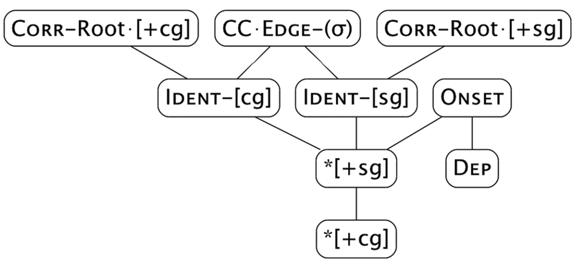
a. Only one ejective per word:	✓q'ata	*q'at'a, etc.
b. Only one aspirated stop:	✓q^{h}ata	*q^{h}at^{h}a, etc.
c. [h] and aspirates do not co-occur:	✓hapa	*hap^{h}a, etc.
d. No roots have C^{h} *and* C':	✓hap'a	*t^{h}ap'a, etc.
e. Plain stops never precede C' or C^{h}: (not targeted for explanation)	✓t'apa	*tap'a, etc.

These restrictions are observed as gaps in the lexicon. They are identified based on surveys of Quechua dictionaries conducted by previous authors (see Parker and Weber (1996) and MacEachern (1999) for dictionary citations).[8] All of the static restrictions in (17) hold at the level of the root: compounds may contain multiple ejectives or aspirates (one in each root) (Parker and Weber 1996: 74; MacEachern 1999: 32).

5.2.3 Analysis

The ranking obtained for the Quechua dissimilation patterns is repeated in (18) below. First, the formal definitions of these constraints are given in §5.2.3.1.

(18) Ranking for Cuzco Quechua: (repeated from (5) above)



Justification for the Cuzco Quechua ranking follows in the rest of this section, proceeding roughly from the bottom upwards, divided by the sub-systems within the ranking. Second, §5.2.3.2 presents the basis for the sub-ranking responsible for the default pattern of [ʔ]-epenthesis before initial vowels: this sub-system consists of Onset, Dep, *[+s.g.], *[+c.g.], and both Ident constraints. Third, §5.2.3.3 gives the support for the [ʔ]~[h] alternation, which

[8] The ban on roots with two ejectives (17a) is also evident in some borrowings from Aymara, e.g. Ay [p'amp'aj] > CQ [p'ampaj] 'to bury' (Mannheim 1991: 206). The 'leftmost' generalization (17e) may not hold in these loanwords: Mannheim notes a seventeenth-century source that gives both [p'ampa-] and [pamp'a-].

arises from the interaction of Corr-Root·[+c.g.] and CC·Edge-(σ) with the faithfulness constraints in the basic epenthesis sub-ranking. Finally, §5.2.3.4 shows how the ranking also explains the static co-occurrence restrictions.

5.2.3.1 Constraints

Three surface correspondence constraints come into play for Cuzco Quechua. The first two are members of the Corr family: one for [+constricted glottis] (19), and one for [+spread glottis] (20). Both Corr constraints have the root as their domain of scope, because the alternation happens within the root (and not in compounds, e.g.).

(19) Corr-Root·[+c.g.]: 'if two Cs in the same root are [+c.g.], then they correspond'.
For each distinct pair of output consonants X and Y, assign a violation if:
a. X and Y are both [+constricted glottis]
b. X and Y are in the same morphological root
c. X and Y are not in the same correspondence class

(20) Corr-Root·[+ s.g.]: 'if two [+s.g.] Cs are in the same root, then they correspond'.
For each distinct pair of output consonants X and Y, assign a violation if:
a. X and Y are both [+spread glottis]
b. X and Y are in the same morphological root
c. X and Y are not in the same correspondence class

The remaining surface correspondence constraint is the Limiter CC·Edge-(σ), repeated in (21). This constraint requires that correspondent consonants be in the same syllable. It assigns violations whenever a consonant in one syllable is in surface correspondence with a consonant in another syllable.

(21) CC·Edge-(σ): 'if two Cs correspond, they are contained in the same syllable'.
For each distinct pair of output consonants, X and Y, assign a violation if:
a. X and Y are in the same surface correspondence class
b. X is inside some syllable Σ_i
c. Y is not inside the syllable Σ_i

The role of the correspondence constraints in the analysis is to favor dissimilation by simultaneously requiring and prohibiting correspondence. Thus, the Corr constraints refer to the two laryngeal features involved in the dissimilation. The dissimilatory [ʔ]~[h] alternation is interpreted as the avoidance of penalized correspondence. The Limiter constraint CC·Edge-(σ) imposes this penalty by limiting correspondence to the confines of a domain, the syllable, which is always smaller than where dissimilation is evident. The result is that

CC·Edge-(σ) prohibits correspondence everywhere that dissimilation is evident in Cuzco Quechua.

The remaining constraints in the analysis are general markedness and faithfulness constraints. First, there are input–output faithfulness constraints of the Ident family; one each for [±constricted glottis] (22), and [±spread glottis] (23).

(22) Ident-[c.g.]: faithfulness for [±constricted glottis].
For each distinct pair of a consonant X in the input, and its correspondent X' in the output, assign a violation if:
a. X is [α constricted glottis]
b. X' is *not* [α constricted glottis]

(23) Ident-[s.g.]: faithfulness for [±spread glottis].
For each distinct pair of a consonant X in the input, and its correspondent X' in the output, assign a violation if:
a. X is [α spread glottis]
b. X' is *not* [α spread glottis]

Next, there are general markedness constraints, also one each for [+constricted glottis] and [+spread glottis]. The role these constraints play in the analysis is controlling the choice of the epenthetic consonant in contexts where dissimilation does not come into play.

(24) *[+s.g.]: 'No aspirates or [h]s'
Assign one violation for each segment in the output which is [+spread glottis]

(25) *[+c.g.]: 'No ejectives or [ʔ]s'
Assign one violation for each segment in the output which is [+constricted glottis]

Finally, there are two constraints responsible for the occurrence of epenthesis. The insertion of an epenthetic consonant before vowel-initial roots is the result of Onset (26) dominating Dep (27): onsets are required, at the cost of inserting an extra consonant (irrespective of which consonant it is).

(26) Onset: 'Have onsets'
Assign one violation for each syllable that does not have an onset

(27) Dep: 'Do not epenthesize'
Assign one violation for each segment in the output that does not have a correspondent in the input

5.2.3.2 Rankings for general [ʔ]-epenthesis

The general epenthesis of [ʔ] before vowel-initial roots does not involve the surface correspondence mechanism; it reflects the interaction of general

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markedness and faithfulness constraints. Because the surface correspondence constraints do not matter for the rankings presented in this section, they are omitted from the tableaux here, and surface correspondence structures are not shown (since they do not bear on these comparisons).

The tableau in (28) shows the input /asikuj/ 'to laugh' mapping to the output [ʔasikuj], with an epenthesized [ʔ]; this reveals two ranking arguments. First, ONSET must dominate DEP; this ranking is what causes epenthesis to occur (a vs. b). Second, *[+s.g.] must dominate *[+c.g.]; this is what favors [ʔ] as the default epenthetic segment rather than [h] (a vs. c). ONSET must also dominate *[+c.g.], since epenthesizing [ʔ] incurs an additional violation of *[+c.g.].

(28) Epenthesis of [ʔ] in onsetless syllables: ONSET»DEP; *[+s.g.]»*[+c.g.]

Input: asikuj Output: ʔasikuj		IDENT-[c.g.]	IDENT-[s.g.]	ONSET	DEP	*[+s.g.]	*[+c.g.]
☞ a.	ʔa.si.kuj	(0)	(0)	(0)	(1)	(0)	(1)
~ b.	a.si.kuj			W (0~1)	L (1~0)		L (1~0)
~ c.	ha.si.kuj					W (0~1)	L (1~0)

The constraints *[+c.g.] and *[+s.g.] that determine the quality of the epenthetic consonant in (28) are general markedness constraints which penalize all instances of [+constricted glottis] and [+spread glottis]. Since aspirated and ejective consonants are not forbidden altogether in Cuzco Quechua, these constraints are crucially dominated by faithfulness for these features. The rankings IDENT-[c.g.]»*[+c.g.] (29) and IDENT-[s.g.]»*[+s.g.] (30) are thus necessary. This explains why roots with an underlying ejective or aspirate emerge with that consonant intact, and instead of reducing it to a plain stop to satisfy *[+c.g.] or *[+s.g.]. The tableau in (29) shows faithful realization of ejectives in words like [naq'o] 'dented', and the one in (30) shows the same thing for aspirates in words like [leqʰe] 'rotten' (examples from Parker and Weber 1996: 73–74).

(29) [+c.g.] consonants (ejectives) are permitted in general: IDENT-[c.g.] » *[+c.g.]

Input: naq'o Output: naq'o		IDENT-[c.g.]	IDENT-[s.g.]	ONSET	DEP	*[+s.g.]	*[+c.g.]
☞ a.	na.q'o	(0)	(0)	(0)	(0)	(0)	(1)
~ b.	na.qo	W (0~1)					L (1~0)

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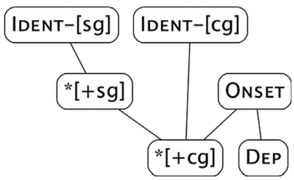
(30) [+s.g.] (aspirated) consonants are permitted in general: IDENT-[s.g.] » *[+s.g.]

Input: leq^he Output: leq^he		IDENT-[c.g.]	IDENT-[s.g.]	ONSET	DEP	*[+s.g.]	*[+c.g.]
☞ a.	$le.q^he$	(0)	(0)	(0)	(0)	(0)	(0)
~ b.	le.qe		W (0~1)			L (1~0)	

The partial ranking that explains the general epenthesis of [ʔ] is shown in (31). This ranking makes [ʔ] the preferred epenthetic consonant, and inserts it as needed to provide onsets. It also faithfully preserves underlying [+c.g.] or [+s.g.] segments.

(31) Recap: sub-ranking responsible for [ʔ]-epenthesis



5.2.3.3 Rankings for dissimilatory [h]-epenthesis

The basic generalization of dissimilatory [h]-epenthesis in Cuzco Quechua is that [h] gets epenthesized instead of [ʔ] if the root contains an ejective. In other words, the quality of the epenthetic consonant is determined by a restriction on the surface form of roots: a [+spread glottis] epenthet is chosen only when doing so avoids the co-occurrence of two [+constricted glottis] consonants, that is, [ʔ] and an ejective.

The dissimilatory [ʔ]~[h] alternation is understood, in the theory developed here, as happening because correspondence is required (by a CORR constraint), but also penalized (by a Limiter constraint). The relevant CORR constraint is CORR-Root·[+c.g.], which demands correspondence among [+c.g.] consonants in the same root. The relevant limiter constraint is CC·EDGE-(σ), which forbids correspondence across syllable edges.

The epenthesis of [h] in roots with ejectives is explained by the ranking CC·EDGE-(σ), CORR-Root·[+c.g.]»*[+s.g.]. This is shown in (32), with the input /ajk'a/ 'how many?' The winning candidate (a) has an initial epenthetic [h], and no correspondence between that [h] and the root-medial [k'].[9] This

[9] The alternative where epenthetic [h] does correspond with the [k'] is harmonically bounded; see (9).

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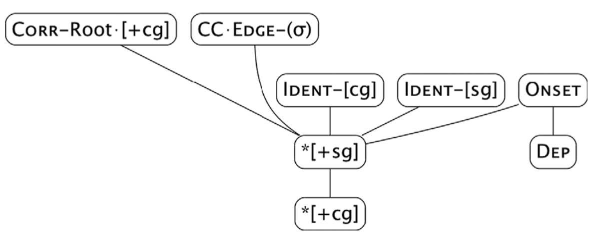
candidate is optimal because the alternatives with epenthetic [ʔ] are ruled out on grounds of correspondence. Corr-Root·[+c.g.] rules out the candidate where there is an epenthetic [ʔ] that does not correspond with the [k'] in the root (b); CC·Edge-(σ) rules out the alternative in (c), where there is correspondence between [ʔ] and [k'], because this correspondence crosses a syllable boundary. The remaining candidates in (d) and (e) show that Onset and Ident-[c.g.] must also dominate *[+s.g.]. The ranking Onset»*[+s.g.] forces epenthesis to happen even when the preferred epenthetic consonant, [ʔ], is not a viable option. It is why the dissimilatory prohibition against [ʔ. . .k'] sequences leads to epenthesis of a different segment, rather than non-epenthesis (d). The ranking Ident-[c.g.]»*[+s.g.] rules out the option of neutralizing the ejective in the root in order to have the preferred epenthetic consonant [ʔ] rather than [h], shown in (e).

(32) Dissimilatory epenthesis of [h] over [ʔ]: CC·Edge-(σ), Corr-Root·[+c.g.] » *[+s.g.]

Input: ajk'a Output: haj.k'a		CC·Edge-(σ)	Corr-Root·[+c.g.]	Ident-[c.g.]	Ident-[s.g.]	Onset	Dep	*[+s.g.]	*[+c.g.]
☞ a.	h$_1$aj$_2$.k'$_3$a $\mathcal{R}$: {h}{j}{k'}	(0)	(0)	(0)	(0)	(0)	(1)	(1)	(1)
~ b.	ʔ$_1$aj$_2$.k'$_3$a $\mathcal{R}$: {ʔ}{j}{k'}		W (0~1)				e$_{(1\sim1)}$	L (1~0)	W (1~2)
~ c.	ʔ$_1$aj$_2$.k'$_1$a $\mathcal{R}$: {ʔ k'}{j}	W (0~1)					e$_{(1\sim1)}$	L (1~0)	W (1~2)
~ d.	aj$_1$.k'$_2$a $\mathcal{R}$: {j}{k'}					W (0~1)	L (1~0)	L (1~0)	e$_{(1\sim1)}$
~ e.	ʔ$_1$aj$_2$.k$_3$a $\mathcal{R}$: {ʔ}{j}{k}			W (0~1)			e$_{(1\sim1)}$	L (1~0)	e$_{(1\sim1)}$

The ranking conditions developed so far are recapped in (33).

(33) Sub-ranking for [h]~[ʔ] in epenthesis



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This ranking explains the dissimilatory [h]~[ʔ] alternation as the result of a requirement that [+constricted glottis] consonants correspond, together with an impossibly narrow locality condition on that correspondence. Epenthesis of [ʔ] in roots with ejectives is forbidden because Cuzco Quechua demands that the [+constricted glottis] consonants in a root correspond with each other, but prohibits any correspondence across the edge of a syllable. Consequently, two [+c.g.] segments cannot co-occur in different syllables of the root.

This ban on [+c.g.] segments in different syllables interacts with the phonotactics of Cuzco Quechua to yield an absolute ban on the co-occurrence of [ʔ] and an ejective. Because ejectives occur only in onset positions, epenthesis of an initial [ʔ] (in any licit root that contains an ejective) would yield a pair of [+c.g.] consonants in different syllables, exactly the configuration that is disallowed. This requirement overrules the usual preferences for epenthetic consonants, leading to the dissimilatory choice of [h] instead of [ʔ] for epenthesis in those situations. This holds regardless of the distance between the two segments. Since ejectives cannot be codas, roots with the shape [VC'.CV(C)] are impossible: there is no way for a vowel-initial root to have an ejective in the first syllable. This means that epenthesis of an initial [ʔ] in any root with an ejective will always result in two [+c.g.] consonants that are in different syllables, so correspondence between them is always prohibited by CC·EDGE-(σ).

5.2.3.4 Rankings for static restrictions

In the ranking responsible for the dissimilatory [ʔ]~[h] epenthesis (33), the surface correspondence constraints are not crucially ranked with respect to the faithfulness constraints IDENT-[c.g.] and IDENT-[s.g.]. The static co-occurrence restrictions are explained by specifying the relative ranking of these two groups of constraints.

When the constraints on surface correspondence in (33) also dominate IDENT-[c.g.], the prohibition against multiple [+c.g.] consonants in (different syllables of) the root holds for underlying consonants, not just epenthetic ones. This is illustrated below with the hypothetical root /q'at'a/. This root represents one of the gaps in the Cuzco Quechua lexicon, since it has two ejectives. By hypothesis, and following Parker (1997), this input would surface with one ejective reduced to a plain stop, that is, as [q'ata]. This is explained by the ranking CC·EDGE-(σ), CORR-Root·[+c.g.]»IDENT-[c.g.], shown in (34). (NB: ONSET and DEP are omitted in this tableau, since they assign no violations for any of these candidates.)

(34) No co-occurrence of ejectives: CC·EDGE-(σ), CORR-Root·[+c.g.] » IDENT-[c.g.] » *[+c.g.]

Input: q'at'a Output: q'a.ta		CC·EDGE-(σ)	CORR-Root·[+c.g.]	IDENT-[c.g.]	IDENT-[s.g.]	*[+s.g.]	*[+c.g.]
☞ a.	$q'_1a.t_2a$ 𝓡: {q'}{t}	(0)	(0)	(1)	(0)	(0)	(1)
~ b.	$q'_1a.t'_1a$ 𝓡: {q' t'}	W (0~1)		L (1~0)			W (1~2)
~ c.	$q'_1a.t'_2a$ 𝓡: {q'}{t'}		W (0~1)	L (1~0)			W (1~2)

The interaction in this case is essentially the same as with the [ʔ]~[h] alternation shown in (32). The root contains two [+c.g.] segments, in different syllables; they are faced with a choice of correspondence or non-correspondence. The former violates CC·EDGE-(σ) (b), and the latter violates CORR-Root·[+c.g.] (c). When both these constraints dominate IDENT-[c.g.], dissimilation of one ejective (a) is favored, in the same way that [h] is favored over [ʔ] in the epenthesis case.

A similar analysis explains the non-co-occurrence of multiple aspirated stops, and of aspirated stops with [h]. This is shown below: the hypothetical root /q^hat^ha/, with two [+s.g.] consonants, maps to the output form [$q^ha.ta$], with only one aspirate preserved. In this case, the correspondence operates over the [+s.g.] consonants rather than the [+c.g.] ones. Consequently, the relevant CORR constraint is CORR-Root·[+s.g.] instead of CORR-Root·[+c.g.]; the relevant limiter constraint CC·EDGE-(σ) remains the same. The tableau in (35) below shows how dissimilation of one aspirate to a plain stop arises from CC·EDGE-(σ) and CORR-Root·[+s.g.] dominating IDENT-[s.g.] – parallel to IDENT-[c.g.] as above (34).

(35) No co-occurrence of aspirates: CC·EDGE-(σ), CORR-Root·[+s.g.] » IDENT-[s.g.] » *[+s.g.]

Input: q^hat^ha Output: $q^ha.ta$		CC·EDGE-(σ)	CORR-Root·[+c.g.]	CORR-Root·[+s.g.]	IDENT-[c.g.]	IDENT-[s.g.]	*[+s.g.]	*[+c.g.]
☞ a.	$q^h{}_1a.t_2a$ 𝓡: {q^h}{t}	(0)	(0)	(0)	(0)	(1)	(1)	(0)
~ b.	$q^h{}_1a.t^h{}_1a$ 𝓡: {q^h t^h}	W (0~1)				L (1~0)	W (1~2)	
~ c.	$q^h{}_1a.t^h{}_2a$ 𝓡: {q^h}{t^h}			W (0~1)		L (1~0)	W (1~2)	

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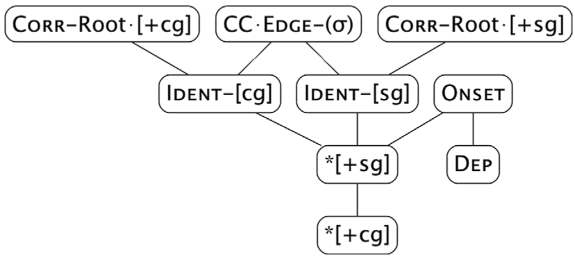
This ranking also explains the non-co-occurrence of [h] with aspirates, noted in (17c). Like the aspirated consonants, [h] is [+spread glottis], so this ranking treats them the same way. A root containing /h/ and an aspirate (e.g. a hypothetical form like /hap^{h}a/) is therefore subjected to neutralization exactly as in (35).[10]

Incorporating this ranking condition with those motivated above yields the full ranking obtained under the analysis proposed here, repeated below for reference.

(36) Full ranking conditions for Cuzco Quechua: (repeated from (18) above)



5.2.4 Quechua: summary and conclusions

The analysis proposed in this section shows that the dissimilatory alternation of [h] and [ʔ] in Cuzco Quechua is explained by the mechanism of surface correspondence. Key to the explanation is a requirement, imposed by Corr-Root·[+c.g.], for correspondence among any and all [+constricted glottis] consonants in a root. The limiter constraint CC·Edge-(σ) requires that correspondents be in the same syllable. This favors dissimilation for any pair of [+c.g.] consonants in different syllables, which is responsible for both the dissimilatory [ʔ]~[h] alternation seen in epenthesis and the static ban on roots with two or more ejectives. The prohibition against roots with multiple [+spread glottis] consonants is explained in a parallel way by CC·Edge-(σ) and Corr-Root·[+s.g.].

The syllable-based characterization derived here is absolutely sufficient to explain the dissimilation patterns observed in Cuzco Quechua. This language bans ejectives and [ʔ]s in coda positions, for reasons independent of dissimilation. As such, the dissimilatory effects are only really supported in the data

[10] The ranking also predicts, redundantly, that roots with aspirated consonants should epenthesize [ʔ], not [h].

for consonants in different syllables. An input like /t'ak'/, with two ejectives in the onset and coda of a single syllable, would reduce to [t'ak] anyway, irrespective of its potential surface correspondence structure. The analysis does not *need* to produce dissimilation for onset-coda pairs, since dissimilation in this situation is not evident from the facts.

The analysis of the Cuzco Quechua dissimilation pattern illustrates an important point about the generalizability of the SCTD: it can produce dissimilation that appears to hold in a context-blind 'across the board' fashion. Previous treatments of Cuzco Quechua have relied on OCP constraints that prohibit any co-occurrence of ejectives and/or aspirates, irrespective of their position (Parker 1997; Gallagher 2011; among others). No constraint in the surface correspondence theory has this character. The CC·Limiter constraints developed in Chapter 2 only penalize correspondence in specified situations; there are no genuine anti-correspondence constraints like '*CORR', and no anti-similarity constraints (cf. *S-IDENT of Krämer 1998, 1999). Nonetheless, the SCTD can derive dissimilation of this sort. If the conditions imposed on correspondence are impossibly severe, or contradictory, the effect is a blanket prohibition of correspondence. In the case of Quechua, CC·EDGE-(σ) permits correspondence only in circumstances where ejectives are disallowed by the basic syllable phonotactics of the language. A similar effect results from combining CC·EDGE-(σ) with CC·SROLE: one allows correspondence only within the syllable, and the other allows correspondence *except* among different parts of a syllable. It is impossible for two different consonants to have the same syllable role without being in different syllables, so together these constraints effectively ban correspondence altogether. Explaining 'indiscriminate' dissimilation does not require an indiscriminate anti-similarity constraint.

The analysis of Cuzco Quechua illustrates another noteworthy point about the surface correspondence theory: dissimilation is not contingent on consonant harmony. The Sundanese and Kinyarwanda cases analyzed in preceding chapters happen to have both harmony and dissimilation, and we can see them dovetailing. But this is just one possible outcome. The analysis of Cuzco Quechua dissimilation does not presume that the language has any kind of consonant harmony.[11] The SCTD is not just about the relationship between harmony and dissimilation; it is a theory of dissimilation in general.

[11] Though see Hansson (2010), Mannheim (1991) for evidence of harmony in Quechua.

5.3 CC·EDGE-(σ) in harmony: Obolo

Obolo exhibits a static pattern of nasal agreement between nasals and stops in the same syllable: if a CVC syllable has a nasal onset, the coda must be nasal as well (Faraclas 1984; Rowland-Oke 2003). Thus, Obolo has CVC syllables with all combinations of nasal vs. oral consonants, except for those that combine a nasal onset with an oral coda. This is illustrated below (examples from Faraclas 1984).

(37) Obolo CVC syllable inventory (T = oral consonant, N = nasal consonant)

	Oral coda	Nasal coda
Oral onset	✓ $[TVT]_\sigma$	✓ $[TVN]_\sigma$
Nasal onset	* **[NVT]**$_\sigma$	✓ $[NVN]_\sigma$

(38) Licit CVC syllables in Obolo
a. ✓$[TVT]_\sigma$ fùk 'read'
b. ✓$[TVN]_\sigma$ bén 'carry'
c. ✓$[NVN]_\sigma$ ɲám 'sell'

(39) Impossible CVC syllables
*$[NVT]_\sigma$ *nap (unattested)

The Obolo pattern is analyzed as the result of CC·EDGE-(σ) operating as a limiter constraint in harmony. The ban on NVT syllables is interpreted as a consequence of nasal agreement: [NVT] syllables are absent on the surface because the language maps problematic /NVT/ inputs to agreeing [NVN] syllables. The reason this harmony is strictly syllable-internal is because agreement is required only between correspondents, and CC·EDGE-(σ) prohibits consonants in different syllables from corresponding with each other.

5.3.1 The theory, as applied to Obolo

5.3.1.1 The nasal agreement generalization and supporting facts

The central generalization about nasal agreement was initially observed by Faraclas, who characterized it (40) in terms of a dependency between consonants in onset and coda positions. A later and more extensive grammar of Obolo also describes CVC syllables as having exactly this restriction (Rowland-Oke 2003: 38).

(40) 'If the initial consonant is a nasal consonant, the final consonant must also be nasal' (Faraclas 1984: xvi).

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Codas in Obolo are always non-continuant: the only consonants allowed in coda positions are the voiceless stops [p t k] and the nasals [m n ŋ].[12] Syllables are maximally CVːC in size, and minimally V or N̩. Consonant clusters do not occur in codas, and onset clusters are limited to the sequences Cw, Cj, Cr. The full consonant inventory is given in (41). Consonants in parentheses are marginal.[13]

(41) Obolo consonant inventory (following Rowland-Oke 2003: 22)

	Labial and labio-velar	Alveolar	Palatal	Velar	Glottal
Stop	p b k͡p g͡b	t d	c ɟ	k g kʷ gʷ	(ʔ)
Fricative	f	s (z)			(h)
Nasal	m	n	ɲ	ŋ ŋʷ	
Approximant		l r	j	w	

Obolo admits syllables with nasal onsets (42), and syllables with oral codas (43). But, there are no syllables that have both a nasal onset and a nasal coda: the syllables in (44) may not occur.

(42) Syllables with a nasal onset: ✓[NV…]σ
a. má ‘like’
b. nɔ́ ‘hear’
c. ɲí ‘give’
d. mɔ̀.ŋɔ̀ ‘take’

(43) Syllables with an oral coda: ✓[…T]σ
a. lép ‘buy’
b. tʃít ‘close’
c. bóːk ‘be wide open’

(44) Gap: syllables with nasal onset and oral coda: *[NVT]σ
a. *map, *mat, *mak
b. *nap, *nat, *nak
c. *ɲap, *ɲat, *ɲak
d. *ŋap, *ŋat, *ŋak

[12] Rowland-Oke (2003: 30) notes that some ideophones have final [s] and [j], but these never occur in codas in the regular lexicon. Both Faraclas and Rowland-Oke also note that CVːC syllables, with a long vowel, can only have [k ŋ] as the coda.

[13] [h] occurs only as a variant of /s/, [z] is a variant of [ɟ], and [ʔ] is a variant of [k] (Rowland-Oke 2003:22; Faraclas 1984:xv).

The disagreeing NVT syllables in (44) are the only prohibited combination. If a closed syllable has a nasal onset, then its coda must also be nasal. This dependency only goes in one direction though. The nasality of the onset does not depend on the nasality of the coda: if the coda is nasal, then the onset can be nasal (45) or non-nasal (46).

(45) Syllables with nasal onset and nasal coda: ✓[NVN]σ

a.	ímɔ̂m	'laugh'
b.	íŋʷɔ̂m	'nose'
c.	mǎn	'birth'
d.	nán	'be rare'
e.	níŋ	'extinguish'
f.	ɲɔ̌ːŋ	'crawl'

(46) Syllables with oral onset and nasal coda: ✓[TVN]σ

a.	bén	'carry'
b.	róm	'make a charm'
c.	tʃím	'sew'
d.	gʷén	'call'
e.	kán	'be ripe'
f.	lǎːŋ	'rinse'
g.	fìːŋ	'last (in time)'
h.	gbáŋ	'listen'

Obolo nasal agreement is syllable-bounded: no nasal agreement is enforced between consonants in different syllables. This is shown in (47) (examples from Faraclas 1984): disagreeing sequences like [...NVT...] *do* occur in the language, *if* the nasal and oral consonant are in different syllables. The two consonants are not required to agree for nasality in this situation, because they are not in the same syllable.

(47) Nasal agreement does not hold across the edge of a syllable

a.	tú.mù.kâ	'instead of'	(*tu.**m**u.**ŋ**a, *tu.**b**u.ka)
b.	nì.ná.lék	'complain'	(*ni.**n**a.**n**ek, *ni.**l**a.**l**ek)
c.	mâ-sì	'1.sg.fut + go'	(***m**a.**n**i, ***b**a.**s**i)
d.	í.mù.mè.tʃjèŋ	'love'	(*i.mu.**me**.**ɲ**jeŋ)
e.	ú.má.nè.bót	'she-goat'	(*u.ma.**ne**.**m**ot)
f.	à.náǹ.ɟìn	'fly'	(*a.nan.**ɲ**in)
g.	ŋ̍.tɔ́ŋ	'ash'	(***ŋ̩**.**n**ɔŋ)
h.	ì.ɲàǹ.tɔ́t	'species of fruit'	(*i.**ɲan**.**nɔn**)
i.	ɔ̀.fɔ́ǹ.tì	'clothing'	(*ɔ.fɔ**r**.**t**i)

Though there are no observable alternations that show nasal agreement happening, the *[NVT]$_\sigma$ generalization is quite robust. In my search of Faraclas's (1984) grammar, I found no exceptions or counter-examples. Faraclas

(1982) observes a number of morpheme-boundary processes which can alter syllabification and/or nasality (such as vowel deletion, metathesis, and consonant alternations), but his data include no examples of these processes deriving a disharmonic [NVT] syllable. I also found no counter-examples in my examination of the data from other sources on Obolo (Rowland-Oke 2003; Aaron 1996/1997a, 1996/1997b).

Obolo nasal agreement is based on a dependency between non-adjacent consonants; agreement between an onset and a coda is not mediated by the vowel that intervenes between them. Both Faraclas (1984) and Rowland-Oke (2003) note that vowels are nasalized when they precede a nasal consonant; neither reports nasalization of a vowel when it follows a nasal consonant. Thus, Faraclas (1982) gives the narrow transcription of /ámà + î-wa/ 'many towns' as [ã́mêwà], not *[ãmẽwa]: the vowel preceding [m] is nasalized, but the vowel after it is not. Similarly, the surface form of /î-dʒɔ̀ŋɔ + érè/ 'it is far away' is given as [îdʒɔ̃̀ŋɔ́rè], not *[idʒɔ̃ŋɔ̃re]. These facts support treating the nasal agreement as a long-distance consonant-to-consonant interaction. The generalization cannot be characterized as [+nasal] spreading locally from one consonant to the adjacent vowel, and then subsequently from the vowel to the following consonant.

5.3.1.2 Surface correspondence interpretation of the pattern

The input–output mappings posited in the analysis of Obolo are given in the table in (48). Representative examples are from Faraclas (1984); tones are omitted for typographical simplicity.

(48) Obolo input–output mappings
(T used for oral consonants, N for nasal ones)

<table>
<tr><th></th><th>Input</th><th colspan="2">Output, SCorr classes</th><th>Remarks</th></tr>
<tr><td>a.</td><td>/NVT/
nap (hypothetical)</td><td>[NVN],
[nam],</td><td>{N N}
{n m}</td><td>Disagreeing NVT syllables are forced to harmonize (to NVN)</td></tr>
<tr><td>b.</td><td>/NVTV/
tumuka 'instead of'</td><td>[NV.TV],
[tu.mu.ka],</td><td>{N}{T}
{t}{m}{k}</td><td>Across syllable edges there is no correspondence, no agreement</td></tr>
<tr><td>c.</td><td>/TVN/
ben 'carry'</td><td>[TVN],
[ban],</td><td>{T N}
{b n}</td><td>Disagreeing TVN syllables have correspondence, no agreement</td></tr>
<tr><td>d.</td><td>/TVT/
lep 'buy'</td><td>[TVT],
[lep],</td><td>{T T}
{l p}</td><td rowspan="2">Agreeing syllables surface faithfully, with correspondence</td></tr>
<tr><td>e.</td><td>/NVN/
man 'birth'</td><td>[NVN],
[man],</td><td>{N N}
{m n}</td></tr>
</table>

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The lack of [NVT] syllables in Obolo is interpreted as a consequence of nasal harmony: syllables with nasal onsets and oral codas do not occur because they are forced to agree. This agreement is obtained by picking the [+nasal] value, like in other well-known cases of nasal harmony (e.g. Kikongo and Ndonga, as noted in Chapter 2; see also Rose and Walker 2004; Hansson 2001/2010). Thus, an NVT input like /nap/ (a) surfaces as [nam], with the oral coda assimilating to the nasality of the onset.[14]

The syllable-bounding effect is illustrated by the input in (b): agreement does not happen across syllable edges. Thus, when the consonants of a disagreeing /…NVT…/ sequence are parsed into different syllables, they surface faithfully as in /tumuka/→[tu.mu.ka] 'instead of'.

The input /TVN/ in (c) is a disharmonic syllable with an oral onset and a nasal coda; [TVN] syllables like this are permitted (see examples in (46) above). Since these disagreeing syllables surface faithfully, the correspondence structure cannot be fully determined from the data – correspondence structures are evidenced only by the changes that happen based on them. Thus, a faithful output like [ben] 'carry' could have [b]~[n] correspondence and tolerate disagreement, or it could tolerate non-correspondence (in which case disagreement is moot). For concreteness, I assume the former, though this is not crucial; see §5.3.2.3 for discussion.

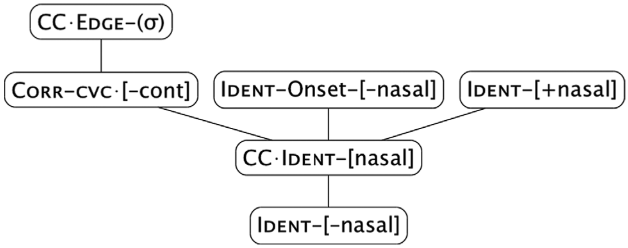
The inputs /TVT/ (d) and /NVN/ (e) have onsets and codas that agree in the input; both surface faithfully. The correspondence structure in these cases is determined by applying the theory to the data. Since the Cs in these forms agree and occur in the same syllable, none of the constraints in this analysis penalize correspondence between them: there is no reason for them not to correspond.

5.3.1.3 Ranking

The ranking obtained for Obolo is given in (49). (Formal definitions of the constraints are supplied in §5.3.1.4 for reference.)

[14] There is an alternative possibility worth noting: agreement could be achieved by picking the [–nasal] value, and mapping problematic NVT inputs to [TVT] – that is, /nap/→[tap]. This is a matter of how the agreement is resolved, an issue distinct from the agreement requirement itself. How agreement is resolved depends crucially on the relative ranking of faithfulness constraints. Under the ranking conditions necessary for faithfulness in /TVN/ inputs, /NVT/ must map to [NVN]. See §5.3.2.3 for further explanation.

(49) Ranking for Obolo



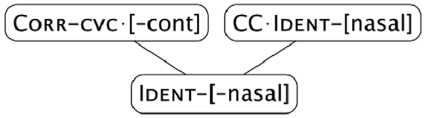
The Obolo ranking breaks down into three essential components (50). The basic pattern of nasal agreement is a standard Agreement By Correspondence interaction: agreement is mandated in CVC sequences by the ranking of Corr-cvc·[–continuant] and CC·Ident-[nasal] over (IO)·Ident-[–nasal] (50a). Codas in Obolo are always nasals or stops, so Corr-cvc·[–continuant] effectively requires correspondence between the onset and coda of any syllable with the shape NVT. This correspondence is the basis for nasal agreement, required by the constraint CC·Ident-[nasal].

The syllable-bounding behavior comes from CC·Edge-(σ) limiting the basic agreement system, by dominating the Corr constraint (50b). No agreement holds for CVC sequences that span syllable edges, because correspondence in this circumstance is prohibited by CC·Edge-(σ), which dominates Corr-cvc·[–continuant]. The effect of this ranking is that non-continuants are required to correspond, as long as this does not create a situation where two correspondents are in different syllables.

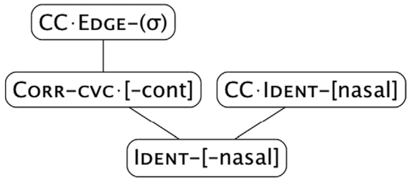
Finally, the ranking of the three I–O faithfulness constraints (50c) is what determines the directionality of the agreement. These constraints split faithfulness for nasality into faithfulness for specific values, Ident-[–nasal] and Ident-[+nasal]. The relative ranking of these split-value constraints leads to a value-dominance interaction. The relative ranking of Ident-[–nasal] and its positional cousin Ident-Onset-[–nasal] also leads to a position-control effect. Because Ident-Onset-[–nasal] and Ident-[+nasal] dominate CC·Ident-[nasal], assimilation only changes non-nasal codas to match nasal onsets; this is why [NVT] syllables are forced to assimilate to [NVN], but [TVN] syllables surface faithfully (see §5.3.2.3 for further discussion of the directionality issue).

(50) Obolo ranking decomposed into sub-systems

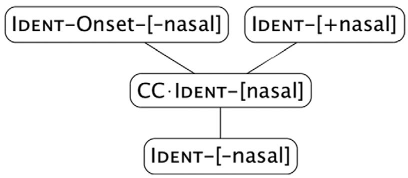
a. Basic nasal agreement: Corr, CC·Ident » Ident



b. Syllable-bounding: CC·Edge-(σ) imposes a limit on the agreement sub-system



c. Directionality: Ident-Onset-[–nasal], Ident-[+nasal] » CC·Ident-[nasal]



5.3.1.4 Constraints

The constraint responsible for demanding correspondence in Obolo is Corr-cvc·[–continuant] (51). It requires correspondence between non-continuants – that is, stops and nasals – when they occur in a CVC configuration.

(51) Corr-cvc·[–continuant]: ‘if two non-continuants are in a CVC domain, they correspond’.
For each distinct pair of output consonants, X and Y, assign a violation if:
a. X and Y are in the configuration . . .CVC. . .
b. X and Y both have the feature specification [–continuant]
c. X and Y are not in the same surface correspondence class

Since Obolo allows only stops and nasals in coda positions, any licit CVC syllable in the language must have a non-continuant coda. As such, this constraint effectively requires correspondence between the onset and coda of all possible syllables where the agreement pattern is observed.

Agreement among correspondents is enforced by CC·Ident-[nasal] (52). Correspondence between a nasal and a non-nasal violates this constraint; it is satisfied only when both correspondents are [+nasal], or when both are [–nasal].

(52) CC·IDENT-[nasal]: ‘if two consonants correspond, then they agree for [±nasal]’.
For each distinct pair of output consonants, X and Y, assign a violation if:
a. X and Y are in the same surface correspondence class
b. X and Y have different specifications for [±nasal]

Together, CORR-CVC·[–continuant] and CC·IDENT-[nasal] favor nasal agreement for non-continuants in any CVC sequence. The role of CC·EDGE-(σ) in the analysis is to restrict the extent of this agreement. By limiting correspondence to syllable-internal pairs of consonants, CC·EDGE-(σ) allows nasal harmony to hold within syllables, but not across syllable edges. (The definition is repeated below for reference.)

(53) CC·EDGE-(σ): ‘if two Cs correspond, then they are contained in the same syllable’.
For each distinct pair of output consonants, X and Y, assign a violation if:
a. X and Y are in the same surface correspondence class
b. X is inside some syllable Σ_i
c. Y is not inside the syllable Σ_i

The remaining constraints are normal members of the IDENT family of input–output faithfulness constraints. These general IDENT constraints penalize deviation from the underlying [±nasal] specification of a segment. Following Pater (1999), IDENT is split into different constraints for each value of the feature [±nasal]. IDENT-[+nasal] penalizes mapping a nasal to a non-nasal (de-nasalization); IDENT-[–nasal] penalizes mapping a non-nasal to a nasal (nasalization). The relative ranking of these constraints affects which value of [±nasal] is picked in assimilation.

(54) IDENT-[+nasal]: ‘do not change from [+nasal] to [–nasal]’.
For each distinct pair of one output segment X, and its input correspondent X’, assign a violation if:
a. X’ is [+nasal]
b. X is [–nasal]

(55) IDENT-[–nasal]: ‘do not change from [–nasal] to [+nasal]’.
For each distinct pair of one output segment X, and its input correspondent X’, assign a violation if:
a. X’ is [–nasal]
b. X is [+nasal]

The Obolo pattern has an asymmetry between two types of disharmonic syllables: NVT syllables are prohibited, while TVN syllables are allowed. This is explained by the constraint IDENT-Onset-[–nasal], a positional variant of IDENT-[–nasal] (Beckman 1998).

(56) Ident-Onset-[–nasal]: 'do not change onsets from [–nasal] to [+nasal]'.
For each distinct pair of one output segment X, and its input correspondent X', assign a violation if:
a. X is the onset of some syllable
b. X' is [–nasal]
c. X is [+nasal]

Nasal disagreement is tolerated in TVN syllables because nasalizing the onset (i.e. mapping /TVN/ to [NVN]) violates Ident-Onset-[–nasal]. By contrast, mapping an input /NVT/ sequence to [NVN] (nasalizing a coda to avoid an NVT syllable) incurs no violation of this constraint.[15]

5.3.2 Analysis: how the ranking derives the Obolo pattern

5.3.2.1 Requiring nasal agreement

Nasal agreement is mandated by the ranking of CC·Ident-[nasal] and Corr-cvc·[–continuant] over faithfulness for nasality. This is shown in the tableau below. The hypothetical input /nap/ has two [–continuant] consonants that disagree for nasality; Corr-cvc·[–continuant] and CC·Ident-[nasal] conspire to favor an agreeing form like candidate (a) over the fully faithful – and disagreeing – alternatives in (b) and (c).

(57) Agreement in CVC sequences:
Corr-cvc·[–continuant], CC·Ident-[nasal] » Ident-[–nasal]

Input: nap Output: nam, *nap		Corr-cvc· [–continuant]	CC·Ident- [nasal]	Ident- [–nasal]
☞ a.	[nam], $\mathcal{R}$: {n m}	(0)	(0)	(1)
~ b.	[nap], $\mathcal{R}$: {n}{p}	W (0~1)		L (1~0)
~ c.	[nap], $\mathcal{R}$: {n p}		W (0~1)	L (1~0)
(☞?) d.	[tap], $\mathcal{R}$: {t p}			L (1~0)

Note that the need for nasal agreement entails nothing about how that agreement is achieved; this is illustrated by candidate (d), which satisfies both Corr-cvc·[–continuant] and CC·Ident-[nasal] equally as well as the winner

[15] We can imagine a parallel constraint, Ident-Onset-[+nasal], the equivalent positional relative of Ident-[+nasal] in (54), but it is not needed for the analysis; its effects are eclipsed by its non-positional counterpart Ident-[+nasal].

in (a). The point here is that when these two surface correspondence constraints dominate faithfulness for nasality, the result is a grammar that prefers nasal agreement over faithful preservation of a disharmonic syllable.

In the absence of visible alternations, we cannot determine from just the Obolo data exactly how the grammar 'repairs' unacceptable NVT syllables like /nap/. The agreeing candidates (a) and (d) are equally acceptable on this sub-ranking, and both are preferable to allowing /nap/ to surface with disagreement. The choice between them comes down to the relative ranking of faithfulness constraints, considered in §5.3.2.3; (a) wins over (d) because of IDENT-[+nasal], not shown here because it is not crucially dominated by the surface correspondence constraints.

5.3.2.2 Syllable-bounding

Obolo's nasal agreement is syllable-bounded: agreement is only required if two consonants occur within the same syllable. This restriction is an effect of the ranking CC·EDGE-(σ) » CORR-CVC·[–continuant]; this is shown below with an input /muka/, representing the NVT sequence of the word [túmùkâ] 'instead of' (48b).[16]

(58) Agreement is confined within the syllable:
CC·EDGE-(σ) » CORR-CVC·[–continuant]

Input: . . .muka Output: . . .mu.ka		CC· EDGE-(σ)	CORR-CVC· [–continuant]	CC·IDENT- [nasal]	IDENT- [–nasal]
☞ a.	[mu.ka], ℛ: {m}{k}	(0)	(1)	(0)	(0)
~ b.	[bu.ka], ℛ: {b k}	W (0~1)	L (1~0)		
~ c.	[mu.ŋa], ℛ: {m ŋ}	W (0~1)	L (1~0)		W (0~1)
~ d.	[mu.ka], ℛ: {m k}	W (0~1)	L (1~0)	W (0~1)	

The optimal candidate in (a) is the faithful output which partitions the two consonants into different surface correspondence classes. This non-correspondence incurs a violation of CORR-CVC·[–continuant], but it satisfies

[16] CC·EDGE-(σ) can also drive dissimilation, as in Quechua in §5.2. Dissimilating candidates are omitted here for simplicity; this is logically equivalent to adding an undominated faithfulness constraint IDENT-[–continuant] to the ranking in (49).

CC·Edge-(σ) because no consonant corresponds with one in another syllable. Non-correspondence between [m] and [k] also satisfies CC·Ident-[nasal], because the disagreeing consonants are not in the same correspondence class. The alternative candidates (b), (c), and (d) are ruled out by undominated CC·Edge-(σ): all of them involve a correspondence structure where one class contains two consonants in different syllables.

5.3.2.3 Resolving nasal agreement

Two final issues still require explanation: the treatment of TVN syllables, and the directionality of the agreement. These two issues amount to a question of how the requirement for nasal agreement gets resolved – determined by how the sub-system that requires agreement interacts with other faithfulness constraints.

Obolo allows syllables of the shape [TVN]; nasality disagreement is tolerated within a syllable, *if* the onset is [–nasal] and the coda is [+nasal]. This is explained by a combination of two faithfulness constraints: the general Ident-[+nasal], and the positional Ident-Onset-[–nasal]. Both of these constraints crucially dominate CC·Ident-[nasal] (59).

(59) TVN syllables are allowed: Ident-Onset-[–nasal], Ident-[+nasal] » CC·Ident-[nasal]

Input: ben Output: ben		Ident-Onset-[–nasal]	Ident-[+nasal]	Corr-cvc·[–continuant]	CC·Ident-[nasal]	Ident-[–nasal]
☞ a.	[**ben**], $\mathcal{R}$: **{b n}**	(0)	(0)	(0)	(1)	(0)
~ b.	[**m**en], $\mathcal{R}$: **{m n}**	W (0~1)			L (1~0)	W (0~1)
~ c.	[be**t**], $\mathcal{R}$: **{b t}**		W (0~1)		L (1~0)	
~ d.	[**ben**], $\mathcal{R}$: **{b}{n}**			W (0~1)	L (1~0)	

The word [ben] 'carry' is allowed to surface faithfully, even though it is a syllable where the onset and coda fail to agree for nasality. The faithfulness constraints Ident-[+nasal] and Ident-Onset-[–nasal] ensure this faithfulness – and therefore disagreement – because they rule out the agreeing candidates (b) and (c). Candidate (b) maps /ben/ to an NVN syllable; it loses because mapping of /b/ to [m] violates Ident-Onset-[–nasal]. The other

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harmonized candidate (c) maps /ben/ to a CVC syllable; it loses because mapping /n/ to [t] violates IDENT-[+nasal].[17]

The nasal disagreement in [ben] necessarily violates either CORR-CVC·[–continuant] or CC·IDENT-[nasal], depending on whether the [b] and [n] are in correspondence or not. This is reflected by the two faithful candidates in (a) and (d). The choice between them depends on the relative ranking of CORR-CVC·[–continuant] and CC·IDENT-[nasal]; the faithful and correspondent candidate (a) wins under the ranking CORR-CVC·[–continuant] » CC·IDENT-[nasal].

The relative ranking of faithfulness constraints also determines the 'featural direction' of agreement – why agreement works by picking the value [+nasal] instead of [–nasal]. The faithful mapping of TVN inputs requires the ranking IDENT-[+nasal] » CC·IDENT-[nasal], shown in (59) above. Since the basic agreement sub-ranking requires CC·IDENT-[–nasal] » IDENT-[–nasal] (57), this entails IDENT-[+nasal] » IDENT-[–nasal]. This ranking makes the banned /NVT/ inputs map to [NVN] rather than [CVC]: it leads to nasal agreement being achieved by nasalization, rather than de-nasalization. This is shown in (60).

(60) IDENT-[+nasal] » IDENT-[–nasal] means assimilation to nasal, not oral

Input: nap Output: nam		IDENT-Onset-[–nasal]	IDENT-[+nasal]	CORR-CVC·[–continuant]	CC·IDENT-[nasal]	IDENT-[–nasal]
☞ a.	[na**m**], $\mathcal{R}$: {**n m**}	(0)	(0)	(0)	(0)	(1)
~ b.	[**t**ap], $\mathcal{R}$: {**t p**}	W (0~1)	W (0~1)			L (1~0)
~ c.	[nap], $\mathcal{R}$: {n}{p}			W (0~1)		L (1~0)
~ d.	[nap], $\mathcal{R}$: {n p}				W (0~1)	L (1~0)

The ranking of IDENT-[+nasal] removes the indeterminacy between the two agreeing candidates seen earlier in (57). The fully nasal agreeing candidate

[17] This interaction is analogous to 'control' phenomena in other kinds of agreement (Baković 2000; see also Lombardi 1999; Hansson 2001/2010). In Obolo, nasal agreement is 'controlled' by consonants in onset positions. Onsets never undergo assimilation, but they can 'trigger' assimilation in a coda, e.g. in /nap/ → [nam].

in (a) is better on IDENT-[+nasal] than the oral agreement alternative in (b). This mapping is not crucial to explain the Obolo agreement generalization, but it follows automatically from the analysis of faithfulness in TVN syllables.

The result of the IDENT-[+nasal] » IDENT-[–nasal] ranking is that Obolo is effectively a dominant-recessive agreement system (in the sense of Baković 2000), with [+nasal] as the dominant value. Thus, agreement operates by choosing the [+nasal] value when it is present, and assimilating [–nasal] consonants to match. This derives a system where harmony is strictly left to right, but in an epiphenomenal way: it is a consequence of harmony picking [+nasal] as the output value, and onsets being invariably faithful – not the result of any directional sensitivity in the correspondence mechanism itself.

One final matter is the status of TVN syllables which have a non-continuant onset, such as [fiːŋ] 'last (in time)' (46g). In this situation, correspondence between the onset and coda is not required: CORR-CVC·[–continuant] only penalizes non-continuants that fail to correspond; it does not require the [–continuant] [ŋ] to correspond with the [+continuant] [f]. Syllables with continuant onsets therefore surface faithfully, violating neither CORR-CVC·[–continuant] nor CC·IDENT-[nasal] in the process. This is fully in accordance with the data: the generalization is that agreement is only necessary when the onset is a nasal (not the coda).

5.3.3 Obolo: summary and conclusions

Obolo exhibits static nasal agreement between the onset and coda of a syllable. This pattern is *not* a strictly local interaction: it cannot be explained by local spreading alone, without a non-linear, consonant-to-consonant relation like surface correspondence. This is because the vowel nasalization facts reported by Faraclas (1982, 1984) indicate that nasality does not 'spread' from a consonant to a following vowel without another consonant after it: the consonant-to-consonant interaction is crucial for the correct characterization of the pattern. Understood in this way, it can be explained as Agreement by Correspondence.

The syllable-bounding behavior in Obolo's harmony provides support for the constraint CC·EDGE-(σ), the same limiter constraint at the heart of the analysis of dissimilation in Cuzco Quechua. This constraint is not an ad hoc stipulation that happens to fit the Quechua data. It is a well-defined member of the CC·EDGE family of limiter constraints, and the Obolo case shows that it is supported by evidence from harmony as well as dissimilation.

Obolo also demonstrates how the surface correspondence theory advanced here can be used to approach directionality effects. The nasal harmony in Obolo holds in a strictly left-to-right fashion: disagreement is prohibited in NVT syllables, but permitted for the reverse order TVN. The analysis derives this asymmetry using a symmetric correspondence relation. The direction of assimilation is determined not by the constraints that demand agreement, but rather by their interaction with positional and value-specific IDENT constraints. By requiring only one correspondent to be faithful, these constraints 'tip the balance' in the interaction. For positional IDENT constraints, this leads to 'control' patterns: IDENT-Onset-[–nasal] produces onset-controlled harmony. For value-specific IDENT constraints, it leads to dominant-recessive patterns: IDENT-[+nasal] produces harmony with [+nasal] as the dominant value. The combination of these interactions leads to directional harmony as an epiphenomenon. Harmony in Obolo is always left to right because assimilation is induced only (i) from an onset to a coda, and (ii) from a [+nasal] consonant to a [–nasal] one.

5.4 Conclusions

Taken together, Obolo and Quechua illustrate four key points about the generalizability of the surface correspondence theory. First, on the simplest level, they show that the theory can explain dissimilation in languages with no inter-related consonant harmony (like Quechua), and can explain harmony in languages with no accompanying dissimilation (like Obolo). Both phenomena arise from the same surface correspondence relation, but they are not logically dependent on each other.

Second, these cases are explained by the interaction of surface correspondence constraints with other limits on phonotactics. In Cuzco Quechua, the rules about well-formed syllables preclude two [+constricted glottis] consonants from co-occurring in the same syllable; the dissimilation driven by CC·EDGE-(σ) explains the ban on [+c.g.] co-occurrence everywhere else. In Obolo, restrictions on codas dictate that they are always [–continuant]; it follows from this that the onset and coda of any NVT syllable always share a feature, since nasals are [–continuant]. This shared feature is the basis for correspondence in CVC syllables, which in turn is the basis for the nasal agreement. In both languages, the interaction between surface correspondence and other phonological factors explains generalizations that do not follow from either one on its own.

Third, Obolo shows that the surface correspondence theory can be extended to directional asymmetries. Directionality is an unsolved issue in surface correspondence theory, as discussed in Chapter 2: the theory does not offer a simple mechanism responsible for all directionality patterns in harmony or dissimilation. The analysis of Obolo explains a one-directional harmony pattern without positing any constraints that refer to directionality in correspondence, or agreement. Instead, it derives the right-to-left directionality from the interaction of faithfulness constraints. These produce a combination of control and dominance interactions, of the same type encountered in other non-correspondence theories of agreement (Lombardi 1999; Baković 2000). While this is not a general explanation for directionality, the same approach could be extended on a case-by-case basis to directional harmony – or dissimilation – in other languages.

Finally, the analysis of Quechua shows how the SCTD can handle 'indiscriminate' dissimilation patterns that are not obviously edge-conditioned. The theory posited in this book does not assume '*CORR' constraints that penalize *all* correspondence; this sets it apart from segmental OCP-based approaches to dissimilation that do posit blanket *[αF]. . .[αF] constraints (cf. Alderete 1997; Suzuki 1998; MacEachern 1999; among others). Even without such constraints, the SCTD can generate dissimilation that holds in the same blanket fashion expected from them. This works because the CC·Limiter constraints may clash with phonotactic constraints, and with each other. In a language like Quechua, where syllable structure restrictions permit [+c.g.] consonants only as simple onsets, it is impossible for two of them to correspond without violating CC·EDGE-(σ). Thus, CC·EDGE-(σ) has the effect of prohibiting correspondence – and therefore favoring dissimilation – for any otherwise-licit pair of [+c.g.] consonants. The net result is that two ejectives can never co-occur in the same root, even though no one constraint directly penalizes this co-occurrence.

The same effect can be generalized to other languages without the same phonotactic limitations because the CC·Limiter constraints can directly conflict with each other. CC·EDGE-(σ) prohibits correspondence between consonants in different syllables. CC·SROLE, however, prohibits correspondence between consonants in the same syllable. Because these limits on correspondence are mutually exclusive, it is impossible for two consonants to correspond without violating *some* CC·Limiter constraint. There is no situation where correspondence is absolutely perfect. This means the SCTD does not need to assume genuine anti-correspondence constraints to derive dissimilation patterns that work in an indiscriminate, OCP-like fashion; this can be handled by layering other limits on correspondence to create an impossibly strict combination that penalizes correspondence in all situations.