


January 2007

Consonant harmony via correspondence: Evidence from Chumash

John J. McCarthy

University of Massachusetts, Amherst, jmccarthy@linguist.umass.edu

Follow this and additional works at: http://scholarworks.umass.edu/linguist_faculty_pubs

 Part of the [Morphology Commons](#), [Near Eastern Languages and Societies Commons](#), and the [Phonetics and Phonology Commons](#)

Recommended Citation

McCarthy, John J., "Consonant harmony via correspondence: Evidence from Chumash" (2007). *Papers in Optimality Theory III* (*University of Massachusetts Occasional Papers in Linguistics*). 31.
http://scholarworks.umass.edu/linguist_faculty_pubs/31

This is brought to you for free and open access by the Linguistics at ScholarWorks@UMass Amherst. It has been accepted for inclusion in Linguistics Department Faculty Publication Series by an authorized administrator of ScholarWorks@UMass Amherst. For more information, please contact scholarworks@library.umass.edu.

Consonant Harmony via Correspondence: Evidence from Chumash¹

John J. McCarthy

University of Massachusetts Amherst

1. Introduction

Hansson (2001), Rose & Walker (2004), and Walker (2000a, 2000b) have recently proposed that long-distance consonant assimilation is accomplished via segmental correspondence rather than autosegmental linking. The phonology of the feature [anterior] in Chumash supports this idea: linking of the feature [anterior] is forbidden across morpheme boundaries, but long-distance [anterior] harmony is allowed across morpheme boundaries. The Chumash evidence therefore shows that assimilation can occur without autosegmental spreading.

2. The Phenomena of Interest

Chumash (isolate, California) has a consonant harmony process that causes sibilant consonants to agree in [anterior]² with the rightmost sibilant in the word (Applegate 1972, Beeler 1970, Gafos 1996, Hansson 2001, Harrington 1974, Lieber 1987, Poser 1982, 1993, 2004). The Ineseño Chumash (hereafter just Chumash) data in (1) illustrate:³

¹ I am grateful to the participants in Ling 730 (Fall, 2004) for their comments. Special thanks go to Joe Pater, whose comments suggested the approach in section 3, to Michael Becker, whose questions led me to the analysis in section 4, and to Gunnar Hansson and Rachel Walker for their generous and helpful comments on an earlier draft of this paper.

² I assume that specification for [anterior] is universally limited to [coronal] segments (McCarthy 1988) (also see fn. 10). Lieber (1987), who assumes the traditional definition of [anterior], proposes that [distributed] is the harmonizing feature. The available descriptions do not decide the question. My analysis uses [anterior], but it could just as well have used [distributed].

³ The Chumash consonant system consists of [p], [t], [c], [č], [k], [q], [s], and [š], the glottalized and aspirated counterparts of the preceding, [x], [m], [n], [l], [w], and [y], the glottalized counterparts of the preceding, [ʔ], and [h] (Applegate 1972:8-9). The vowels are [i], [e], [i̠], [a], [u], [o].

McCarthy

(1) Sibilant harmony in Ineseño Chumash

	/ha-s-xintila-waš/	[hašxintilawaš]	‘his former gentile’
cf.	/ha-s-xintila/	[hasxintila]	‘his gentile’
	/s-iš-sili-uluaqpey=us/	[s ^h is ^h uleqpeyus]	‘they two want to follow it’ ⁴
cf.	/p-iš-al-nanʔ/	[pišananʔ]	‘don’t you two go’

Examples like these show that harmony is feature-changing in Chumash, since it affects both values of [anterior], mapping /s/ to [š] and /š/ to [s].⁵ Although this process is not without occasional exceptions (Applegate 1972:119), there is clear evidence of its productivity from loan words (2).⁶

(2) Productivity of sibilant harmony in loan words (Applegate 1972:164)

	/k-sapatu-Vč/	[kšapatuč]	‘I wear shoes’ (< Sp. <i>zapato</i>)
	/s-kamisa- Vč/	[škamišač]	‘he wears a shirt’ (< Sp. <i>camisa</i>)

Chumash has another process affecting sibilants: when a [+anterior] sibilant is immediately followed by one of the [+anterior] nonsibilant coronals [t], [l], or [n], it dissimilates and becomes [-anterior].⁷ The data are given in (3):

(3) [anterior] dissimilation (data from Applegate 1972, via Poser 1993:317)

	/s-nanʔ/	[šnanʔ]	‘he goes’
	/s-tepuʔ/	[štepuʔ]	‘he gambles’
	/s-loxiʔ/	[šloxiʔ]	‘he surpasses me’

When a [+anterior] sibilant is derived by [anterior] dissimilation, it does not *undergo*, but it does *trigger* sibilant harmony, as shown in (4) and (5), respectively:

(4) Output of [anterior] dissimilation does not undergo harmony (Poser 1993:318)

	/s-ti-yep-us/	[štiyepus]	‘he tells him’
--	---------------	------------	----------------

(5) Output of [anterior] dissimilation does trigger harmony (Hansson 2001:59)

	/s-is-tiʔ/	[šištiʔi]	‘he finds it’
--	------------	-----------	---------------

Example (6) shows that the same is true for sibilants that are already [-anterior] in underlying representation but that occur in the appropriate context for [anterior] dissimilation:

⁴ The reduction of /...š-sili-uluaq.../ to [...s^huleq...] conforms to the regular phonology of Chumash.

⁵ Kiparsky (1993:299) shows the morphemes /s-/ and /-iš/ as both having archisegmental /S/ in underlying representation. If this is not just a typographical error, it presents obvious problems of analysis, since there would seem to be no way of deriving the [š] in [pišananʔ].

⁶ Bird (1995) and Russell (1993) have proposed that Chumash sibilant harmony is a “phonetic process” that lies outside the scope of phonological theory. See Poser (2004) for convincing argumentation that this view is incorrect.

⁷ According to Applegate (1972:117-118), [anterior] dissimilation is regular with /s/ but less regular with /c/, which moreover occurs less frequently than /s/ in preconsonantal position.

Consonant Harmony via Correspondence

- (6) Effect of vacuous [anterior] dissimilation (Poser 1993:318)
/s-iš-lu-sisin/ [ṣ̌iṣ̌lusisin] ‘they two are gone awry’

Even though the second [ṣ̌] in [ṣ̌iṣ̌lusisin] is not literally derived by [anterior] dissimilation, it behaves the same as the derived [ṣ̌]s in (4) and (5): it does not undergo harmony with the following [s]s, and it does trigger harmony in the preceding /s/.⁸

Now we get to the interesting part, the significance of which was first noted by Poser (1982). The process of [anterior] dissimilation only affects heteromorphemic consonant sequences. When the sequence is tautomorphemic, as in (7), then there is no change and [anterior] is contrastive:

- (7) Blocking of [anterior] dissimilation in tautomorphemic sequences (Poser 1993:319)
/stumukun/ [sṭumukun] ‘mistletoe’
/slowʔ/ [ṣlowʔ] ‘eagle’
/wastuʔ/ [wạstuʔ] ‘pleat’
cf. /wašti-nanʔ/ [wạšṭinanʔ] ‘to spill’

Remarkably, sibilants that occur in this contrastive environment *do* undergo sibilant harmony, as shown in (8):⁹

- (8) Harmony affects tautomorphemic ST sequences (Poser 1993:319)
/s-wašti-lokʔin-us/ [ṣwạšṭilokʔinus] ‘the flow stops on him’

This is the main analytic challenge that Chumash presents: how to account for the different behavior of heteromorphemic and tautomorphemic sibilant + [t], [n], [l] sequences under [anterior] dissimilation and harmony.

3. Dissimilation and Its Interaction with Consonant Harmony

If [anterior] dissimilation is what its name suggests it is, then it is presumably a consequence of ranking the constraint OCP(anterior) above faithfulness to anteriority, as shown in the comparative tableau (Prince 2002) in (9):

⁸ Poser (1982:133) cites an exception to this generalization: [s-iš-tiši-yep-us/ → [ṣistisiyepus] ‘the two show him’. He notes, however, that the generalization is exceptionless in Ventureño Chumash, according to Harrington (1974).

⁹ Kiparsky (1993:309-310) points out that attestation of examples that are like (8) but with opposite values of [anterior] is limited to /ha p-xosloʔ-ṣ̌/ → [apxoṣ̌loṣ̌] ‘you blow your nose’ (Applegate 1972:522), and the underlying /s/ in this form is not explicitly argued for by Applegate. The analysis I propose here, like all other analyses except Kiparsky’s, predicts that derivations like this one should exist.

(9) OCP(anterior) >> IDENT(anterior)

/s-nan?/	OCP(anterior)	IDENT(anterior)
→ šnan?		1
a. ~ snan?	1 W	L

The data in (4) and (6) show that OCP(anterior) crucially dominates the markedness constraint responsible for sibilant harmony. I will postpone serious discussion of the harmony constraint until section 4; for now, I will adopt the ad hoc expedient of positing a constraint AGREE(anterior) that is violated once by every sequence of the form ...[α ant, +strid]X[$-\alpha$ ant, +strid]..., where $X \neq$ [+strid]. Tableau (10) accounts for the interaction of sibilant harmony and anteriority dissimilation:

(10) OCP(anterior) >> AGREE(anterior) >> IDENT(anterior)

/s-iš-lu-sisin/	OCP(anterior)	AGREE(anterior)	IDENT(anterior)
→ šišlusisin		1	1
a. ~ sišlusisin		2 W	L
b. ~ sislusisin	1 W	L	1

Because OCP(anterior) dominates AGREE(anterior), harmony cannot force a sibilant to be [+anterior] before [t], [n], or [l]. But violation of AGREE(anterior) is minimized, so [šišlusisin] beats [sišlusisin], which is less harmonizing and therefore less harmonic.

Dissimilation of anterior only occurs in heteromorphemic sequences (cf. (7)). This means that tautomorphemic sequences somehow avoid the effects of OCP(anterior). The explanation is that tautomorphemic sequences have a linked structure, as Kiparsky (1993:297-299) proposes in his analysis of Chumash.

Autosegmental theory (Goldsmith 1976) offers (at least) two ways of representing a sequence like [st]. In one representation, which I will write as [\widehat{st}], a single instance of the feature value [+anterior] is shared by the two segments. The other representation, which I will write as [s|t], has two instances of the feature value [+anterior].¹⁰

In general, a constraint OCP(x) is sensitive only to literal sequences of x and not to sequences of segments that share a linked value of x (McCarthy 1979, 1981 and much subsequent work). Therefore, the cluster [s|t] violates OCP(anterior), whereas the cluster [\widehat{st}] obeys it. Because heteromorphemic clusters are observed to dissimilate, they must not be allowed to take on the [\widehat{st}] structure that would give them immunity from OCP(anterior). The constraint responsible for this limitation is a version of CRISPEGE (Ito and Mester 1994, 1999).

¹⁰ Feature geometry (Clements 1985) offers other options for representing [st] as a linked structure: it could share a single instance of [coronal] or a single Place node. Either of these possibilities would also entail sharing of [anterior] under the assumption that [anterior] is a dependent of [coronal] (McCarthy 1988). This richer range of structures has no effect on the analysis presented here since it is still necessary to rule out [+anterior]-linked [st] across morpheme boundaries.

Consonant Harmony via Correspondence

The CRISPEGE constraints were proposed by Ito and Mester as a way of limiting linked structure across the edges of certain domains. CRISPEGE(*x*) is violated if and only if some linked structure transgresses an edge of the domain *x*. Kawahara (to appear) and Walker (2001:852) argue that a second argument is required: CRISPEGE(*x*, *y*) is violated if and only if some node *y* is linked across an edge of some *x*. In Chumash, the constraint CRISPEGE(Morpheme, anterior) crucially dominates IDENT(anterior), as shown in (11).

(11) CRISPEGE(Morpheme, anterior) >> IDENT(anterior)

/s-nan?/	OCP(anterior)	CRISPEGE(Morph, ant)	IDENT(anterior)
→ šnan?			1
a. ~ $\widehat{\text{s}}\text{nan?}$		1 W	L
b. ~ s nan?	1 W		L

The candidate * $\widehat{\text{s}}\text{nan?}$ succeeds in dodging the OCP bullet, but it steps into CRISPEGE's line of fire. The problem is that * $\widehat{\text{s}}\text{nan?}$'s linked [+anterior] straddles a morpheme boundary, and this is inconsistent with the requirement imposed by CRISPEGE(Morpheme, anterior).

Morpheme-internally, however, CRISPEGE(Morpheme, anterior) is irrelevant. Morpheme internal $\widehat{\text{st}}$ clusters satisfy OCP(anterior) without further ado, so dissimilation is unnecessary. This result is certified in (12).

(12) Morpheme-internal sibilant + [t], [n], [l] clusters

/w $\widehat{\text{a}}\text{stu?}$ / or /was tu?/	OCP(anterior)	CRISPEGE(Morph, ant)	IDENT(anterior)
→ w $\widehat{\text{a}}\text{stu?}$			
a. ~ waš tu?			1 W
b. ~ was tu?	1 W		

Because the linked structure is a viable option, dissimilation need not occur and is in fact ruled out by low-ranking IDENT(anterior). The unlinked [s|t] structure of [was|tu?] is banned by OCP(anterior). Observe that it doesn't matter whether the input contains / $\widehat{\text{st}}$ / or /s|t/. This is important because, under richness of the base (Prince and Smolensky 2004), we cannot presuppose that tautomorphic /s|t/ is absent from inputs. The OCP-motivated fusion of /s|t/ to $\widehat{\text{st}}$ happens automatically, since it exacts no cost in faithfulness because IDENT(anterior) is satisfied either way (Keer 1999).

To complete the picture, we now need to look at how hetero- and tautomorphic clusters fare in harmony contexts. The introduction of the $\widehat{\text{st}}$ /[s|t] representational distinction requires us to reopen the heteromorphic case in (10). As shown in (13), CRISPEGE(Morpheme, anterior) ensures that there is no change in the winning candidate despite the wider range of losers, provided that it dominates AGREE(anterior).

(13) CRISPEGE(Morpheme, anterior) >> AGREE(anterior)

/s-iš-lu-sisin/	OCP(anterior)	CRISPEGE(Morph, ant)	AGREE(ant)	IDENT(ant)
→ šišlusisin			1	1
a. ~ sišlusisin			2 W	L
b. ~ sišlusisin		1 W	L	1
c. ~ sis lusisin	1 W		L	1

This ranking result concurs with the earlier observations: CRISPEGE(Morpheme, anterior) dominates IDENT(anterior) by direct argument (see (11)) and by transitivity via AGREE(anterior) (see (13) and (10)).

Even though it dominates AGREE(anterior), CRISPEGE(Morpheme, anterior) does not block long-distance consonant harmony, which is obviously not impeded by morpheme boundaries. This is an indication that consonant harmony does not involve autosegmental spreading of [anterior]. Section 4 deals with this matter in detail.

In the tautomorphemic case, CRISPEGE(Morpheme, anterior) is irrelevant and sibilant harmony is not affected by OCP(anterior). Tableau (14) shows why.

(14) Harmony in tautomorphemic clusters

/s-wašti-lokʔin-us/	OCP(anterior)	CRISPEGE(M, ant)	AGREE(ant)	IDENT(ant)
→ swaštilokʔinus				1
a. ~ šwaštilokʔinus			1 W	1
b. ~ swaštilokʔinus			2 W	W
c. ~ swas tilokʔinus	1 W			1

Even though OCP(anterior) dominates AGREE(anterior) and is therefore able to block harmony in heteromorphemic cases like (13), it has no comparable effect on tautomorphemic clusters because they have the option of assuming a linked structure — an option that is not available to heteromorphemic clusters because of high-ranking CRISPEGE(Morpheme, anterior).

This section concludes with some remarks about alternative analyses.

The fact that only heteromorphemic clusters dissimilate looks like a derived environment or strict cycle effect, and it has been analyzed as such by Poser (1982, 1993). Łubowicz (2002) proposes an Optimality-Theoretic account of derived environment effects based on local constraint conjunction (Smolensky 1995). The idea is that a markedness constraint M can be limited to derived environments by conjoining M with some constraint that is only violated in a derived environment. Environments derived by morpheme concatenation, as in Chumash, require that M be conjoined with a constraint on stem-syllable alignment — with prefixing morphology, this would be

Consonant Harmony via Correspondence

ALIGN-L(Stem, σ).¹¹ The local conjunction of OCP(anterior) and ALIGN-L(Stem, σ) in the domain of adjacent segments — written as [OCP(anterior)&ALIGN-L(Stem, σ)]_{AdjSeg} — would then replace OCP(anterior) in tableaux above.

Some general criticisms of this approach to derived environment effects can be found in McCarthy (2003:24-28). A Chumash-specific problem concerns syllabification. This analysis will only work if, e.g., /s-is-ti?/ is syllabified as [ši.šti.ʔi] in the output, since it is crucial that the prefix de-align the stem /ti?/. Although Chumash does have word-initial clusters like [št] (Applegate 1972:39), the parsing of medial clusters as complex onsets does not fit what we know of Chumash syllabification. From Harrington's testimony and from the evidence of reduplication and stress, all of it reviewed for Barbareño Chumash by Wash (1995), intervocalic biconsonantal clusters are heterosyllabic: [šiš.ti.ʔi]. If so, then ALIGN-L(Stem, σ) is satisfied and [OCP(anterior)&ALIGN-L(Stem, σ)]_{AdjSeg} will not produce the desired effect, though perhaps ALIGN-L(Stem, Word) would be more successful.

Another possible approach to Chumash, suggested by Inkelas (1999), is to invoke the distinction between root and affix faithfulness (McCarthy and Prince 1995, 1999). Since OCP(anterior) is observed to compel unfaithfulness in affixes but not roots, the ranking IDENT_{Root}(anterior) >> OCP(anterior) >> IDENT_{Affix}(anterior) (or just IDENT(anterior)) seems like a promising alternative. The problem is that, by transitivity of domination, this gives us IDENT_{Root}(anterior) >> AGREE(anterior), which predicts that sibilants within a root can be disharmonic in anteriority. This is not the case. Anterior harmony is exceptionless within morphemes (Applegate 1972:34-35); see Lieber (1987:145) for some examples of roots with multiple sibilants. Therefore, Chumash cannot be analyzed in terms of greater faithfulness to root features.

4. Consonant Harmony Itself

When we look more closely at consonant harmony in Chumash, a paradox emerges. The analysis in section 3 relies on the claim that [anterior]-linked clusters like [št] are prohibited across morpheme boundaries by CRISPEGE(Morpheme, anterior). In this way, heteromorphemic clusters feel the full force of OCP(anterior). Furthermore, as (13) shows, CRISPEGE(Morpheme, anterior) must dominate AGREE(anterior), since there are situations where allowing a noncrisp morpheme edge would improve performance on the harmony constraint, yet harmony is blocked. But if CRISPEGE(Morpheme, anterior) dominates AGREE(anterior), how is it possible to have [anterior] harmony across morpheme boundaries?

¹¹ Inkelas (1999), citing Chumash as an example, argues against Łubowicz's proposal on the grounds that locally conjoining M with ALIGN-R(Stem, σ) will not work, since the morphemes involved are prefixes, so they do not fall at the right edge of a stem. This argument does not seem valid; although Łubowicz uses ALIGN-R(Stem, σ) in a couple of her examples, I cannot find any indication that she disallows derived environment effects involving left-edge alignment, nor is this limitation suggested by anything in Łubowicz's theory.

McCarthy

Recent proposals by Hansson (2001), Rose & Walker (2004), and Walker (2000a, 2000b) suggest a well-motivated way out of this paradox.¹² They observe that long-distance consonant harmony processes, of which Chumash is a typical example, have a different constellation of properties than local harmony processes that affect, say, vowel features or nasality. Reserving autosegmental spreading for phenomena like vowel or nasal harmony, they claim that long-distance consonant harmony is the result of a different kind of mechanism, a type of correspondence relation (McCarthy and Prince 1995, 1999) between segments in the output. In fact, Hansson (2001:336ff., 386ff.) develops an analysis of Chumash in these terms, though he does not address the problem that has been my focus here.

Assimilation via correspondence works approximately like this. GEN freely emits candidates that may be identical except that different output segments may be in correspondence with one another. This type of correspondence, called CC-correspondence, has nothing to do with the input or the morphology; it is simply the case that any output segment may (or may not) be in CC-correspondence with any other output segment. Constraints from the CORR- $X \leftrightarrow Y$ family favor CC-correspondence, and they favor it most strongly in segments that are most similar to one another. For example, CORR- $T \leftrightarrow T$ requires that identical stops be in CC-correspondence, and it is in a stringency relation with CORR- $T \leftrightarrow D$, which requires that stops differing in no more than voicing stand in CC-correspondence. IDENT constraints proper to the CC correspondence relation require that CC-correspondent segments be identical in their featural composition. For example, IDENT_{CC}(anterior) is active in Chumash, crucially dominating the IO faithfulness constraint IDENT(anterior). (It should perhaps be noted that CORR- $X \leftrightarrow Y$ and IDENT_{CC} are technically *markedness* constraints, since they evaluate output forms without reference to the input or any other form.)

In Chumash, the set of sibilants includes the fricatives [s] and [š], the affricates [c] and [č], and their glottalized and aspirated counterparts. CC correspondence among these consonants is demanded by the constraint in (15).

(15) CORR- $S \leftrightarrow \check{C}$

For every pair of segments [... α ... β ...]
if α and β are [+strident]
and α and β are not in CC correspondence
assign a violation-mark.

CC-corresponding segments must agree in their values of [anterior] if they are to conform with the constraint in (16).

¹² Also relevant are proposals by Kitto and de Lacy (2000) and Zuraw (2003) about nonreduplicative segmental correspondence. See Kawahara (2004) for a different view.

Consonant Harmony via Correspondence

(16) IDENT_{CC}(anterior)

For every pair of segments [... α ... β ...]
 if α and β are in CC correspondence
 and α and β have different values for [anterior]
 assign a violation-mark.

CORR-S \leftrightarrow Č and IDENT_{CC}(anterior) are applied to a simple example of harmony in (17). CC correspondence is indicated by coindexation.

(17) CORR-S \leftrightarrow Č, IDENT_{CC}(anterior) >> IDENT(anterior)

/ha-s-xintila-waš/	CORR-S \leftrightarrow Č	IDENT _{CC} (anterior)	IDENT(anterior)
→ haš _j xintilawaš _j			1
a. ~ haš _j xintilawaš _j		1 W	L
b. ~ haš _j xintilawaš _k	1 W		L
c. ~ haš _j xintilawaš _k	1 W		1

The winning candidate, [haš_jxintilawaš_j], has established a CC correspondence relation between its two stridents, and they agree in anteriority. Therefore, both of the high-ranking constraints are satisfied. The loser in (a), *[haš_jxintilawaš_j], has the right correspondence relation but it violates IDENT_{CC}(anterior). The homophonous loser in (b), *[haš_jxintilawaš_k], doesn't have the right correspondence relation, so CORR-S \leftrightarrow Č is breached, though IDENT_{CC}(anterior) is satisfied vacuously. The final candidate is harmonically bounded within the scope of these constraints; it has harmonized, but for no reason, since the harmonizing segments are not in correspondence.

This analysis does not address the problem of directionality — why is the winner [haš_jxintilawaš_j] and not *[haš_jxintilawaš_j]? — though see Hansson (2001:336ff.) for relevant discussion. I will not deal with directionality in this paper and will instead just assume that a correspondence chain always obtains its [anterior] value from the rightmost segment in the chain.

When sibilant harmony is blocked, as in [š_jtiyepus], there are two logical possibilities under this theory:

- (i) The nonharmonizing sibilants are in correspondence but violate IDENT_{CC}(anterior), like [š_jtiyepus_j]. This analysis requires the ranking CORR-S \leftrightarrow Č >> IDENT_{CC}(anterior), so [š_jtiyepus_j] will beat [š_jtiyepus_k].
- (ii) the nonharmonizing sibilants are not in CC correspondence, like [š_jtiyepus_k], so they violate CORR-S \leftrightarrow Č while vacuously satisfying IDENT_{CC}(anterior). This analysis requires the opposite ranking, IDENT_{CC}(anterior) >> CORR-S \leftrightarrow Č, so [š_jtiyepus_k] will beat [š_jtiyepus_j].

Although Hansson (2001:389) takes option (i), option (ii) looks like the better bet. Option (ii)'s advantage is shown by words with two separately harmonizing sequences, such as

[šišlusisin]. If CORR-S↔Č were to dominate IDENT_{CC}(anterior), then we could not explain why [šišlusisin] is more harmonic than *[sišlusisin], as tableau (18) shows.¹³

(18) Wrong result if CORR-S↔Č >> IDENT_{CC}(anterior)

/s-iš-lu-sisin/	CORR-S↔Č	IDENT _{CC} (anterior)	IDENT(anterior)
→ *s _k iš _k lus _k is _k in		3	
a. ~ š _k iš _k lus _k is _k in		4 W	1 W
b. ~ š _i iš _j lus _k is _k in	4 W	L	1 W
c. ~ s _i iš _k lus _i is _j in	5 W	L	

The violation-marks for CORR-S↔Č and IDENT_{CC}(anterior) have been determined in accordance with the definitions in (15) and (16): one mark for every linearly ordered pair of non-conforming segments.¹⁴

On the other hand, if IDENT_{CC}(anterior) dominates CORR-S↔Č, as option (ii) demands, then there is no difficulty in obtaining the right result, as tableau (19) shows.

(19) IDENT_{CC}(anterior) >> CORR-S↔Č

/s-iš-lu-sisin/	IDENT _{CC} (anterior)	CORR-S↔Č	IDENT(anterior)
→ š _i iš _j lus _k is _k in		4	1
a. ~ š _k iš _k lus _k is _k in	4 W	L	1
b. ~ s _k iš _k lus _k is _k in	3 W	L	L
c. ~ s _i iš _k lus _i is _j in		5 W	L

Other definitions are possible, of course, as long as CORR-S↔Č correctly distinguishes [š_iiš_jlus_kis_kin] from *[s_jiš_klus_iis_jin].¹⁵

Integrating these results with those of the previous section is a straightforward matter. We know from (13) that consonant harmony is blocked by the joint agency of OCP(anterior) and CRISPEDGE(Morpheme, anterior). And we know from (19) that blocked consonant harmony involves violation of CORR-S↔Č. Therefore, OCP(anterior) and CRISPEDGE(Morpheme, anterior) must dominate CORR-S↔Č, as the ranking argument in (20) demonstrates.

¹³ Hansson (2001:391) deals with this problem by taking the winning candidate to be [š_iiš_klus_kis_kin], with the second [š] assigned to two different correspondence domains simultaneously. As (19) shows, however, this sort of dual allegiance is unnecessary and can perhaps be dispensed with universally.

¹⁴ The definition of CORR-S↔Č in (15) refers to the linear order of the segments in each pair simply to avoid doubling the number of violation marks. (That is, [...x...y...] contains two pairs of x and y, (x,y) and (y,x), but only one pair in the order x...y.) For example, [š_iiš_jlus_kis_kin] incurs 4 violation-marks, one for each of the italicized pairs in [š_iiš_jlus_kis_kin], [š_iiš_jlus_kis_kin], [š_iiš_jlus_kis_kin], and [š_iiš_jlus_kis_kin]. In contrast, [s_jiš_klus_iis_jin] gets 5 marks: [s_jiš_klus_iis_jin], [s_jiš_klus_iis_jin], [s_jiš_klus_iis_jin], [s_jiš_klus_iis_jin], and [s_jiš_klus_iis_jin].

¹⁵ Rachel Walker points out that [s_jiš_klus_iis_jin] is also a logical possibility, with one harmony domain embedded inside another. The matter deserves further study, but for now it is probably safe to assume that such forms are not supplied by GEN and therefore are banned universally.

Consonant Harmony via Correspondence

(20) OCP(anterior), CRISPEDGE(Morpheme, anterior) >> CORR-S↔Č

/s-iš-lu-sisin/	OCP(ant)	CRISPEDGE(Morph, ant)	ID _{CC} (ant)	CORR-S↔Č	ID(ant)
→ š _i iš _i lus _k is _k in				4	1
a. ~ š _k iš _k lus _k is _k in			4 W	L	1
b. ~ s _k is _k lus _k is _k in		1 W		L	1
c. ~ s _k is _k lus _k is _k in	1 W			L	1

The loser in (a), [š_kiš_klus_kis_kin], perfectly satisfies CORR-S↔Č but it fatally violates undominated IDENT_{CC}(anterior), as we already saw in (19). The other two candidates are also perfect in their performance on CORR-S↔Č, but at the price of violating two other higher-ranked constraints: [s_kis_klus_kis_kin] in (b) is out because the cluster's [+anterior] specification straddles a morpheme edge, and [s_kis_klus_kis_kin] in (c) violates OCP(anterior).

The analysis of the tautomorphemic clusters is unchanged, as tableau (21) indicates. Because the tautomorphemic cluster in [s_kwas_ktilok?inus_k] can share a single instance of the feature [anterior], its sibilant is free to harmonize at no risk of violating OCP(anterior).

(21) Harmony in tautomorphemic cluster

/s-wašti-lok?in-us/	OCP(ant)	CRISPEDGE(M, ant)	ID _{CC} (ant)	CORR-S↔Č	ID(ant)
→ s _k was _k tilok?inus _k					1
a. ~ š _i waš _i tilok?inus _k				2 W	1
b. ~ s _k was _k tilok?inus _k	1 W				1
c. ~ s _k waš _k tilok?inus _k			2 W		L

This now brings us to the point of the argument. As I previously noted, the analysis developed in section 3 leads to a paradox. CRISPEDGE(Morpheme, anterior) prevents heteromorphemic clusters from sharing a single instance of [+anterior], and that is why they must dissimilate. But consonant harmony assimilates [anterior] across morpheme boundaries with flagrant disregard for the requirements of CRISPEDGE(Morpheme, anterior). Moreover, the argument in (13) showed that CRISPEDGE(Morpheme, anterior) must dominate the constraint responsible for harmony (AGREE(anterior) in (13)). Therefore, if long-distance consonant harmony involved autosegmental spreading, it would be blocked at morpheme edges because of the ranking CRISPEDGE(Morpheme, anterior) >> AGREE(anterior). This is obviously not the case.

This paradox only arises, though, if long-distance [anterior] harmony involves a linked structure. By design and by definition, CRISPEDGE constraints rule out multiply-linked autosegmental structures, but of course they say nothing about assimilation by CC correspondence. Long-distance consonant harmony is not the result of autosegmental spreading of [anterior] — it could not be, since CRISPEDGE(Morpheme, anterior) would not allow it. Rather, as this section has shown, consonant harmony is an effect of CC

correspondence among sibilants coupled with undominated IDENT_{CC}(anterior). Edges remain crisp under this mode of assimilation.

This argument concurs with the claims of Hansson, Rose, and Walker that there are two distinct modes of assimilation: local, by autosegmental spreading, and long-distance, by correspondence. Chumash has local, OCP-induced autosegmental fusion of [+anterior], but it also has long-distance correspondence-based assimilation of [anterior]. Structurally-sensitive constraints like CRISPEGE can be used to detect this difference in assimilation processes. Correspondence-based assimilation is not and could not be affected by CRISPEGE, since this mode of assimilation derives from identity among correspondent segments rather than autosegmental spreading. (This is not to say, however, that correspondence-based assimilation is necessarily indifferent to morphological structure. It is not inconceivable that CORR constraints can be relativized to particular morphological domains.)

5. Conclusion

The phonology of [anterior] in Chumash supports recent proposals by Hansson (2001), Rose & Walker (2004), and Walker (2000a, 2000b) that long-distance consonant assimilation does not involve autosegmental spreading. Linking of the feature [anterior] is forbidden across morpheme boundaries, but long-distance [anterior] harmony is allowed across morpheme boundaries. The Chumash evidence therefore shows that assimilation can occur without autosegmental spreading.

References

- Applegate, Richard B. 1972. *Ineseño Chumash Grammar*. Doctoral dissertation, University of California, Berkeley, CA.
- Beeler, Madison. 1970. Sibilant harmony in Chumash. *International Journal of American Linguistics* 36:14-17.
- Bird, Steven. 1995. *Computational Phonology: A Constraint-Based Approach*. Cambridge: Cambridge University Press.
- Clements, G. N. 1985. The geometry of phonological features. *Phonology Yearbook* 2:225-252.
- Gafos, Adamantios. 1996. *The Articulatory Basis of Locality in Phonology*. Doctoral dissertation, Johns Hopkins University, Baltimore, MD.
- Goldsmith, John. 1976. *Autosegmental Phonology*. Doctoral dissertation, MIT, Cambridge, MA. [Published by Garland Press, New York, 1979.]
- Hansson, Gunnar Ólafur. 2001. *Theoretical and Typological Issues in Consonant Harmony*. Doctoral dissertation, University of California, Berkeley, CA. [Available at <http://www.ai.mit.edu/projects/dm/featgeom/hansson-diss.pdf>.]
- Harrington, John P. 1974. Sibilants in Ventureño. *International Journal of American Linguistics* 40:1-9.

Consonant Harmony via Correspondence

- Inkelas, Sharon. 1999. Phonotactic blocking through structural immunity. Ms., University of California, Berkeley, Berkeley, CA. [Available on Rutgers Optimality Archive, ROA-366.]
- Ito, Junko, and Armin Mester. 1994. Reflections on CodaCond and Alignment. In *Phonology at Santa Cruz*, eds. Jason Merchant, Jaye Padgett and Rachel Walker, 27-46. Santa Cruz: Linguistics Research Center, UC Santa Cruz. [Available on Rutgers Optimality Archive, ROA-141.]
- Ito, Junko, and Armin Mester. 1999. Realignment. In *The Prosody-Morphology Interface*, eds. René Kager, Harry van der Hulst and Wim Zonneveld, 188-217. Cambridge: Cambridge University Press.
- Kawahara, Shigeto. 2004. Locality in echo epenthesis: Comparison with reduplication. In *Proceedings of the North East Linguistics Society 34*, eds. Keir Moulton and Matthew Wolf, 295-309. Amherst, MA: GLSA.
- Kawahara, Shigeto. to appear. On the proper treatment of non-crisp edges. In *Japanese/Korean Linguistics 13*, eds. Mutsuko Endo, Sun-Ah Jun and Peter Sells. Stanford, CA: CSLI Publications. [Available at http://www.people.umass.edu/kawahara/kawahara_jk13.pdf.]
- Keer, Edward. 1999. *Geminates, the OCP, and the Nature of CON*. Doctoral dissertation, Rutgers University, New Brunswick, NJ. [Available on Rutgers Optimality Archive, ROA-350.]
- Kiparsky, Paul. 1993. Blocking in non-derived environments. In *Studies in Lexical Phonology*, eds. Sharon Hargus and Ellen Kaisse, xxx-xxx. San Diego: Academic Press.
- Kitto, Catherine, and Paul de Lacy. 2000. Correspondence and epenthetic quality. In *Proceedings of AFLA VI: The Sixth Meeting of the Austronesian Formal Linguistics Association (Toronto Working Papers in Linguistics)*, eds. Catherine Kitto and Carolyn Smallwood, 181-200. Toronto: Department of Linguistics, University of Toronto. [Available on Rutgers Optimality Archive, ROA-337.]
- Lieber, Rochelle. 1987. *An Integrated Theory of Autosegmental Processes*. Albany, NY: State University of New York Press.
- Lubowicz, Anna. 2002. Derived Environment Effects in Optimality Theory. *Lingua* 112:243-280.
- McCarthy, John J. 1979. *Formal Problems in Semitic Phonology and Morphology*. Doctoral dissertation, MIT, Cambridge, MA. [Published by Garland Press, New York, 1985.]
- McCarthy, John J. 1981. A prosodic theory of nonconcatenative morphology. *Linguistic Inquiry* 12:373-418. [Excerpts reprinted in John Goldsmith, ed., *Essential Readings in Phonology*. Oxford: Blackwell. Pp. 162–184, 1999.]
- McCarthy, John J. 1988. Feature geometry and dependency: A review. *Phonetica* 43:84-108.
- McCarthy, John J., and Alan Prince. 1995. Faithfulness and Reduplicative Identity. In *University of Massachusetts Occasional Papers in Linguistics 18*, eds. Jill Beckman, Laura Walsh Dickey and Suzanne Urbanczyk, 249-384. Amherst, MA: GLSA Publications. [Available on Rutgers Optimality Archive, ROA-103.]
- McCarthy, John J., and Alan Prince. 1999. Faithfulness and identity in Prosodic Morphology. In *The Prosody-Morphology Interface*, eds. René Kager, Harry van

McCarthy

- der Hulst and Wim Zonneveld, 218-309. Cambridge: Cambridge University Press. [Excerpted in *Optimality Theory in Phonology: A Reader*, ed. by John J. McCarthy, Malden, MA and Oxford, Blackwell (2004).]
- McCarthy, John J. 2003. Comparative markedness. *Theoretical Linguistics* 29:1-51.
- Poser, William. 1982. Phonological representations and action-at-a-distance. In *The Structure of Phonological Representations*, eds. Harry van der Hulst and Norval Smith, 121-158. Dordrecht: Foris.
- Poser, William. 1993. Are strict cycle effects derivable? In *Studies in Lexical Phonology*, eds. Sharon Hargus and Ellen M. Kaisse, 315-321. New York: Academic Press. [Available at <http://www.cis.upenn.edu/~wjposer/.downloads/ssc.pdf>.]
- Poser, William. 2004. On the status of Chumash sibilant harmony. Ms., University of Pennsylvania, Philadelphia. [Available at <http://www.cis.upenn.edu/~wjposer/.downloads/ChumashStatus.pdf>.]
- Prince, Alan. 2002. Arguing optimality. In *Papers in Optimality Theory II* (= *University of Massachusetts Occasional Papers* 26), eds. Angela Carpenter, Andries Coetzee and Paul De Lacy, 269-304. Amherst, MA: GLSA. [Available on Rutgers Optimality Archive, ROA-562.]
- Prince, Alan, and Paul Smolensky. 2004. *Optimality Theory: Constraint Interaction in Generative Grammar*. Malden, Mass., and Oxford, UK: Blackwell. [Revision of 1993 technical report, Rutgers University Center for Cognitive Science. Available on Rutgers Optimality Archive, ROA-537.]
- Rose, Sharon, and Rachel Walker. 2004. A typology of consonant agreement as correspondence. *Language* 80:475-531. [Available on Rutgers Optimality Archive, ROA-458.]
- Russell, Kevin. 1993. *A Constraint-Based Approach to Phonology and Morphology*. Doctoral dissertation, University of Southern California, Los Angeles.
- Smolensky, Paul. 1995. On the structure of the constraint component Con of UG. Ms.UCLA. [Available on Rutgers Optimality Archive, ROA-86.]
- Walker, Rachel. 2000a. Long-distance consonantal identity effects. In *Proceedings of the 19th West Coast Conference on Formal Linguistics*, eds. Roger Billerey and Brook Danielle Lillehaugen, 532-545. Somerville, MA: Cascadilla Press.
- Walker, Rachel. 2000b. Yaka nasal harmony: Spreading or segmental correspondence? In *Proceedings of the Berkeley Linguistics Society* 26, 321-332. Berkeley, CA: Berkeley Linguistics Society.
- Walker, Rachel. 2001. Round licensing, harmony, and bisyllabic triggers in Altaic. *Natural Language and Linguistic Theory* 19:827-878.
- Wash, Suzanne M. 1995. *Productive Reduplication in Barbareño Chumash*. Master's thesis, University of California Santa Barbara, Santa Barbara, CA.
- Zuraw, Kie. 2003. Aggressive reduplication. *Phonology* 19:395-439.

Department of Linguistics
South College
University of Massachusetts
Amherst, MA 01003

jmccarthy@linguist.umass.edu