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IDENTITY AND CONSONANT HARMONY IN CHOL (MAYAN)[1]

0 Introduction

- Non-local consonant interactions can be divided into two classes: agreement in a **single feature** and **total identity**. An example of both types is found in Chol (Mayan).

(1) **total identity:** ejectives and plain stridents in a root must agree in all features

a:	*k'-p'	√ p'ip'	'wild'
	*t^{j}'-ts'	√ t^{j}'ot^{j}'	'snail'
b:	*ts-s	√ sus	'scratch'
	*s-tʃ	√ tʃitʃ	'older sister'

(2) **single feature:** stridents agree only in anteriority if one is ejective or outside the root

a:	*tʃ'-s	√ ts'is	'sew'	b:	**ʃ-tʃ'**ok	'girl'
	*s-tʃ'	√ ʃutʃ'	'thief'		**s-ts**ihb	'fern'

- In this talk, we discuss the interaction of total and single feature identity in Chol and examine its implications for the analysis of both types of non-local consonant interactions.

> **Main point:** Total identity is formally distinct from single feature identity. Total identity is true **action-at-a-distance**, while single feature identity is **local spreading**.

- The Agreement by Correspondence (ABC) framework (Hansson 2001, Rose & Walker 2004) can account for the both of the phenomena in (1) and (2). ABC is a theory of *non-local* assimilation, non-adjacent consonants interact via a correspondence relation.

- While ABC is unique in providing an account of total identity in Optimality Theory (Prince & Smolensky 1993, 2004)[2], it overlaps in its coverage of many single feature harmonies.

- Several competing proposals analyze anteriority harmony (and other single feature harmonies) as autosegmental or articulatory spreading (Flemming 1995, Gafos 1999, Ni Chiosain & Padgett 1997).

- The first portion of this talk shows that the different domains of total identity and anteriority harmony makes a unified ABC analysis of both phenomena impossible, thereby providing support for a spreading analysis of anteriority harmony.

- The second portion of the talk argues that total identity is an explicit requirement of interacting consonants. It is not the composite effect of multiple single feature identities, as is implicit in the original formulation of ABC.

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[2] See MacEachern 1999 for an alternative proposal.

Outline:

1 Chol background & data
2 Agreement by Correspondence
3 Anteriority harmony is spreading
4 The total identity requirement
5 Conclusion

1 Chol background and data[3]

1.1 Chol inventory

- Chol is a Mayan language spoken in Chiapas, Mexico by around 150,000 people. It has the consonant inventory in (4).

(4)

	labial	coronal	velar	glottal
implosive	b			
plosive	p	t^j	k	ʔ
ejective	**p'**	**ts' tʃ' t^j'**	**k'**	
fricative		**s ʃ**		h
affricate		**ts tʃ**		
nasal	m	ɲ		
approximant	w	l j		

- Chol has six vowels: [a, e, i, o u, ɨ].

- Lexical roots in Chol and other Mayan languages are predominately CVC in shape.

  - All twenty of Chol's consonants may appear in either initial or final position, though not all pairs of consonants may *cooccur* in the same root.

  - The quality of the vowel plays no role in the cooccurence restrictions.

1.2 Total identity

- Consonants in Chol roots are subject to two cooccurrence restrictions. The first applies to the five ejective consonants [p', t^j', ts', tʃ', k'].

(5) **<u>Restriction on the cooccurrence of ejective consonants</u>:**
A root may contain two ejective consonants only if they are identical.

- Examples of roots with identical ejectives are given in (6a). Hypothetical roots with distinct ejectives are unattested (6b).

(6) a: k'ok' 'healthy'
ts'uhts' 'kiss'
tʃ'ɨtʃ' 'absorb'

b: *k'ats'
*p'otʃ'
*t^j'uk'

[3] The data presented here draws heavily on the 1978 Aulie and Aulie dictionary, combined with fieldnotes collected by the first author in Chiapas, Mexico.

- The second restriction applies to the six strident consonants [s, ʃ, ts, tʃ, ts', tʃ'].

(7) **Restriction on the cooccurrence of strident consonants**:
A root may contain two plain strident consonants only if they are completely identical

- The examples in (8) show the total identity requirement on non-ejective stridents. [4]

(8)	a:	sus	'scratch'	b:	*tsus
		ʃeʃ	'shrimp'		*tʃuʃ
		tsɨts	'difficult'		*sats
		tʃitʃ	'older sister'		*ʃutʃ

1.3 Anteriority harmony

- Total identity only applies to plain stridents within a root. If one strident in a root is ejective, only anteriority harmony applies, as shown in (9).

(9)	a:	sɨts'	'stretch'	b:	*ts'aʃ
		sits'	'saliva'		*tʃ'us
		tʃ'oʃ	'worm'		*ʃats'
		ʃutʃ'	'thief'		*satʃ'

- Anteriority harmony, but not total identity, is also found if one strident is outside of the root. The data below show right-to-left anteriority harmony between heteromorphemic stridents.

(10) the gender marker /ʃ-/

a:	**ʃ-tʃ'**ok	'girl'	b:	**s-ts**a**ts**	'sardine'
	ʃ-wuht^{j}	'shaman'		**s-ts**ihb	'fern'

(11) the causative suffix /-(i)sɨ/

a:	tʲik	'dry'	b:	tʲik-i**sɨ**	'make dry'
	hub	'descend'		huʔ-**sɨ**	'lower'
	ʔo**tʃ**	'enter'		ʔo**ts-sɨ**	'bring in'
	tʃɨm	'die'		**ts**ɨñ-**sɨ**	'kill'

- The data in this section show that anteriority harmony and total identity apply in different domains in Chol. The pattern for stridents is summarized in (12).

(12) a: **total identity**: Pairs of non-ejective stridents in a root

*ts-s	*s-ʃ	√ tsɨts 'difficult'	√ tʃitʃ 'older sister'
*s-tʃ	*ʃ-tʃ	√ sus 'scratch'	√ ʃeʃ 'shrimp'

b: **identity in [α anterior]**: All stridents

*ts'-ʃ	√ ts'is 'sew'
*ʃ-tsihb	√ s-tsihb 'fern'

[4] One counterexample was found to the generalization in (7): tʃaʃ 'mosquito'.

- A proper analysis of Chol must account for the different domains of total identity and anteriority harmony.

2 Agreement by Correspondence

2.1 The framework

- In the ABC framework, total identity and single feature harmonies are given a unified analysis as effects of **correspondence between non-adjacent consonants**.

- Output correspondence relations are established by CORR-C⇔C constraints.

(13) CORR-C⇔C Let S be an output string of segments and let C_i C_j be segments that share a specified set of features F. If C_i, $C_j \in S$, then C_i is in a relation with C_j: that is, C_i and C_j are correspondents of one another.
[Rose & Walker 2004, #19 pg. 491]

- If two segments stand in correspondence, they are required to agree in certain features by constraints from the CC-IDENT[F] family. This is an extension of the correspondence based theory of faithfulness in McCarthy & Prince (1995).

(14) CC-IDENT[F] Let C_i be a segment in the output and C_j be any correspondent of C_i in the output. If C_i is [αF] then C_j is [αF].

- For harmony to occur, some CORR-C⇔C constraint *and* CC-IDENT must outrank IO-IDENT: **CORR-C⇔C, CC-IDENT[F] >> IO-IDENT[F]**.

- The tableau in (15) illustrates an ABC account of total identity between stridents in Chol.
  - The constraint CORR-S⇔S demands that output stridents stand in correspondence. CC-IDENT and IO-IDENT stand in for the feature specific constraints needed to account for total identity. The issue of feature specific CC-IDENT constraints will be discussed in Section 4.

(15)

/tsaʃ/	CORR-S⇔S	CC-IDENT	IO-IDENT
a: → ts_xats_x			**
b: ts_xats_y	*!		**
c: $ts_xaʃ_y$	*!		
d: $ts_xaʃ_x$		** !	
e: $ts_xatʃ_x$		* !	*
f: ts_xas_x		* !	*

  - Candidates (b) and (c) are eliminated by high-ranked CORR-S⇔S because two stridents do not correspond.
  - In (d-f), the stridents are placed in correspondence but they are not identical.
  - In the winning form, the two stridents are both in correspondence and identical.[5]

[5] [tsats] is not the only possible output for an ungrammatical input /tsaʃ/. Rather than assimilation, dissimilation could occur, as in /tsaʃ/ → [tʲaʃ]. If one of the consonants loses stridency, the consonants are no longer required to be in correspondence. Another possibile output is [ʃaʃ]. There are no alternations in Chol which tell us the actual output of an ungrammatical input like /tsaʃ/.

2.2 The problem for Chol

- Total identity is required of plain stridents within a root. If one strident is ejective or outside of the root, however, total identity is not required and only anteriority harmony applies.

(16) a: √ ts'is 'sew' √ tʃ'iʃ 'thorn'
b: ʃ-we**tʃ** 'armadillo' **s-ts**ihb 'fern'
c: **tʃ**ɨm 'die' **ts**ɨñ-**s**ɨ 'kill'

- The data in (16) show that Chol has right-to-left anteriority harmony, independent of the total identity requirement.

- It is possible to analyze anteriority harmony in ABC. Stridents must be in correspondence, and high-ranked CC-IDENT[α anterior] forces corresponding segments to agree for anteriority.

(17)

/ts'aʃ/	CORR-S⇔S	CC-IDENT[α ant]	IO-IDENT[α ant]
a: → ts'$_x$as$_x$			*
b: ts'$_x$as$_y$	* !		*
c: ts'$_x$aʃ$_y$	* !		
d: ts'$_x$aʃ$_x$		* !	

- The analysis in (17) is incompatible with the analysis of total identity in (15). The overlapping domains of anteriority harmony and total identity make an ABC analysis of both phenomena impossible.

- In ABC, identity in all features and identity in *only* anteriority are both dependent on the same correspondence relation.

- It's impossible to require some pairs of corresponding segments to agree in all features, and other pairs to only agree for anteriority.

  - For total identity to not be required in (17), these stridents must not violate the total identity constraint. This is only possible if they do not stand in correspondence.

  - Outputs with non-identical stridents must have the correspondence relations in (18a), not (18b). Stridents that are not identical must not correspond.

(18) a: ts'$_{\mathbf{x}}$as$_{\mathbf{y}}$ b: ts'$_{\mathbf{x}}$as$_{\mathbf{x}}$
s$_{\mathbf{y}}$-ts$_{\mathbf{x}}$ats$_{\mathbf{x}}$ s$_{\mathbf{x}}$-ts$_{\mathbf{x}}$ats$_{\mathbf{x}}$

- Given (18a), anteriority harmony cannot be analyzed as ABC. CC-IDENT[α anterior] can have no effect on the ouput if the relevant consonants do not correspond.

- Attempting to analyze total identity and anteriority harmony in the same framework leads to a simple paradox.

  - If all stridents are in correspondence, as in (18b), then total identity will be required between all stridents.

- If only some stridents are in correspondence, as in (18a), then anteriority harmony will never apply.

- The impossibility of constructing a single analysis that accounts for both total identity and anteriority harmony in Chol is support for the claim that total and partial identity are distinct.

- While anteriority harmony can be analyzed within ABC, there are also alternative analyses, making the ABC coverage formally redundant.

- We propose that *only* total identity be analyzed within ABC as a non-local effect. Anteriority harmony is a local process, and does not refer to correspondence between stridents.

  - CORR-S⇔S must be formulated as in (19), to only demand correspondence between non-ejective stridents within the root.

(19) CORR-S⇔S Non-ejective stridents in a root correspond.[6]

3 Anteriority harmony is spreading

- Autosegmental or gestural spreading analyses of anteriority harmony (and other minor-place harmonies) have been proposed in Flemming (1995), Gafos (1999) and Ni Chiosain & Padgett (1997).

  - In these proposals, the anteriority feature or gesture spreads from trigger to target through all intervening segments.

  - While the spreading feature or gesture is concomitant with all intervening segments, it is only perceptible on coronals (those segments that can potentially contrast for anteriority).

  - Spreading, unlike ABC, is strictly local. The appearance of action-at-a-distance results because the spreading feature has no acoustic effects on intervening segments, but there is no non-local agreement and no correspondence.

- The impossibility of an ABC account of anteriority harmony in Chol supports a spreading analysis.

  - If *only* total identity is analyzed within ABC and single feature harmonies are instead local spreading, the overlap in empirical coverage between these two theories disappears.

- If anteriority harmony is analyzed as local spreading, we can account for its application outside of the domain of total identity.

- The proposed analysis follows Gafos (1999). We analyze anteriority harmony as alignment of an articulatory gesture with the edge of the word.

  - The anteriority contrast is represented by different values for the gestural parameter TTCA (Tongue Tip Constriction Area): [mid] for [ʃ] or [narrow] for [s].

[6] A more detailed discussion and analysis of the factors that determine correspondence in Chol and other languages can be found in Coon & Gallagher (2007).

- Harmony is the result of constraints from the ALIGN family (McCarthy and Prince 1993). In Gafos' framework, the gestural parameter, domain of harmony and directionality are the three arguments of an ALIGN constraint.

(20) ALIGN(TTCA; WD, L) The rightmost TTCA specification is aligned with the left edge of the word.

- When correspondence and total identity are required anteriority harmony is redundant.

(21) anteriority harmony subsumed under total identity

	/tsiʃ/	CORR-S⇔S	CC-IDENT	ALIGN(TTCA; WD, L)	IO-IDENT
a:	→ $ts_x it s_x$				**
b:	$ts_x is_x$		* !		*
c:	$ts_x iʃ_y$	* !		*	
d:	$ts_x it s_y$	* !			**

- The ranking ALIGN(TTCA; WD, L) >> IO-IDENT(TTCA) results in anteriority harmony when correspondence and total identity are not active, ie. when one strident is an ejective, (22), or is outside of the root, (23).

(22) anteriority harmony between an ejective and a non-ejective strident in the root

	/ts'iʃ/	CORR-S⇔S	CC-IDENT	ALIGN(TTCA; WD, L)	IO-IDENT
a:	→ $ts'_x is_y$				*
b:	$ts'_x is_x$		* !		*
c:	$ts'_x iʃ_y$			* !	
d:	$ts'_x it s'_x$				*** !

(23) anteriority harmony outside of the root

	/ʃ-tsats/	CORR-S⇔S	CC-IDENT	ALIGN(TTCA; WD, L)	IO-IDENT
a:	→ s_y-$ts_x ats_x$				*
b:	s_x-$ts_x ats_x$		* !		*
c:	$ʃ_x$-$ts_x ats_x$		* !	*	
d:	$ʃ_y$-$ts_x ats_x$			* !	** !

- The ranking in (24) can account for both total identity and anteriority harmony in Chol.

(24) CORR-S⇔S, CC-IDENT, ALIGN(TTCA) >> IO-IDENT

- Plain stridents within a root are required to be in correspondence, and consequently are also required to be completely identical.

- An ejective and a plain strident, or two non-root-internal stridents, are not required to be in correspondence, due to the formulation of CORR-S⇔S.

- Anteriority harmony is not dependent on a correspondence relation, and can be seen in environments where total identity is not required.

4 The total identity requirement

4.1 Against a single feature analysis of total identity

- As originally formulated, interacting consonants in an ABC analysis are required to agree with one another on a feature by feature basis.

- A language with total identity between interacting consonants, then, must have multiple CC-IDENT[F] constraints outranking their IO counterparts.

- Both ejectives and plain stridents must be totally identical in order to cooccur in Chol.

- Stridents contrast for [α anterior] ([s,ts,ts'] v. [ʃ,tʃ,tʃ'] and [α continuant] ([ts,ts',tʃ,tʃ'] v. [s,ʃ]. Additionally, ejectives contrast for major place ([k'] v. [p'] v. [tʲ',ts',tʃ']) and stridency ([tʲ'] v. [ts',tʃ']).

- The four feature specific constraints in (25) are needed to account for total identity in Chol.

(25) CC-IDENT[α anterior] CC-IDENT[α strident] CC-IDENT[α continuant] CC-IDENT[place]

- Proposing all the constraints in (25), however, predicts that the effect of each constraint should be found in the absence of the others. Each single feature harmony should be independently attested.

- The languages in (26) and (27), among others, are predicted. CORR-S⇔S and CORR-C'⇔C' demand correspondence between stridents and ejectives, respectively.

    - In (26), stridents must agree for continuancy but not anteriority.

(26) a: CORR-S⇔S, CC-IDENT[α cont], IO-IDENT [α ant] >> CC-IDENT [α ant], IO-IDENT [α cont]
b: *ts-s, *tʃ-s √ts-tʃ, √s-ʃ

    - In (27), ejectives must agree for major place, but may contrast for stridency.

(27) a: CORR-C'⇔C', CC-IDENT[place], IO-IDENT[α strid] >> IO-IDENT[place], CC-IDENT[α strid]
b: *tʲ'-k', *ts'-p' √tʲ'-ts', √tʲ'-tʃ'

- Both of the languages in (26) and (27) are unattested.

    - Continuancy harmony between stridents, as in (26), is unattested. In his survey of consonant harmony systems, Hansson (2001) gives a single case of continuancy harmony (Yabem), which also results in complete identity. CC-IDENT[α cont] is unmotivated.

    - Major place harmony, and therefore the effect of CC-IDENT[place], is completely unattested outside of child language (Hansson 2001).

    - Stridency harmony (favored by CC-IDENT[α strident]) is also unattested to my knowledge.

- Beyond making undesirable typological predictions, in a feature specific analysis *total* identity is an accident. Under the CC-IDENT[F] formulation, there is nothing special about being *totally* identical as opposed to being *partially* identical.

- Looking at languages with a total identity requirement, however, it seems that there is something quite special about being totally identical.

- In languages with place cooccurrence restrictions, for example, identical pairs of consonants may be allowed while increasingly similar pairs of consonants are increasingly disfavored.

- Muna (van den Berg 1989; Coetzee & Pater in press) exemplifies the exceptional status of identical consonants.

    - Muna has a gradient place-based cooccurrence restriction. Within a major place class, two consonants are less likely to cooccur the more similar they are.

    - Degree of attestation is represented by the Observed/Expected ratio. An O/E of 1 indicates that two consonants cooccur as often as expected by chance. An O/E less than 1 shows under-representation, indicating the effect of some cooccurrence restriction.

    - The O/E of non-identical labial consonants in Muna is given in (28a). The O/E of identical pairs of labials is in (28b).

(28) a: homorganic consonants are increasingly under-attested the more similar they are

consonants	**O/E**	**disagreeing features**
m-f	1.04	continuant, nasal, voice
b-f	0.58	continuant, voice
m-p	0.39	nasal, voice
b-p	0.10	voice
p-f	0.07	continuant
m-b	0.07	nasal

b: identical consonants

m-m 1.24 b-b 2.79 p-p 1.46 f-f 2.5

- In Muna, there is an inverse correlation between similarity and grammaticality, as is found in many other languages (Arabic, Frisch et al. 2004; Tigrinya, Buckley 1997; others).

- Identical pairs of consonants in Muna are exceptional. While very similar consonants are very under-attested, identical consonants are very over-attested.

- If total identity were the result of multiple single-feature identities, we would expect the opposite pattern. Increasingly similar consonants should be increasingly grammatical, since they violate fewer CC-IDENT[F] constraints.

- Constraints must favor *totally* identical pairs of consonants without favoring *partially* identical pairs of consonants. This is possible if there are no feature specific CC-IDENT[F] constraints, but only a total identity constraint.

- MacEachern's (1999) survey of laryngeal cooccurrence restrictions shows that languages vary on two dimensions: the strength of the cooccurrence restriction and whether totally identical pairs of consonants are allowed.

4.2 A total identity constraint

- The previous sub-section showed that a single feature analysis of total identity makes undesirable typological predictions and does not reflect the unique status of *totally* identical pairs of segments in cooccurrence restrictions.

- We propose instead that total identity is explicitly required by a general, non-feature-specific, constraint, CC-IDENT.

- The proposed constraint formalizes the claim that total identity is distinct from single-feature identity.

(29) CC-IDENT Given two segments in the output C_i and C_j,
If C_i and C_j stand in correspondence, then C_i and C_j are identical.

- The single constraint in (29) replaces the four constraints in (25) in an analysis of total identity between stridents and ejectives in Chol.

(30) CORR-S⇔S, CORR-C'⇔C', CC-IDENT >> IO-IDENT[F]

(31) Total identity between plain stridents

	/tsaʃ/	CORR-S⇔S	CC-IDENT	IO-IDENT[F]
a:	→ ts_xats_x			**
b:	ts_xats_y	*!		**
c:	$ts_xaʃ_y$	*!		
d:	$ts_xaʃ_x$		* !	
e:	$ts_xatʃ_x$		* !	*
f:	ts_xas_x		* !	*

(32) Total identity between ejectives

	/k'ats'/	CORR-C'⇔C'	CC-IDENT	IO-IDENT[F]
a:	→ $k'_xak'_x$			**
b:	$k'_xak'_y$	*!		**
c:	$k'_xats'_y$	*!		
d:	$k'_xat^{j}'_x$		* !	*

- The total identity constraint unifies the analysis of stridents and ejectives. The consistent preference for *totally* identical pairs of consonants over similar pairs is no longer a coincidence.

5 Conclusion

- This talk has argued that total identity and single feature harmonies are formally distinct.

- In Chol, total identity and anteriority harmony apply in different domains. It is impossible to construct an ABC analysis of both phenomena.

- The analysis of anteriority harmony within ABC is formally redundant, given that coronal and other minor place harmonies can be analyzed as strictly local, articulatory spreading.

- We proposed that only total identity is the result of correspondence. Single feature harmonies are gestural spreading.

    - Beyond providing an account of Chol, this proposal eliminates redundancy in the empirical coverage of ABC.

- We also showed that a single-feature analysis of total identity requires postulating harmonies that never occur in isolation (e.g. major place and continuancy harmony).

    - Total identity is an explicit requirement of interacting, non-adjacent segments. It is not the accidental side-effect of multiple single feature harmonies applying together.

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