A Formal Theory of Dissimilation

John Alderete
University of Massachusetts, Amherst

Rum J. Clam II
May, 1996

1 Introduction

(1) Local Conjunction (LC) (Smolensky 1993, 1995, cf. Crowhurst and Hewitt 1995)
Multiple constraint violations in a local context are categorically worse than the same violations in a nonlocal context.

(2) Some Formulations (Smolensky 1993)
a. **Local Conjunction of C_1 and C_2**: C_1 & C_2 is violated when there is a [local context] in which both C_1 and C_2 are violated.
b. **Self-Conjunction**: when $C_1 = C_2 \equiv C$, C_1 & $C_2 \equiv C^2$ is violated when there is a [local context] in which C is violated twice.

(3) Exemplification of LC in Syllable Parsing (Kager 1994, Alderete 1995)

OBSERVATION: σ {σ́ σ} σ is more harmonic than {σ́ σ} σ σ

(4) LC in Syllable Parsing

Candidates	PARSE-SYLL$^2_{\text{Adj Syll}}$	PARSE-SYLL
☞ σ {σ́ σ} σ		**
{σ́ σ} σ σ	*!	**

INTERPRETATION A self-conjoined PARSE-SYLL^2, defined for adjacent syllables, separates the two candidates in the required way.

ABSTRACTION Stated more abstractly, multiple violations of a constraint C are tolerated, but more than one violation of C *in a local context*, is absolutely forbidden.

(5) Application of LC in the analysis of Dissimilation

a. $\alpha \ldots \beta$, α | F, β | F

b. $*\alpha\ \beta \rightarrow \alpha\ \beta$, $*\alpha$ | F, β | F → α | F

OBSERVATION More than one instantiation of the feature F is licensed in nonlocal segments (a), but more than one F is not licensed in neighboring segments (b).

INTERPRETATION A self-conjoined featural markedness constraint, $*F^2$, separates the two forms: multiple violations of *F in neighboring segments are categorically worse than the same violations in distant segments.

(6) Some Questions for the theory of Dissimilation

a. What is the character of the constraint(s) driving dissimilation?
b. How is the notion of locality to be characterized in dissimilation, in the sense of what can stand between the target and trigger of the dissimilation process?
c. How are the constraint rankings that describe dissimilation similar in character to those describing assimilation?

2 Dissimilation as Local Conjunction

2.1 Lyman's law

(7) Lyman's Law in Rendaku

a. Rendaku voicing

iro+kami	→	irogami	'colored paper'
yo+sakura	→	yozakura	'blossoms at night'
e+tako	→	edako	'picture kite'

b. Rendaku blocked by Lyman's Law

kami+kaze	*kami+gaze	'divine wind'
mono+šizuka	*mono+jizuka	'tranquil'
siro+tabi	*siro+dabi	'white tabi'

OBSERVATION Morphemes contain at most one voiced obstruent. More generally, [αvoi] is contrastive in obstruents, but this contrast is limited to one obstruent per morpheme.

(8) Lyman's Law as self-conjunction of *[+voi]

a. &(*[+voi], *[+voi]) = $*[+voi]^2$ is violated when *[+voi] is violated more than once

b. $*[+voi]^2_{MCat}$ is applied to the segments of a morpheme

Note 1. Crucially, $*[+voi]^2$ is violated when *[+voi] is violated more than once *in obstruents* (voicing in sonorants does not block the application of Rendaku). One way to describe this fact is to self-conjoin the already complex constraint, *[-son] & *[+voi], i.e. &(*[-son] & *[+voi], *[-son] & *[+voi]) = $(*[-son] \ \& \ *[+voi])^2$. The basic constraint, *[-son] & *[+voi], is independently motivated, given the fact that voiced obstruents are marked in segmental inventories cross-linguistically.

(9) a. IDENT[αvoi] >> *[+voi]: obstruents have a surface voicing contrast

b. $*[+voi]^2_{MCat}$ >> IDENT[αvoi]: only one segment may be specified [+voi]

(10) Rendaku blocked by Lyman's Law: /kami+kaze/ → kami+kaze, *kami+gaze

Candidates	$*[+voi]^2_{MCat}$	RENDAKU	*[+voi]
☞ kami+kaze		*	*
kami+gaze	*!		**

RESULT OCP-effects derived from self-conjoined featural markedness constraint. Local conjunction of *[+voi] posits a threshold for number of voiced obstruents, effectively blocking the application of Rendaku in roots with voiced obstruents. Importantly, this result is derived regardless of the position of the voiced obstruent.

QUESTION Is the notion of locality relevant for local conjunction simply domain-based?

Note 2. There is a residual problem here, namely how to account for the fact that underlying voiced obstruents do not devoice to satisfy the dissimilatory constraint $*[+voi]^2_{MCat}$; so why do you get *kami+kaze*, and not *kami+gase*? The answer to this question involves considering the ranking of RENDAKU relative to the featural faithfulness constraints governing the realization of the underlying voice contrast. Suppose that the realization of underlying voicing (MAX[αvoi] in the theory defined in Lombardi 1996) is more important than the root-initial voicing characterizing Rendaku; realization of voicing in obstruents will therefore prevail over RENDAKU in satisfying the dissimilatory constraint, giving the desired effect in this class of examples.

2.2 Adjacency conditions

(11) Adjacency conditions on dissimilation rules

a. Head Adjacency (~Syllable Adjacency)
The target and trigger must be adjacent syllable heads (or in adjacent syllables).

b. Root Adjacency (Segment Adjacency)
The target and trigger must be adjacent root nodes.

References: Archangeli & Pulleyblank 1987, 1994, Steriade 1987, Myers 1987, Selkirk 1988, 1993, Odden 1994

(12) Dissimilation within a domain D
a. *Lyman's law in Japanese* (Itô & Mester 1986)
Morphemes in Yamato Japanese have at most one voiced obstruent.
b. *Liquid dissimilation in Georgian* (Fallon 1993)
r dissimilates to *l* when preceded by *r* in the word.
c. *NC dissimilation in Gurindji* (McConvell 1988)
Pairs of underlying NC clusters are resolved by dropping the nasal of the second cluster.

(13) Dissimilation under Head Adjacency
a. *Woleaian low vowel dissimilation* (Sohn 1971, 1975)
The first member of a pair of low vowels dissimilates to the corresponding mid vowel.
b. *Yimas rhotic dissimilation* (Foley 1991)
r dissimilates to *t* when the preceeding syllables contains an *r*.
c. *Dahl's law in Kikuyu* (Davy & Nurse 1982)
k dissimilates to *g* when the following syllable contains a voiceless obstruent.

(14) Dissimilation under Root Adjacency
a. *Arusa vowel raising* (Levergood 1987)
Mid vowels raise when they occur directly before a low vowel.
b. *Delabialization in Tashlhiyt Berber* (Jebbour 1985, Lasri 1991, Selkirk 1993)
Secondary [labial] is contrastive, yet labialized velars delabialize when they are directly preceded by a consonant specified for [labial].
c. *Rhotic dissimilation in Ainu* (Shibatani 1990)
r becomes *n* directly before another *r*

(15) Locality Relations

a. **Local Domains** (L_D):
Given two segments α and β, $\alpha L_D \beta$ iff α and β are contained in domain described as *D*.
(Here *D* ranges over MCat's like Root and MWd, and possibly prosodic categories.)

b. **Syllable Adjacency** (L_{SA}):
Given two segments α and β, $\alpha L_{SA} \beta$ iff α and β are contained in adjacent syllables.
(This relation is reflexive; a syllable is adjacent with itself.)

c. **Root Adjacency** (L_{RA}):
Given two segments α and β, $\alpha L_{RA} \beta$ iff α and β are adjacent segments.

(16) **Self-Conjunction ($C_1 = C_2 \equiv C$, C_1 & $C_2 \equiv C^2$) under Locality Relation *L***
If Cat_1 and Cat_2 are of the same category type,
and Cat_1 and Cat_2 stand in the locality relation *L*,
then C^2 is violated iff C is violated twice in Cat_1 and Cat_2.

2.2.1 *Case Study I: Woleaian a-Raising*

(17) Paradigms showing *a* → *e*

a.	/mata/	→	maat	'eye'	b.	ruwetab^w	'2 halves'
	/mata-ja/	→	metaj	1sg		ruweŋaf	'2 arm-lengths'
	/mata-mu/	→	metam	2sg		cf. ruwam^{w}ey	'2 groups'
	/mata-la/	→	metal	3sg			
	/mata-ca/	→	metaš	1pl incl	c.	xelago	'to make him come'
	/mata-mami/	→	matemam	1pl excl		xemm^{w}ašy	'to hold him'
	/mata-mii/	→	metami	2pl		cf. xab^{w}uutogo	'to make him go'
	/mata-jire/	→	metaar	3pl			

OBSERVATION (Sohn 1971, 1975) *a* dissimilates to *e* when the following syllable also contains *a*.

(18) Morphologically related words

a.	yefar	'shoulder'	b.	tepaŋi	'to help it'
	yaferai	'my shoulder'		xetapetap	'to support'
	yefaremam	'our shoulders'		xetapetepa	'to support it'
	gemmat	'bailor'		raŋeraŋ	'yellow'
	gammetal	'bailor of'		xeraŋeraŋ	'make yellow'
				xeraŋereŋa	'make it yellow'

OBSERVATION The site of *a*-Raising is predictable from a right-to-left scansion of the word, yaferai, cf. yefaremam.

(19) a. Self-conjunction of *Phar: &(*Phar, *Phar) = *Phar^2
b. *Phar^2 is defined for the Locality Relation of Syllable Adjacency (L_{SA})

INTERPRETATION A self-conjoined *Phar, defined for L_{SA}, characterizes the ill-formedness of two adjacent syllables containing low vowels.

(20) a. IDENT[Phar] >> *Phar: low/nonlow contrast
b. *Phar$^2{}_{SA}$ >> IDENT[Place]: bans two low vowels in adjacent syllables

(21) Interrupted Power Hierarchy for *Phar

Input: mata-l	*Phar$^2{}_{SA}$	IDENT[Place]	*Phar
matal	*!		**
☞ metal		*	*

RESULT In the first candidate, there are two vowels which stand in the locality relation of head adjacency which violate *Phar twice, which is fatal for this candidate. Importantly, this result depends crucially on a relation-based characterization of locality.

Note 3. There is a residue of problems here to be addressed in deriving the full dissimilatory process, essentially involving predicting which vowel will dissimilate. One problem involves accounting for medial *a*-Raising in a form like matemam, which has three syllable adjacent low vowels; medial *a*-Raising is a strainghtforward consequence of the principle of minimal violation of the featural faithfulness constraints: the only single application of *a*-Raising which will satisfy the dissimilatory constraint is for the medial vowel.

Also, there is the problem with deriving the alternating pattern, biasing the second and fourth syllables in a form like yefaremam. This problem requires an independent treatment in the theory defined here. One idea is to posit iambic foot structure, rendering the fourth and second syllables heads of iambs, and employ a set of Head Faithfulness constraints (see McCarthy 1995, Beckman 1995) to account for the fact that these vowels do not change.

2.2.2. *Case Study II: Arusa nonlow raising*

(22) a. *ea* → *ia* b. *oa* → *ua*

/il-ŋojine-ak/	→	ilŋojiniak	'hyenas'	/n-koshok-ak/	→	nkoshuak	'stomaches'
/n-kare-ak/	→	nkariak	'water (pl)'	/kitok-ak/	→	kituak	'big (pl)'
/ate-dek-a/	→	atedia	'I cursed'	/a-to-lok-a/	→	atotua	'I intercepted it'

OBSERVATION (Levergood 1987) Mid vowels raise to their corresponding high vowels when they directly precede a low vowel.

(23) a etanyokyena 'It was red' b atoodora 'I was tall'
elakwani 'People are very far away' todora 'I was red'

CLARIFICATION Mid vowels separated from a low vowel by a consonant do not raise.

(24) Major Articulatory Theory (Selkirk 1991, cf. Particle Theory approach à la Schane 1987)

a. Featural Classification

	Cor	Lab
Dor	i	u
Dor, Phar	e	o
Phar	a	

b. Input-Output Pairing

e/o a → i a
[D, P] [P] → [D] [P]

INTERPRETATION The first vowel of the VV sequences dissimilates its Phar specification before another pharyngeal vowel. In mid+low vowel sequences this involves droping the Phar in the mid vowel; in low+low VV sequences, this involves double linking of Phar.

(25) a. Self-conjunction of *Phar: &(*Phar, *Phar) = *Phar^2
b. *Phar^2 is defined for the Locality Relation of Root Adjacency (L_{RA})

INTERPRETATION A self-conjoined *[Phar], defined for L_{RA}, characterizes the ill-formedness of two adjacent vowels with a pharyngeal specification.

(26) a. IDENT[Place] >> *Phar: vowels have a height contrast
b. *Phar$^2_{RA}$ >> IDENT[Place]: bans two adjacent vowels with a Phar specification

(27) Interrupted Power Hierarchy for *Phar yields dissimilation of Phar

Input: e a [D P] [P]	*Phar$^2_{RA}$	IDENT[Place]	*Phar
e a [D P] [P]	*!		**
☞ i a [D] [P]		*	*

RESULT Root adjacent vowels dissimilate for their Phar specification.

Note 4. There is a rich residue of problems to be addressed in a full account of the patterns here. For example, why don't low vowels lose their Phar specification instead of the mid vowels raise. Two possible treatments come to mind: (i) Faithfulness to primary Phar is higher ranked than nonprimary Phar, *a* has a primary Phar, and so it doesn't change; (ii) Adding features is more costly than lossing features (DEP[F] >> MAX[F]), raising *a* to *i* will involve adding a coronal feature in the output, whereas raising *e* to *i* simply involves dropping Phar in the output.

Further, Why don't the low+mid vowel sequences trigger dissimilation? This fact has an independent account. One idea is that a gradual sonority fall in VV sequences is more harmonic than a marked fall, e.g. *ae* is more harmonic than *ai*; the constraints responsible for this outweigh the dissimilatory constraint, $*\text{Phar}^2_{RA}$.

(28) Contrasting Arusa with Woleaian

a. Arusa Dissimilation under L_{RA}

(i) *e a* → *i a*
o a → *u a*

(ii) *a a* → *e a*

b. Woleaian dissimilation under L_{SA}

(i) * *e...a* → *i...a*
**o...a* → *u...a*

(ii) *a...a* → *e...a*

OBSERVATION Dissimilation patterns are complementary.

INTERPRETATION It comes in two parts, Part 1 deals with the (lack of) dissimilation with mid vowels (31i), and Part 2 deals with the (lack of) dissimilation with the low vowels (31ii).

Part 1: It isn't enough that root adjacent vowels be partially dissimilar; any two violations of *Phar in adjacent vowels triggers dissimilation in Arusa. In Woleaian, dissimilation is triggered by a self-conjoined *1-Phar: since only low vowels have a *primary* Phar specification, only a pair of low vowels will dissimilate. One form of linguistic evidence supporting the distinction in the rank of Phar in mid vowels and low vowels is that mid vowels and high vowels pattern as a class that excludes low vowels in many types of height harmony; if this class is characterized by a primary dorsal specification, the necessary distinctions can be made.

Part 2: The same constraints are at work in (ii). Arusa licenses V-to-V spreading as a means of satisfying $*\text{Phar}^2_{RA}$; the same strategy is not available in Woleaian because the offending low vowels are nonadjacent.

(29) A Parallel in Tashlhiyt Berber Labial Dissimilation (Selkirk 1993)

Aorist	Preterit	Agent, sg.	Agent, pl.	
gru	g^wra	amgru	imgra	'glean'
g^wrd	g^wrd	amgrud	imgrad	'tame'
gg^w	gg^{w}a	tamggant	timgganin	'do the wash'
kru	k^{w}ra	amkray	imkrayn	'rent'

OBSERVATION (Jebbour 1985, Lasri 1991) In some varieties of Tashlhiyt Berber (Tiznit, Tidli), labialized velar dissimilate with a labial consonant directly preceding it.

(30) Dissimilation of [labial] assuming different rank

a.

i	m	g^w	r	a
	|	|		
	Lab	Dor		
		Lab		

b.

i	m	g	r	a
	|	|		
	Lab	Dor		

INTERPRETATION (Selkirk 1993) Under conditions of root adjacency, secondary Lab dissimilates with a primary Lab; under root adjacency a stronger form of dissimilation is exerted.

2.3 Summary and Implications

(31) Factorial Typology relative to Power Hierarchies

$*F^3_L$ >>	(iii)	>>	$*F^2_L$	>>	(ii)	>>	*F	>>	(i)
	↑				↑				↑
	Faith [F]				Faith [F]				Faith [F]

RESULT Permuting the rankings of the featural faithfulness constraint, Faith [F], relative to the markedness power hierarchy for *F gives three types of languages:

(i) one in which the feature [F] is not contrastive at all,
(ii) one in which [F] are restricted to one segment per local context,
(iii) and languages in which [F] contrasts are not restricted to a single segment per local context.

(32) A Typology relative to Locality Relations

$*F^2_{RA}$ >>	(iii)	>>	$*F^2_{SA}$ >>	(ii)	>>	$*F^2_{PrWd}$ >>	(i)
	↑			↑			↑
	Faith [F]			Faith [F]			Faith [F]

RESULTS Reranking Faith [F] relative to self-conjoined *F constraints ordered hierarchically by the locality relation they are defined for yields a clear cut typology for dissimilation processes:

(i) dissimilation within the domain of the word,
(ii) dissimilation in which the target and the trigger are in adjacent syllables,
(iii) and dissimilatin in which the target and the trigger are in adjacent segments.

(33) *Correlations in Featural Markedness Results, Part I*

- Featural Markedness derived by the presence of a constraint *F
- Dissimilatory effects derived by subordinating Faith[F] to a self-conjoined $*F^2$
- RESULT: Only 'marked' features will participate in dissimilation processes
  a. Example 1. *[-son] & *[+voi], but no analogous *[-son] & *[-voi]; the prediction then is that only voiced obstruents will participate in dissimilation processes because the theory only gives $(*[-son] \ \& \ *[+voi])^2$ as a dissimilatory constraint
  b. Example 2. The theory of the inventory gives us NOLONGVOWEL (Rosenthall 1994), but no analogous NOSHORTVOWEL; thus only long vowels will dissimilate by NOLONGVOWEL^2

(34) *Correlations in Featural Markedness Results, Part II*

- Featural markedness constraints are structured in meta-constraints on rankings, e.g., Prince & Smolensky's 1993 Markedness Subhierarchy for Place: *Lab >> *Dor >> *Cor
- The meta-constraint carries over to relations between power hierarchies, e.g. *Lab >> *Cor means that a labial is always worse than a coronal; thus two labials is worse than two coronals, i.e. $*Lab^2 >> *Cor^2$
- Certain entailments can therefore be derived in dissimilation patterns by considering the factorial typology of this markedness subhierarchy for $*Place^2$ and Faith(Place)
  RESULT: If a language dissimilates for Cor, it dissimilates for Lab.
  i. Faith(Place) >> $*Lab^2$ >> $*Cor^2$: No dissimilation
  ii. $*Lab^2$ >> Faith(Place) >> $*Cor^2$: Lab dissimilation, no Cor dissimilation
  iii. $*Lab^2$ >> $*Cor^2$ >> Faith(Place): Lab and Cor dissimilation

(35) Formal Parallels between Dissimilatory and Assimilatory Processes

a. **Dissimilation**, compelled by $*F^2$ where "F" = F_i

b. **Assimilation**, compelled by $*F^2$, where "F" ranges over F_i and $F_{i'}$

OBSERVATIONS The formal parallels between dissimilation and assimilation processes are rich:
(i) Both processes make reference to segments of the same natural class.
(ii) Both dissimilation and assimilation are subject to a set of locality conditions, often the *same* locality conditions.
(iii) Both processes effect loss of featural loss. In dissimilation, an underlying feature is deleted and an default one is put in its place. In assimilation, certain positional biases are exerted, with the effect of supplanting the featural specification of an underlying segment.

(36) The Role of Local Conjunction in Assimilation

	Input		Output	Operative Constraint
a.	*V C C V Place Place	→	V C C V Place	$*CPlace^2_{RA}$
b.	*C V C V C Place Place	→	C V C V C Place	$*VPlace^2_{SA}$

OBSERVATION (Beckman 1995, forthcoming) Assimilation, effected by featural spreading, is driven by featural markedness. Additional characteristics of assimilation or harmony rules receive an independent account. For example, the directionality of spreading is governed by positional biases, e.g. by Root Faith or Onset Faith (McCarthy & Prince 1995, Lombardi 1996).

(37) Some Schematic Rankings

a. Dissimilation
- $*F^2_L$ >> Faith[F]: More than one instantion of F in a local context defined by *L* is not allowed.
- STAY[F] >> $*F^2_L$: Spreading is not employed under pressure from $*F^2_L$

b. Assimilation
- $*F_C{}^2_L$ >> Faith[F_C]: More than one instantion of members of the major class of features F_C is not allowed in a local context defined by *L* .
- $*F_C{}^2_L$ >> STAY[F]: Spreading is employed under pressure from $*F_C{}^2_L$

OBSERVATION Dissimilation may be treated on a par with assimilation in that both involve local conjunction of featural markedness constraints, where the dissimilatory constraint targets a subset of the set of segments targeted in the constraint driving assimilation. The two classes of processes, radically different in surface form, are distinguished largely on the basis of the ranking of the anti-spreading constraint relative to the self-conjoined featural markedness constraint.

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