(Dis)Agreement by (Non)Correspondence

Inspecting the Foundations

Gunnar Ólafur Hansson

Department of Linguistics
University of British Columbia

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Outline

Deconstructing ABC: "A" vs. "C"

Agreement by Correspondence

as a model developed for long-distance consonant agreement (LDCA) phenomena (Walker 2000a,b, 2001; Rose and Walker 2000, 2004; Hansson 2001; Bennett 2013, etc.)

Agreement...

- a set of general (not very formalism-specific) claims:
  - LDCA is driven by constraints demanding featural **agreement** (≈ AGREE[F])
  - not by constraints that demand **spreading** (SPREAD[F], ALIGN[F])
  - agreement is sensitive to, and brought on by, **similarity** (shared features)

Similarity-based agreement constraints can be formalized in various ways—not necessarily involving a **correspondence** relation in the ABC sense

Deconstructing ABC: “A” vs. “C”

…by **C**orrespondence

- specific formal architecture
- central idea: connection between similarity (conditioning factor) and agreement (target configuration) is **mediated**, not direct
  - “middle man” is an abstract structural relation, $\mathfrak{R}$ (surface correspondence)

Correspondence relation as mediator

similarity → $\mathfrak{R}$ (CORR constraints)

$\mathfrak{R}$ → agreement (CC-IDENT[F] constraints)

Agreement with or without Correspondence

- Similarity-based agreement, schematically
  - **P** = x and y agree in [G, ...] (the similarity condition)
  - **Q** = x and y agree in [F] (the harmony imperative)
- **P** → **Q** (logical implication)
  - “if P holds, then Q holds as well”

Example: Laryngeal harmony in homorganic stops

P = x and y agree in [son, cont, Place]

Q = x and y agree in [constr.gl.]

P → **Q**

Agreement with or without Correspondence

Example: Laryngeal harmony in homorganic stops

P = x and y agree in [son, cont, Place]

Q = x and y agree in [constr.gl.]

P → **Q**

- "Pure" agreement as well-formedness
  - ban against (P & ¬Q) encapsulated in a single constraint
  - for analogous examples, see e.g. Pulleyblank (2002)
- $\text{AGREE[c.g.]}_{[\alpha\text{son},\beta\text{cont},\gamma\text{Place}]}$

$$\text{P} \xrightarrow{\text{AGREE[c.g.]}_{[\alpha\text{son},\beta\text{cont},\gamma\text{Place}]}} \text{Q}$$

Agreement with or without Correspondence

Example: Laryngeal harmony in homorganic stops

$\mathbf{P}$ = x and y agree in [son, cont, Place]

$\mathbf{Q}$ = x and y agree in [constr.gl.]

$\mathbf{R}$ = $x\mathfrak{R}y$ (the correspondence relation)

- Agreement by correspondence
  - ban against (P & ¬Q) by combination of two separate constraints
  - if P then R; $\mathbf{P} \rightarrow \mathbf{R}$ (= CORR)
  - if R then Q; $\mathbf{R} \rightarrow \mathbf{Q}$ (= CC-IDENT)
- CORR-[αson,βcont,γPlace]
- CC-IDENT[c.g.]

$$\mathrm{P} \xrightarrow{\text{CORR-[}\alpha\text{son,}\beta\text{cont,}\gamma\text{Place]}} \mathrm{R} \xrightarrow{\text{CC-IDENT[c.g.]}} \mathrm{Q}$$

ABC: Apportioning credit

How much is due to the "A" alone vs. to the "C" machinery?

Agreement gets us...

- inertness of intervening material (typically)
  - general absence of blocking effects
- **dissimilation** as alternative repair (Bennett 2013)
  - (with some limitations)
- **spreading** as alternative repair (Hansson 2010)
  - with possibility of blocking effects
  - and with profile distinct from other spreading processes

Agreement-driven dissimilation: Minding your Ps and Qs

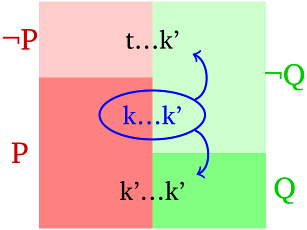
Example: Laryngeal harmony in homorganic stops

P = *x* and *y* agree in [son, cont, Place]

Q = *x* and *y* agree in [constr.gl.]

P → **Q**

- Prohibited structure: (P & ¬Q)
- Two conceivable repairs
  - change ¬Q to Q (assimilation)
  - change P to ¬P (dissimilation)



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  - and with profile distinct from other spreading processes

Agreement-driven spreading: Ends and means

- **Agreement** is a well-formedness **target** (an "end")
  - encoded in some Markedness constraint (AGREE[F], CC-IDENT[F])
  - can be achieved in multiple ways ("homogeneity of target, heterogeneity of process")
- **Spreading** is a type of **process** (a "means")
  - (strictly local) feature spreading/sharing/extension/etc. is one way of getting $C_1 \ldots C_2$ to agree in [F]
  - can emerge as the sole permitted repair strategy (in a given language)
  - no gapped structures assumed; spreading feature affects interveners too
- Profile of "agreement by spreading" (Hansson 2010)
  - susceptible to **blocking** (incompatible interveners)
  - spreading is **not myopic** (cf. Wilson 2006 on unbounded spreading); [F] does not spread up to blocker
  - spreading is **economical**; [F] does not continue past agreement target
- No time to go into details here; see Hansson (2010) for discussion and attested examples

ABC: Apportioning credit

How much is due to the "A" alone vs. to the "C" machinery?

Correspondence gives us...

- Constraint families already needed elsewhere (IDENT, mostly)
  - but many are missing/incompatible (MAX, DEP, LINEARITY, UNIFORMITY, CONTIGUITY, ...)
  - or lack counterparts elsewhere (CC-SYLLADJ, CC-EDGE)
- A **correspondence relation** $\mathfrak{R}$ that is
  - transitive (Bennett 2013); much more on this later
  - all-purpose (not sound-pattern-specific)
    - established by **any** CORR constraint
    - accessed by **all** CC-Limiter constraints
  - established on segment-by-segment basis, and by ranked + violable constraints **other** than the agreement imperative itself
    - individual (occurrences of) segments can opportunistically **opt out** of the harmonic class

Correspondence sets vs. autosegmental tiers: Advantages

Many advantages of correspondence sets over **tiers** as defined by autosegmental (feature-geometric) representations:

- Any **natural class** can in principle define a correspondence set
  - multiple, intersecting possibilities for classes
    - sibilants; same-voicing sibilants, same-voicing same-manner sibilants; same-voicing consonants; same-voicing homorganic consonants; etc.
  - no single feature geometry can accommodate all of these as tier-defined subsequences
- Loose relationship between agreement feature [F] and set of conditioning (shared) features
  - e.g. laryngeal harmony in all homorganic stops vs. in all stops
- No reliance on underspecification (contrastive or radical)
  - inert intervener can carry contrastive and marked value for [F] (contra Vaux 1999; Nevins 2005, 2010; see Hansson 2010 for examples)

Correspondence sets vs. autosegmental tiers: Disadvantages

But also some disadvantages in that comparison:

- Correspondence sets are **sets**, not tier-like **(sub)sequences**
  - but behave more like the latter in most (all?) relevant respects
  - pathologies arise if not treated as such
- A **single, all-purpose** partition into correspondence sets, which every agreement constraint references
  - weak (if any) empirical support for such “process-neutrality”
  - problematic cases attested
- Membership in correspondence set is **negotiable** (segment-token by segment-token)
  - due to ranked and violable nature of CORR-[F, G, ...] constraints
  - weak (if any) empirical support for this

“Tiers” redux: Projections

Projection

Any well-defined **class** of segments defines (**projects**) a **subsequence** of the output string, consisting of all and only the segments belonging to that class

e.g. the subsequence of a string *S* which results from “removing” all **non**-members of the natural class [+F, –G, +H] from *S*

Example

$S =$ tʃuzinɛs

Some projections of *S*:

[αPlace]	tʃ…z…n…s	[+strid, αcont]	z…s
[+strid]	tʃ…z…s		tʃ
[+strid, αvoi]	tʃ…s	*(etc.)*	
	z		

Agreement by projection?

A modest proposal

Individual agreement constraints single out (stipulate) a particular **projection** on which they are to be evaluated

> and "disagreement" constraints? (≈ OCP[F], *pace* Bennett 2013; cf. Pulleyblank 2002)

Agreement (disagreement) is evaluated for pairs of segments that are **adjacent** on the prescribed projection

- Closely related to the "tier" notion in the **Tier-based Strictly Local** (TSL) class in formal language theory (Heinz et al. 2011; cf. Kevin McMullin's talk today)
  - in effect, each (dis)agreement constraint references a TSL_2 language
  - the reference tier varies from constraint to constraint

"ABP" vs. ABC

- Projection-based agreement ("ABP"?)
  - conflates the work of (high-ranked) CORR constraints and CC-IDENT[F] into **a single constraint**

Example

*** [–F] [+F] $_{[\alpha G,\ \beta H]}$**

*** [–F] [+F]** $_{[\ldots]}$	≈	CC-IDENT[F]	(or $C_R C_L$-IDENT[+F])
*[…][…] $_{[\alpha G,\ \beta H]}$	≈	CORR-[αG, βH]	

Comparing scenarios

"ABP"	**ABC**
$*[–F][+F]_{[\alpha G,\ \beta H]}$	{ CC-IDENT[F], CORR-[αG, βH] }
|	|
IO-IDENT[F]	IO-IDENT[F]
$*[–F][+F]_{[\alpha G,\ \beta H]}$	{ CC-IDENT[F], CORR-[αG, βH] }
|	|
IO-IDENT[F]	IO-IDENT[F]
|	|
$*[–F][+F]_{[\alpha G]}$	CORR-[αG]

What is $\mathfrak{R}$?

- Arguably the most formally coherent definition (see Bennett 2013):
  - $\mathfrak{R}$ is an **equivalence relation**

Properties of $\mathfrak{R}$

reflexive ($x\mathfrak{R}x$)

symmetric (if $x\mathfrak{R}y$, then $y\mathfrak{R}x$)

transitive (if $x\mathfrak{R}y$ and $y\mathfrak{R}z$ then $x\mathfrak{R}z$)

- $\mathfrak{R}$ defines a **partition** of the set of segments contained in the output string into non-overlapping, non-empty subsets: **correspondence sets**
  - within each such correspondence set, every member is a correspondent of every member, including itself

Excursus: Strings vs. sets

String

A **string** is a finite totally ordered (multi)set. We can define an output string S as the pairing $(Seg, \prec)$, where Seg is the (multi)**set** of output segments that occur in S and $\prec$ is the (strict) linear precedence relation.

Example

S = souʃəlɪzeɪʃən

Seg = {s, ʃ, ʃ, z, l, n, ɪ, eɪ, oʊ, ə, ə}

$\prec$ = {(s,oʊ), (s,ʃ), (s,n), (ʃ,z), (z,ʃ), ...}

- The correspondence relation $\mathfrak{R}$ is a relation on Seg, not on S as such
  - defines a partition of Seg into equivalence classes

Correspondence sets

Correspondence set

Let S be an output string of length k, and let Seg be the (multi)set of k output segments (occurrences) contained in S. Then $C \subseteq Seg$ is a **correspondence set** iff for any pair of segments $x, y \in C$, it is the case that $x\mathfrak{R}y$. In other words, C is a correspondence set if it is one of the **equivalence classes** that the relation $\mathfrak{R}$ partitions Seg into.

- Bennett (2013) uses the term “correspondence class” for this notion.

Example

$S = \mathrm{s_x oʊ_y ʃ_x ə_y l_z ɪ_y zeɪ_y ʃ_x ə_y n_z}$

The correspondence sets for S (exhaustive list):

{ s, ʃ, ʃ } { l, n }
{ oʊ, ə, ɪ, eɪ, ə } { z }

Correspondence sets and string-based relations

- The correspondence sets defined by $\mathfrak{R}$ are unordered **sets**: subsets of *Seg*, not subsequences of *S*
- Corollary of $\mathfrak{R}$ being defined as an **equivalence relation**
  - reflexivity, symmetry, transitivity
- Reference to **non**-symmetric, **non**-reflexive or **non**-transitive relations among members of a correspondence set (e.g. linear precedence, within-set "adjacency") must be made **indirectly**

Definitions of CC-Limiter constraints must often include conditions in terms of relations **other** than $\mathfrak{R}$

weakens the parallel with other correspondence dimensions (IO, BR)
makes "correspondence sets" less like (sub)sets and more like (sub)sequences (= **projections**!)

Remainder of talk

- Identifying and illustrating some problematic properties of the correspondence notion
  - pathological consequences (some with stipulative fixes, others with no obvious solution)
  - weak empirical support
- The sore points
  - **all-purposeness** of $\mathfrak{R}$
  - **transitivity** of $\mathfrak{R}$
  - **violability** of $\mathfrak{R}$ (as such) — not covered here

All-purposeness of $\mathfrak{R}$

- Fundamental ingredient of ABC: a **single, all-purpose** $\mathfrak{R}$ relation, regardless of which CORR constraint is imposing it.
  - $\mathfrak{R}_{\text{CORR-[F,...]}} = \mathfrak{R}_{\text{CORR-[G,...]}}$
  - CC-Limiter constraints (e.g. CC-IDENT) cannot be sensitive to **which** set of shared features brings C_1 and C_2 into correspondence
- Certain things that only CC-Limiter constraints can reference (not CORR constraints), such as **linear order**
  - $C_R C_L$-IDENT[+F] vs. $C_R C_L$-IDENT[–F]
  - prohibit $[–F]_x \ldots [+F]_x$ and $[+F]_x \ldots [-F]_x$, respectively

Intractable cases

Impossible to selectively **prevent** harmony for a specific **combination** of similarity criterion (set of shared features) and linear-order configuration

not a problem for “ABP”: each agreement constraint **is** such a combination (and can be demoted as needed)

Similarity and linear order: Kiga sibilant harmony

- (Ru)Kiga: regressive sibilant harmony in [±anterior] (Hyman 1999; Hansson 2001; cf. Bennett and Pulleyblank's talk later today)
- Linear-order asymmetry emerges (*[+ant]…[–ant] vs. ✓[–ant]…[+ant])
  - but only for different-voicing pairs, not same-voicing pairs
  - (same goes for long-range vs. transvocalic pairs, incidentally)

	[+strid, αvoi]	[+strid, ~~αvoi~~]
[+ant]…[–ant]	harmony	harmony
[–ant]…[+ant]	harmony	**no harmony**

Similarity and linear order: Kiga sibilant harmony

- Harmony not enforced in different-voicing [–ant]…[+ant] sequences (Taylor 1959)

-ʃanzire	'spread out (perf.)'
-ʃá:zja	'bully; leave over'
aka-ʃúzi	'bug'
omw-eʃezi	'cattle-waterer'

		Corr-[+strid, αvoi]	Corr-[+strid]
		[+strid, αvoi]	[+strid, ~~αvoi~~]
$C_R C_L$-Ident[–ant]	[+ant]…[–ant]	harmony	harmony
$C_R C_L$-Ident[+ant]	[–ant]…[+ant]	harmony	**no harmony**

- Neither Corr-[+strid] nor $C_L C_R$-Ident[–ant] can be demoted below IO-Faith without collateral damage
  - dismantling harmony in the adjoining cell as well

Kiga sibilant harmony: Ranking paradox

Evidence from same-voicing [–ant]…[+ant] pairs:

/ʃ…s/	$C_R C_L$-IDENT[+ant]	CORR-[+str]	IO-IDENT[+ant]	IO-IDENT[–ant]
$s_x…s_x$				*
∼ $ʃ_x…s_x$	W			L

Evidence from different-voicing [+ant]…[–ant] pairs:

/s…ʒ/	$C_R C_L$-ID[+ant]	CORR-[+str]	IO-ID[+ant]	IO-ID[–ant]
$ʃ_x…ʒ_x$			*	
∼ s…ʒ		W	L	

Winner for /ʃ…z/ needs to be either [$ʃ_x…z_y$] or [$ʃ_x…z_x$]

/ʃ…z/	$C_R C_L$-ID[+ant]	CORR-[+str]	IO-ID[+ant]	IO-ID[–ant]
$ʃ_x…z_x$	*			
∼ $s_x…z_x$	L			W

/ʃ…z/	$C_R C_L$-ID[+ant]	CORR-[+str]	IO-ID[+ant]	IO-ID[–ant]
$ʃ_x…z_y$		*		
∼ $s_x…z_x$		L	W	

Correspondence sets are not (sub)sequences

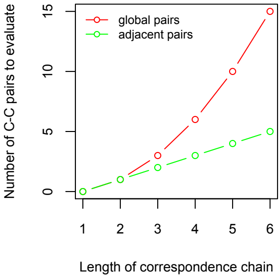
- A **correspondence set**, as defined by transitive $\mathfrak{R}$, is a **set**
  - each member is a correspondent of each other member
  - each pairing of correspondents should be subject to evaluation by CC-Limiter constraints
- A subsequence—such as a **projection**—is a **string**
  - **adjacency** is an inherent notion (i.e. adjacency in that subsequence)
  - no *a priori* reason to expect interaction between non-adjacent segments

Transitive $\mathfrak{R}$ must be curtailed

- Problems with unrestricted transitive $\mathfrak{R}$
  - combinatorics of CC-Limiter evaluation
  - wrong predictions for transvocalic/syllable-adjacent agreement
  - “solution”: make CC-Limiter definitions more restrictive
- Problems with making $\mathfrak{R}$ non-transitive Details
  - combinatorial explosion of hypothesis space (correspondence configurations)
  - stipulating restrictions creates other pathological predictions

Transitivity of $\mathfrak{R}$: Combinatorics

- With transitive $\mathfrak{R}$, the number of correspondent pairs to evaluate grows **quadratically** in the size of the correspondence set
  - number of pairs in **set** of n elements: $\binom{n}{2} = \frac{n(n-1)}{2}$
- With subsequences (projections), the number of relevant (i.e. adjacent) pairs grows **linearly** in the length of the subsequence
  - number of adjacent pairs in **subsequence** of n elements: $n - 1$



The problem with quadratic constraints

Heinz et al. (2005) on undesirable properties of quadratic constraints (e.g. gradient ALIGN)

- Constraints whose number of (potential) violations grows quadratically with the length of a word
  - make various anomalous predictions (Eisner 1997; McCarthy 2003)
  - are categorically more powerful than most other constraints that phonologists employ
  - are formally too complex to compute optimization over (with any of the current proposals for doing so; see Riggle 2004)

“Adjacency” and CC-IDENT[F]

- For pathologies arising from global-pair (vs. “adjacent”-pair) evaluation of CC-IDENT[F], see Hansson (2007)
  - majority-rule effects of certain kinds
  - parity (odd vs. even cardinality of correspondence set) starts to matter

CC-IDENT[F] (simplified from Hansson 2007)

Let X and Y be segments in the output, such that

1. $X \mathfrak{R} Y$; and
2. there exists no segment Z in the output such that $X \prec Z \prec Y$ and $X \mathfrak{R} Z$.

If X is [αF], then Y is also [αF].

- But see next section for cases where even this “fix” does not suffice Go

Transitive $\mathfrak{R}$ must be curtailed

- Problems with unrestricted transitive $\mathfrak{R}$
  - combinatorics of CC-Limiter evaluation
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  - “solution”: make CC-Limiter definitions more restrictive
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Transvocalic harmony in multi-segment correspondence sets

Nasal consonant harmony in **Bemba** (Bantu; Kula 2002)

- Applicative /-il/:
  - /-som-ik-il-a/ → -so**m**eke**l**a ‘plug for’ (p. 148)
  - /-tan-il-a/ → -ta**n**i**n**a ‘refuse for’ (p. 146)
  - /-no:n-il-a/ → -**n**o:**n**e**n**a ‘sharpen for’ (p. 153)
  - /-palam-il-a/ → -pala**m**i**n**a ‘get closer to’ (p. 146)
- Completive /-ilil/:
  - /-kan-ilil-a/ → -ka**n**i**n**i**n**a ‘refuse totally’ (p. 146)
- Reciprocal /-an/ as trigger:
  - /-kak-an-il-a/ → -kaka**n**i**n**a ‘become difficult for’ (p. 148)
  - /-kum-an-il-a/ → -ku**m**a**n**i**n**a ‘be [numerous] enough’ (p. 148)
  - /-no:n-an-il-a/ → -**n**o:**n**a**n**i**n**a ‘sharpen e.o. for’ (conjectured form)

Transvocalic harmony: Regulating locality

- Option 1: Separate CC-Limiter constraint
  - PROXIMITY (Rose and Walker 2004)
    “If $x\mathfrak{R}y$, then x and y must be in adjacent syllables.”
  - ≈ CC-SYLLADJ (Bennett 2013)
- Option 2: “Window” restriction on CORR constraints (Hansson 2001; Bennett 2013)
  - e.g. CORR_{CVC}-[cons,voi]
  - no demand for correspondence in beyond-transvocalic pairs; hence no agreement for such pairs

PROXIMITY with transitive $\mathfrak{R}$: Wrong predictions

Incorrect predictions for transvocalic harmony systems (e.g. Bemba):

Sequence Type	*Example*	*Actual Output*	*Predicted?*
…NvR…	/-tan-il-a/	ta**nina**	✓
	/-kak-an-il-a/	kaka**nina**	✓
…NvRvR…	/-kan-ilil-a/	ka**ninina**	ka**nilila**
…RvNvR…	/-palam-il-a/	pala**mina**	pala**mila**
…NvNvR…	/-no:n-il-a/	**no:nena**	**no:nela**
	/-kum-an-il-a/	ku**manina**	ku**manila**
…NvNvNvR…	/-no:n-an-il-a/	**no:nanina***	✓
…RvNvNvR…	/-palam-an-il-a/	pala**manina***	✓
…RvRvNvR…	/-lu:l-an-il-a/	**lu:lanina***	✓

* = conjectured forms

PROXIMITY with transitive ℜ: Sequence of targets

Example: /-kan-ilil-a/ → -ka**n**i**n**i**n**a 'refuse totally' (...NvRvR...)

/-kan-ilil-a/			PROXIMITY	CORR-[cons, +voi]	$C_L C_R$-ID[nas]	OI-ID[nas]
a.		kanilila		∗∗∗!		
b.		$kan_x il_x il_x a$	∗!		∗∗	
c.	☹	$kan_x in_x in_x a$	∗!			∗∗
d.		$kan_x in_x ila$		∗∗		∗!
e.	☞	$kanil_x il_x a$		∗∗		

- Correspondence set with > 2 members violates PROXIMITY
  - (assuming 1 member per syllable, as in the CV sequences here)
- In chains of 3, one segment must opt out of correspondence; which one?
  - choice falls to low-ranked IO-FAITH considerations

Harmony fails to apply to a **sequence of targets** in successive syllables

PROXIMITY with transitive $\mathfrak{R}$: Preceding C interferes

Example: /-palam-il-a/ → -**palamin**a 'get closer to' (...RvNvR...)

/-palam-il-a/		PROXIMITY	CORR-[cons, +voi]	$C_L C_R$-ID[nas]	OI-ID[nas]
a.	palamila		***!		
b.	$pal_x am_x il_x a$	*!		**	
c. ☹	$pal_x am_x in_x a$	*!			**
d. ☞	$pal_x am_x ila$		**		
e.	$palam_x in_x a$		**		*!

Harmony fails to apply if trigger is **preceded** by a segment belonging to the harmonizing class (here: either N or R)

actual criterion is "...preceded by **an odd number** of segments..."!

PROXIMITY with transitive $\mathfrak{R}$: Even-parity correspondence sets

Example: /-lu:l-an-il-a/ → -**lu:lanin**a ‘praise e.o. for’ (…RvRvNvR…)

/-lu:l-an-il-a/		PROXIMITY	CORR-[cons, +voi]	$C_L C_R$-ID[nas]	OI-ID[nas]
a.	lu:lanila		*****!*		
b.	$l_x u{:}l_x an_x il_x a$	*!**		*	
c.	$l_x u{:}l_x an_x in_x a$	*!**			*
d.	$l_x u{:}l_x an_x ila$	*!	***		
e. ☞	$l_x u{:}l_x an_y in_y a$		****		*

- Four-member correspondence set = 6 C↔C pairs. If obeying PROXIMITY, minimum number of CORR violations is 4
  - by partitioning into two 2-member chains: $C_1 \mathfrak{R} C_2$ and $C_3 \mathfrak{R} C_4$
  - C_3 is thus cleared to interact with C_4

Harmony **does** apply if trigger is preceded by **an even number** of segments belonging to the harmonizing class

Solution: Going beyond $\mathfrak{R}$

- Again: confining CC-Limiter evaluation to correspondents that are "adjacent" within the correspondence set

CC-SyllAdj (paraphrased from Bennett 2013)

Let X and Y be segments in the output, such that

1. X $\mathfrak{R}$ Y
2. there exists no segment Z in the output such that X $\prec$ Z $\prec$ Y and X $\mathfrak{R}$ Z

and let σ_X and σ_Y denote the syllables containing X and Y, respectively.

There exists no syllable σ_Z such that $\sigma_X \prec \sigma_Z \prec \sigma_Y$

- Restrictions like these effectively "undo" the transitivity attributed to $\mathfrak{R}$
- And they are not always sufficient...

Correspondence without similarity

Recall: a **single, all-purpose** $\mathfrak{R}$ relation, regardless of which CORR constraint is contributing it

- e.g. $\mathfrak{R}_{\text{CORR-[F,...]}} = \mathfrak{R}_{\text{CORR-[G,...]}}$
- Therefore, given a sequence $\ldots C_1 \ldots C_2 \ldots C_3 \ldots$
  - if $C_1 \mathfrak{R} C_2$ by CORR-[F,...]
  - and $C_1 \mathfrak{R} C_3$ by CORR-[G,...]
- then $C_2 \mathfrak{R} C_3$ **by transitivity alone**
  - even if C_2, C_3 share neither [F] nor [G], and are thus **below** the similarity threshold of either CORR constraint

Pathological prediction:

Agreement (or dissimilation) between C_x and C_y that is **parasitic** on the presence of a co-occurring “proxy” segment (C_z)

Pathologies of $\mathfrak{R}$: Agreement by proxy

Hypothetical voicing harmony system:

- Only **homorganic** obstruent pairs participate
  - CORR-[–son, αPlace] ≫ OI-IDENT[voi] ≫ CORR-[–son]
- Regressive voicing harmony: only **voiceless...voiced** sequences affected
  - { C_RC_L-IDENT[voi] , CORR-[–son, αPlace] } ≫ OI-IDENT[voi]

/s...d/	CORR-[-son, αPlace]	C_RC_L-ID[voi]	OI-ID[voi]	CORR-[-son]
a. s...d	*!			*
b. s_x...d_x		*!		
c. ☞ z_x...d_x			*	

Pathologies of $\mathfrak{R}$: Agreement by proxy

Hypothetical voicing harmony system:

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  - CORR-[–son, αPlace] ≫ OI-IDENT[voi] ≫ CORR-[–son]
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  - { C_RC_L-IDENT[voi] , CORR-[–son, αPlace] } ≫ OI-IDENT[voi]

/s...g/	CORR-[-son, αPlace]	C_RC_L-ID[voi]	OI-ID[voi]	CORR-[-son]
a. ☞ s...g				*
b. $s_x ... g_x$		*!		
c. $z_x ... g_x$			*!	

Pathologies of $\mathfrak{R}$: Agreement by proxy

Hypothetical voicing harmony system:

- Only **homorganic** obstruent pairs participate
  - CORR-[–son, αPlace] ≫ OI-IDENT[voi] ≫ CORR-[–son]
- Regressive voicing harmony: only **voiceless...voiced** sequences affected
  - { $C_R C_L$-IDENT[voi] , CORR-[–son, αPlace] } ≫ OI-IDENT[voi]
- Additional ingredient: high-ranked demand for correspondence in same-manner, same-voicing pairs (CORR-[αcont, βvoi])
  - e.g. [s...x], [d...g], [g...g]
  - ought to be irrelevant for voicing harmony (since these pairs already agree in voicing)
  - but alas, the allpurposeness and transitivity of $\mathfrak{R}$ makes it not so...

Pathologies of $\mathfrak{R}$: Agreement by proxy

- Recall: no harmony in heterorganic pairs like /s…g/

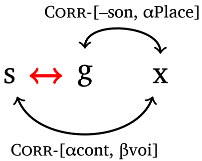
/sago/		CORR-[αcont, βvoi]	CORR-[-son, αPlace]	$C_R C_L$-ID[voi]	OI-ID[voi]	CORR-[-son]
a. ☞	sago					*
b.	$s_x a g_x o$			*!		
c.	$z_x a g_x o$				*!	

- But /s…g/ **will** undergo harmony if /x/ is nearby!

/s…g…x/		CORR-[αcont, βvoi]	CORR-[-son, αPlace]	$C_R C_L$-ID[voi]	OI-ID[voi]
a.	s…g…x	*! (s,x)	*! (g,x)		
b.	$s \ldots g_x \ldots x_x$	*! (s,x)		*	
c.	$s_x \ldots g_x \ldots x$		*! (g,x)		
d.	$s_x \ldots g_x \ldots x_x$			*!	
e. ☞	$z_x \ldots g_x \ldots x_x$				*

Agreement by proxy: Solutions?

Correspondence



$C_R C_L$-IDENT[+voi] accesses **any** linked pair, even across CORR dimensions

Projections

[–son, αPlace] …g x…

[αcont, βvoi] …s x…

*[–voi][+voi]$_{\text{[–son, αPlace]}}$ accesses a projection with **no** […s g…] sequence

> Here restricting evaluation of CC-IDENT[F] to “adjacent” pairs (Hansson 2007, cf. earlier) is of no help whatsoever
>
> [s…g] **are** “adjacent”, so fall under $C_R C_L$-IDENT[+voi] regardless

Conclusions

- **Agreement** is well-supported as the well-formedness target underlying long-distance consonant assimilation (LDCA)
  - even for *prima facie* problem cases (e.g. evidence for spreading/blocking)
  - and probably for many non-LDCA phenomena (e.g. much of dissimilation; and more?)
- Less clear that the same is true for **correspondence** in the ABC sense
  - typology of LDCA, as well as computational (incl. learnability) considerations, point more in the direction of “tier”-like structures
  - subsequences of the output string, formalizable as **projections** of (natural) segment classes
- Much work yet to do to reconcile the “ABP” notion with other considerations
  - e.g. the typological profile of LDCA vs. dissimilation (Bennett 2013)

References I

Bennett, William. 2013. Dissimilation, consonant harmony, and surface correspondence. Doctoral dissertation, Rutgers University.

Eisner, Jason. 1997. What constraints should OT allow? Paper presented at the 71st Annual Meeting of the Linguistic Society of America, Chicago, January 1997. [ROA-204 (talk handout)].

Hansson, Gunnar Ólafur. 2001. Theoretical and typological issues in consonant harmony. Doctoral dissertation, University of California, Berkeley.

Hansson, Gunnar Ólafur. 2006. Locality and similarity in phonological agreement. Paper presented at the Current Perspectives on Phonology workshop, Indiana University, June 23, 2006.

Hansson, Gunnar Ólafur. 2007. Blocking effects in agreement by correspondence. *Linguistic Inquiry* 38 (2): 395–409.

Hansson, Gunnar Ólafur. 2010. Long-distance voicing assimilation in Berber: spreading and/or agreement? In *Actes du Congrès de l'ACL 2010 / 2010 CLA Conference Proceedings*, ed. Melinda Heijl. Canadian Linguistic Association. `http://homes.chass.utoronto.ca/~cla-acl/actes2010/actes2010.html`.

Heinz, Jeffrey, Greg Kobele, and Jason Riggle. 2005. Exploring the typology of quantity-insensitive stress systems without gradient constraints. Paper presented at the 79th Annual Meeting of the Linguistic Society of America, Oakland, January 2005..

References II

Heinz, Jeffrey, Chetan Rawal, and Herbert G. Tanner. 2011. Tier-based strictly local constraints for phonology. In *Proceedings of the 49th Annual Meeting of the Association for Computational Linguistics*, 58–64. Portland, OR: Association for Computational Linguistics.

Hyman, Larry M. 1999. Towards a history of “sibilant harmony” in Western Lacustrine Bantu. Seminar presentation, University of California, Berkeley, September, 1999.

Kula, Nancy Chongo. 2002. The phonology of verbal derivation in Bemba. Doctoral dissertation, Leiden University.

McCarthy, John J. 2003. OT constraints are categorical. *Phonology* 20: 75–138.

Nevins, Andrew. 2005. Microvariations in harmony and value-relativized parametrization. *Linguistic Variation Yearbook* 5: 119–164.

Nevins, Andrew. 2010. *Locality in vowel harmony*. Cambridge, MA: MIT Press.

Pulleyblank, Douglas. 2002. Harmony drivers: no disagreement allowed. In *Proceedings of the 28th annual meeting of the Berkeley Linguistics Society*, eds. Julie Larson and Mary Paster, 249–267. Berkeley, CA: Berkeley Linguistics Society.

Riggle, Jason. 2004. Generation, recognition and learning in finite-state optimality theory. Doctoral dissertation, University of California, Los Angeles.

References III

Rose, Sharon, and Rachel Walker. 2000. Consonant agreement at a distance. Paper presented at the 31st meeting of the North Eastern Linguistic Society, Georgetown University, October 2000..

Rose, Sharon, and Rachel Walker. 2004. A typology of consonant agreement as correspondence. *Language* 80: 475–531.

Taylor, Charles. 1959. *A simplified Runyankore-Rukiga-English and English-Runyankore-Rukiga dictionary*. Nairobi: The Eagle Press (East African Literature Bureau).

Vaux, Bert. 1999. Does consonant harmony exist? Paper presented at the 73rd Annual Meeting of the Linguistic Society of America, January 1999..

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 26th annual meeting of the Berkeley Linguistics Society*, eds. Lisa Conathan, Jeff Good, Darya Kavitskaya, Alyssa Wulf, and Alan C. L. Yu, 321–332. Berkeley, CA: Berkeley Linguistics Society.

Walker, Rachel. 2001. Consonantal correspondence. In *Proceedings of the Workshop on the Lexicon in Phonetics and Phonology (Papers in Experimental and Theoretical Linguistics 6)*, eds. Robert Kirchner, Joe Pater, and Wolf Wikeley, 73–84. Edmonton: Department of Linguistics, University of Alberta.

References IV

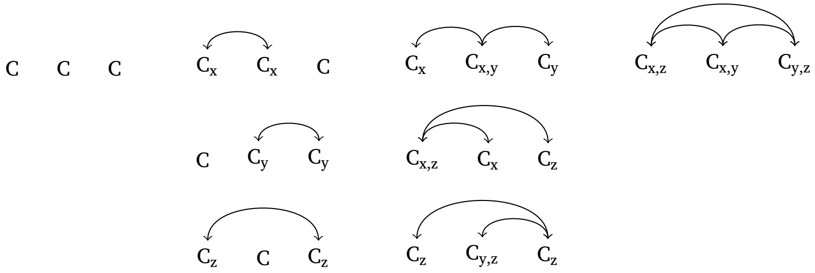
Wilson, Colin. 2006. Unbounded spreading is myopic. Paper presented at the Current Perspectives on Phonology workshop, Indiana University, June 23, 2006. [Slides at http://www.linguistics.ucla.edu/people/wilson/Myopia2006.pdf].

Problems with transitive $\mathfrak{R}$: Conceivable solutions

- Make $\mathfrak{R}$ non-transitive (Hansson 2001, 2006) Back
  - combinatorial explosion of possible correspondence configurations
  - a learnability problem (configurations have different CC-Limiter implications)
- Make $\mathfrak{R}$ non-transitive, with hard restrictions imposed
  - e.g. banning one-to-many and many-to-one relations (in the precedence dimension)
  - cf. the C_LC_R-INTEGRITY and C_LC_R-UNIFORMITY of Hansson (2006); here these would have to be hard restrictions on GEN
    - in effect: imposing (literal) "chain" structure $C_x \ldots C_{x,y} \ldots C_{y,z} \ldots C_{z,w} \ldots$ on all multi-correspondent sets
  - (A **tier** by any other name...)
  - and even this gives rise to oddities!

Non-transitive, unrestricted $\mathfrak{R}$: Combinatorial explosion

- Without the transitivity restriction, the number of possible correspondence configurations becomes very large very fast
  - for an output with n consonants, this number is $2^{\binom{n}{2}}$



Non-transitive, unrestricted $\mathfrak{R}$: Combinatorial explosion

- Without the transitivity restriction, the number of possible correspondence configurations becomes very large very fast
  - for an output with *n* consonants, this number is $2^{\binom{n}{2}}$

Number of consonants in output	Number of distinct correspondence configurations	
	Transitive $\mathfrak{R}$	Non-transitive $\mathfrak{R}$
1	1	1
2	2	2
3	5	8
4	15	64
5	52	1,024
6	203	32,768

- That is a lot of hidden-structure options to keep track of!

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  - (A **tier** by any other name…)
  - and even this gives rise to oddities!

Non-transitive correspondence chains: Competition for $\mathfrak{R}$

- General assumption in ABC: hierarchies of CORR constraints
  - e.g. CORR-[F,G,H] $\gg$ CORR-[F,G] $\gg$ CORR-[F]
- Recall: $\mathfrak{R}$ is still a single, all-purpose relation
- The imposed restriction on correspondence configurations creates implications among correspondence pairings
  - e.g. in a C...C...C sequence, not every C can correspond to every other C
  - if $C_1 \mathfrak{R} C_3$ then $\neg C_1 \mathfrak{R} C_2$ and $\neg C_2 \mathfrak{R} C_3$(etc.)
- Creates **competition** among CORR constraints for "access" to $\mathfrak{R}$
  - higher-ranked CORR constraints lay stronger claim to correspondence than lower-ranked ones
  - satisfying CORR-[F,G] for one C-C pair may come at the cost of violating CORR-[F] for a different C-C pair, forcing the latter **not** to correspond (and hence not to harmonize)

Non-transitive correspondence chains: Odd predictions

- Ineseño-like sibilant harmony system: fricatives and affricates alike participate
  - { Corr-[+strid] , CC-Ident[ant] } ≫ IO-Ident[ant]
- Assume that correspondence imperative is stronger for more similar (same-manner) than less similar (different-manner) pairs
  - Corr-[+strid, αcont] ≫ Corr-[+strid]

/katʃaso/	Corr-[+strid, αcont]	Corr-[+strid]	CC-Id[ant]	IO-Id[ant]
a. katʃaso		*!		
b. $\text{katʃ}_{x}\text{as}_{x}\text{o}$			*!	
c. ☞ $\text{kats}_{x}\text{as}_{x}\text{o}$				*

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  - CORR-[+strid, αcont] ≫ CORR-[+strid]

/satʃako/	CORR-[+strid, αcont]	CORR-[+strid]	CC-ID[ant]	IO-ID[ant]
a. satʃako		*!		
b. $s_x$at$ʃ_x$ako			*!	
c. ☞ $ʃ_x$at$ʃ_x$ako				*

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/satʃaso/			CORR-[+strid, αcont]	CORR-[+strid]	CC-ID[ant]	IO-ID[ant]
a.		satʃaso	*!	**		
b.		$s_x$atʃ$_{x,y}$as$_y$o	*!	*	**!	
c.	☹	$s_x$ats$_{x,y}$as$_y$o	*!	*		*
d.	☞	$s_z$atʃas$_z$o		**		

Non-transitive correspondence chains: Odd predictions

- Ineseño-like sibilant harmony system: fricatives and affricates alike participate
  - { CORR-[+strid] , CC-IDENT[ant] } ≫ IO-IDENT[ANT]
- Assume that correspondence imperative is stronger for more similar (same-manner) than less similar (different-manner) pairs
  - CORR-[+strid, αcont] ≫ CORR-[+strid]
- End result:
  - harmony applies in /tʃ…s/, as well as in /s…tʃ/ (or /ʃ…ts/)
  - but no harmony in /s…tʃ…s/!
  - likewise, /ʃ…tʃ…s/ → [s…tʃ…s] (not [s…ts…s])