Relational Hierarchies in OT

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1. Introduction: kinds of markedness

Not all markedness constraints are alike. While some are context-free, (*ŋ), others evaluate markedness in context (*[$_\sigma$ ŋ). The purpose of this paper is to investigate a subtype of context-sensitive constraints: relational markedness. These constraints assess markedness by comparing two elements in a structure. I propose a theory of relational constraints in Optimality Theory (Prince and Smolensky 1993), and apply it to Syllable Contact (SC).

SC expresses a preference for a coda to exceed the following onset in sonority (Davis 1998, Hooper 1976, Murray and Vennemann 1983, Vennemann 1988). What makes SC relational is that it does not simply require onsets to be as obstruent as possible, and codas to be as sonorant as possible. Rather, coda and onset sonority are evaluated simultaneously. Furthermore, like other sonority constraints, SC is argued here to be hierarchical: the markedness of a coda-onset sequence incrementally increases with the sonority rise (*at.ra* ≻ *at.wa*) and decreases with the sonority fall (*al.ta* ≻ *an.ta*). I discuss evidence that languages can vary rather minimally in the degree of sonority distance they require.

The paper is organized as follows. In section 2, I discuss relational constraints. In section 3, the general formalism of relational alignment is developed. Section 4 presents the typological predictions of the SC hierarchy and applies the theory to alternations in Sidamo. Section 5 is the conclusion.

2. What are relational constraints?

A relational constraint evaluates the difference between two elements along some parameter. For example, Prince's (1990) GROUPING HARMONY compares the weight of the second syllable of the foot to the weight of the

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first, and expresses a preference for a 2:1 ratio. GrpHarm must see the entire foot—it cannot assess violations by looking at just one syllable.

In the phonological domain, GrpHarm is just one example of a relational constraint. There are several relational hierarchies for consonant sequences based on the sonority hierarchy: Onset Sonority Distance (Baertsch 1998) and SC, which is the subject of this paper. Relational constraints have also been proposed for syntax. Aissen (1999) presents a constraint hierarchy that requires the subject to be higher on the person hierarchy than the object (based on evidence from Nocte, Tibeto-Burman).

A common thread in all these cases is that a prominent position is being compared with a non-prominent position with respect to some scale: sonority, tone, person. The need to refer to both positions simultaneously is explored further in the next section.

3. SC as a relational hierarchy

3.1. Onset and coda sonority constraints do not produce SC effects

SC is best satisfied when the coda is maximally sonorant and the onset is minimally sonorant.[1] In this, it echoes the well-known constraints on onset and coda sonority (Clements 1990, Hankamer and Aissen 1974, Prince and Smolensky 1993, Zec 1995). Some theories question the necessity of a separate principle whose sole purpose is to sort out *adjacent* codas and onsets. For example, Clements (1990) proposes that SC follows from the more general Sonority Dispersion Principle.

Davis (1998) argues that SC is necessary. Onset and coda sonority constraints fall short of producing SC effects, because they are not sensitive to adjacency. Davis' evidence comes from onset alternations in Kazakh. In Kazakh, onsets cannot exceed adjacent codas in sonority, but onset sonority is otherwise unrestricted. This pattern, exemplified below, requires reference to the entire coda-onset sequence.

In Kazakh, onsets of all levels of sonority are permitted word-initially and/or after vowels (1). Stops (a,b, f), fricatives (e), nasals (b,c,d), laterals (d), rhotics (c), and glides (a,g) are all found in these positions:

(1) *Kazakh onsets, word-initially or after vowels* (Davis 1998)

a.	kijar	'cucumber'	d.	alma-lar	'apples'
b.	koŋɯz	'bug'	e.	syjek	'bone'
c.	murin	'nose'	f.	alma-ga	'apple+direct'

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[1] That is, apart from cases where SC is vacuously satisfied, e.g. in the absence of a coda-onset sequence that consists of two consonants. A simple vowel-onset sequence or a geminate does not violate SC at all.

Following certain codas, some of these onsets are allowed as well (2). Lateral onsets may follow glides and rhotics (a,b), and nasal onsets may follow glides, rhotics, and laterals (c-e). (Obstruent onsets can follow codas of any sonority—see Gouskova (2002) for more discussion.)

(2) *Kazakh onsets after codas of higher sonority*

a.	/kijar-lar/	kijar.lar	'cukes'	c.	/mandaj-ma/	mandaj.ma	'foreh.+int.'
b.	/mandaj-lar/	mandaj.lar	'foreheads'	d.	/kijar-ma/	kijar.ma	'cuke+int.'
				e.	/kol-ma/	kol.ma	'hand+int.'

However, there are some codas that lateral and nasal onsets cannot follow (3). After a coda of equal (a,b) or lower sonority (c-f), nasal and liquid onsets desonorize:

(3) *Kazakh nasal and liquid onsets after codas of equal or lower sonority*

a.	/kol-lar/	kol.dar	'hands'	d.	/murin-lar/	murin.dar	'noses'
b.	/murin-ma/	murin.ba	'nose+int.'	e.	/koŋɯz-ma/	koŋɯz.ba	'bug+int.'
c.	/koŋɯz-lar/	koŋɯz.dar	'bugs'	f.	/syjek-ma/	syjek.pe	'bone+int.'

Davis notes that this pattern is straightforward in relational terms: an onset in Kazakh must be lower in sonority than the preceding coda, but otherwise onset sonority is unrestricted. Thus, coda-onset sonority is not allowed to be flat, and this relational prohibition (*DISTANCE 0, defined in section 3.4 below) dominates faithfulness (4).

(4) *Onsets desonorize following codas of equal or lower sonority*

/murin-ma/	*DISTANCE 0	IDENT [F]
a. ☞ murinba		*
b. murinma	*!(n.m)	

Faithfulness, in turn, dominates all the non-relational constraints on onset sonority. (These constraints, if undominated by Faithfulness, would prohibit sonorant onsets regardless of position[2]—see 3.3 below.) Thus, when not adjacent to codas of equal or lower sonority, onsets surface faithfully (5).

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[2] The onset sonority hierarchy (also Prince and Smolensky's margin hierarchy) predicts: 1) languages that have only obstruent onsets, or even no onsets at all, 2) languages in which intervocalic sonorants should syllabify as codas, while obstruents should syllabify as onsets. Despite these problematic predictions, the preference for obstruent onsets is well-supported. There is independent evidence for it from Sanskrit reduplication (Parker 2002, Steriade 1988) and from L1 acquisition (Gnanadesikan 1995/to appear).

(5) *Onset sonority is irrelevant in other positions*

/murin /	IDENT[F]	*ONS/N
a. ☞ murin		*
b. burin	*!	

What about the non-relational alternative? Suppose there are no sequence constraints that require contours (as argued for tone in DeLacy 1999). The Kazakh pattern would have to be triggered by the non-relational onset and coda sonority constraints, and be blocked in all cases where desonorization does not apply. It is precisely this blocking that is problematic.

Recall that desonorization must be blocked word-initially, intervocalically, and after consonants of higher sonority (1)-(3). These environments do not form a class. The word-initial position may be protected from desonorization by IDENT-σ1 (Beckman 1998), which would prevent /murin/ from becoming *[burin]. Intervocalic onsets may be similarly protected, perhaps by a faithfulness constraint from the Licencing-by-Cue framework (Steriade 1999). However, there is no plausible explanation for why lateral onsets should be protected after [r] and [j] but not after [n] or [z] codas, or why nasal onsets should be banned after nasals and obstruents. What happens to nasals and laterals depends on the adjacent consonant, and this dependence cannot be captured without some sort of sequence constraints, which brings us back to SC.

Sequential constraints are necessary to account for cases where X is not banned outright, but only when it is adjacent to Y. Cases like this abound: in Icelandic and Faroese, a stop is an acceptable coda when it precedes a nasal onset (Far. [b̥a^{h}t.na]), but not when it precedes a rhotic or a glide onset (Far. [ai.^{h}trantɪ], (Gouskova 2002). In Kirgiz, both sonorants and obstruents can occur intervocalically or word-initially, but after a coda, only obstruents are allowed. All of these cases receive a unified explanation under sequential, relational constraints.

Exactly how these sequential constraints should be expressed formally is the subject of the next section.

3.2. The formalization of relational markedness constraints

I argue that SC and other relational principles are hierarchies of constraints that evaluate the distance between elements (adjacent at some level) along a natural scale. These constraints directly refer to the scale and are derived from it in CON by a general mechanism similar to Prince and Smolensky's (1993) Harmonic alignment.

The need for relational constraints to refer to groups of sequences with the same distance (e.g. *DIST 0: ‘no *p.t*, *w.j*, *n.m*, etc.’) rather than to sequences themselves (*P.T, *W.J, *N.M, etc.) is discussed in Gouskova

(2002), so it will not be addressed here. My second claim is that relational constraints are hierarchical, and that they are derived from natural scales.

The hierarchical nature of SC and other relational constraints is supported by typological evidence. Languages can choose different degrees of distance along the same hierarchy. In the literature on SC, the hierarchy view is not standard. Most research[3] espouses what I will call the Two-Constraint Theory of SC (Bat-El 1996, Davis and Shin 1999, Davis 1998, Rose 2000). In this view, there are just two SC constraints: one banning sonority rise, and another requiring sonority to drop. These constraints do not derive from the sonority scale, but rather refer to it indirectly. As a result, their predictions are not rich enough to accommodate the typology of SC effects.

3.3. Onset and coda sonority constraints and Harmonic alignment

Sequential constraint hierarchies arise from scales that evaluate in isolation, and capture the following generalization: *the relational markedness of a sequence is proportional to the cumulative markedness of its individual components.* The markedness of individual elements in a sequence, in turn, is determined by their position on the relevant harmonic scales, which are derived by Harmonic alignment.

Harmonic alignment (Prince and Smolensky 1993) is a general schema for deriving constraint hierarchies from linguistic scales by combining a binary and a multi-valued scale. For example, the more prominent *moraic* position will gravitate towards the more prominent, sonorant end of the sonority scale, while the *non-moraic* position (onset) will gravitate towards the less prominent non-sonorant end. This association of sonority and syllable position is directly encoded in a pair of harmonic scales.

Harmonic alignment is formally defined in (6). Taking the pair of prominence scales in (7), Harmonic alignment returns the harmonic scales (8) and (9). The first of these scales entails that the less sonorous an onset, the more harmonic it is. The second scale entails a preference for sonorous codas.

(6) Suppose given a binary dimension D_1 with a scale $X > Y$ on its elements {X, Y}, and another dimension D_2 with a scale $a > b > \ldots > z$ on its elements. The *Harmonic alignment* of D_1 and D_2 is the pair of Harmony scales:
H_X: $X/a \succ X/b \succ \ldots \succ X/z$ [more harmonic … less harmonic]
H_Y: $Y/z \succ \ldots \succ Y/b \succ Y/a$ (Prince and Smolensky 1993: 136)

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[3] Notable exceptions are Baertsch (2002) and Ham (1998), who also propose hierarchical theories of SC, though different from this one. See Gouskova (2002).

(7) *Moraicity scale*: Coda> Onset, or Moraic > non-moraic
Sonority scale (Jespersen 1904): glides > rhotics > laterals > nasals > voiced fricatives > voiced stops > voiceless fricatives > voiceless stops
Abbreviated as: w> r > l > n > z > d > s > t

(8) *Onset Sonority scale*
Ons/t ≻ Ons/s ≻ Ons/d ≻ Ons/z ≻ Ons/n ≻ Ons/l ≻ Ons/r ≻ Ons/w

(9) *Coda (Mora) Sonority scale*
μ/w ≻ μ/r ≻ μ/l ≻ μ/n ≻ μ/z ≻ μ/d ≻ μ/s ≻ μ/t

Harmonic scales, which state the preference for a position to be filled by a element of a certain type, are converted into the negatively stated, universally fixed *constraint* hierarchies by Constraint Alignment (10).

The constraint hierarchies in (11)-(12) are fixed with respect to each other, but can be interspersed with markedness and faithfulness constraints. For example, if FAITH is ranked below *μ/Z but above *μ/N, then the ranking allows only sonorants to be moraic in coda position. Other cutoff points are possible, too, for both onsets and codas, so these hierarchies predict fine-grained variation between languages (but see fn. 2.)

(10) The *Constraint alignment* is the pair of constraint hierarchies:
C_X:*X/Z >> … *X/B >> *X/A[more marked >> … >> less marked]
C_Y:*Y/A >> *Y/B >>…>>*Y/Z (Prince and Smolensky 1993: 136)

(11) *Onset Sonority constraint hierarchy* (cf. Gnanadesikan 1995/to appear)
*ONS/W>>*ONS/R>>*ONS/L>>*ONS/N>>*ONS/Z>>*ONS/D>>*ONS/S>>*ONS/T

(12) *Coda (Mora) constraint hierarchy* (cf. Morén 1999, Zec 1995)
*μ/T >>*μ/S >> *μ/D >> *μ/Z >> *μ/N >> *μ/L >> *μ/R >> *μ/W

As shown in section 3.1, these non-relational coda and onset sonority constraints cannot subsume SC. This is because they penalize all occurrences of particular onsets and codas, not just adjacent ones. Thus, *nap.ma* is just as bad as *ma.nap* as far as onset and coda sonority go, but only *nap.ma* has a SC problem.

A relational hierarchy based on harmonic scales should have the same fine-grained control as the hierarchies (11)-(12), which I argue is necessary to account for the SC typology. Another property that relational hierarchies should have is the ability to evaluate the markedness of the sequence while ignoring the markedness of its individual members. For SC, this means that all of the sequences that have the same sonority distance should be treated the same, whether they be *s.n, p.l, z.r*, or *b.w*. I propose a mechanism that creates hierarchies with these properties called *Relational alignment*.

3.4. Relational alignment

Relational alignment picks up where Harmonic alignment leaves off, and combines two harmonic scales into a single *relational scale*. The SC scale entails that the relation between a coda and an adjacent onset is the more harmonic, the less marked the onset and the coda. Several different coda/onset combinations can be equally harmonic: for example, *an.za* and *al.na* have the same sonority drop of 1. Because of this, the relational scale will be partially ordered: it will contain strata of configurations that have the same relational markedness, in this case the same sonority profile.

Relational alignment, formally defined in (13), is a general schema for determining the relational markedness of sequences. Where an onset/coda combination falls on the relational scale will depend on the cumulative harmony of the onset and coda sonority. If both of the elements in the configuration are relatively well-formed, then so will the relation be. The best coda (a glide) followed by the best onset (a voiceless stop onset) will form the most harmonic relation, followed by {rhotic coda/voiceless stop onset, glide coda/voiceless fricative onset}, and so on.

To keep track of where the individual elements stand in their harmonic scales, they are assigned indices (e.g. glide coda=1, stop onset=1, etc.). The harmony of the relation is determined by the sum *s* of these indices: if both elements are high up in their harmonic scales, then their relation will have a high harmony index.[4]

The number of strata in the relational scale depends on the length of the two harmonic scales that are being aligned: it is equal to the sum of the scale lengths minus one, which in the case of SC is 8 + 8 – 1 = 15 strata. This formula combines the onset and coda harmonic scales (8)-(9) to yield the stratified relational scale in (14). (For the reader's convenience, the sonority rise (e.g. +4) and the sonority drop (e.g. –2) is indicated under each stratum.)

(13) The *Relational alignment* of two harmonically aligned scales H_X $(X_1 \succ ... X_n)$ and H_Y $(Y_1 \succ ... Y_m)$ is the relational scale $\text{stratum}_1 \succ \ldots \text{stratum}_{n+m-1}$, where stratum $_s = \{X_iY_j \mid i + j = s+1\}$.

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[4] The 1 is added to *s* because the indices of the two most harmonic levels, here t/ons and w/coda, which form level 1 of the relational hierarchy, already add up to 2. Thus, the first level, t/ons-w/coda, will contain the elements whose *s*= i+j=2, but the index of the level itself is *s*–1=1.

(14) *The SC scale*

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
w/t≻	w/s≻	w/d≻	w/z≻	w/n≻	w/l≻	w/r≻	w/w≻	r/w≻	l/w≻	n/w≻	z/w≻	d/w≻	s/w≻	t/w
	r/t	r/s	r/d	r/z	r/n	r/l	r/r	l/r	n/r	z/r	d/r	s/r	t/r	
		l/t	l/s	l/d	l/z	l/n	l/l	n/l	z/l	d/l	s/l	t/l		
			n/t	n/s	n/d	n/z	n/n	z/n	d/n	s/n	t/n			
				z/t	z/s	z/d	z/z	d/z	s/z	t/z				
					d/t	d/s	d/d	s/d	t/d					
						s/t	s/s	t/s						
							t/t							
–7	–6	–5	–4	–3	–2	–1	0	+1	+2	+3	+4	+5	+6	+7

The relational harmony scale translates into a constraint hierarchy by Constraint Alignment (15). Each constraint in the hierarchy refers to some *stratum* in (14), not to an *individual configuration* *N.Z, *L.N.[5] Thus, each *DISTANCE constraint prohibits all the sequences with a particular sonority distance. The resulting SC constraint hierarchy is given in (16). The highest-ranked constraints in the hierarchy prohibit coda-onset sequences with a maximal degree of sonority rise. The lowest ranked constraints ban sequences with the greatest degree of sonority drop.

(15) The *Constraint Alignment* of the relational scale $stratum_1 \succ \ldots stratum_n$ is the hierarchy *DIST M >> *DIST M–1>> …*DIST 0…>>*DIST –M,

where $M = \frac{n+1}{2} - 1$.

*DIST M bans the configurations in stratum *n*, *DIST M–1 bans the configurations in stratum *n*–1, etc.

(16) *DIST +7>>*DIST +6>>*DIST +5>>*DIST +4>>*DIST +3>>*DIST +2>>*DIST+1 >>*DIST 0>>*DIST –1>>*DIST –2>>*DIST –3>>*DIST –4>>*DIST –5>>*DIST –6>>*DIST –7

The Relational alignment schema is hypothesized to be part of the structure of CON in Optimality Theory, along with Harmonic alignment. Its relation to constraint alignment and Harmonic alignment are summarized in (17). A binary and a multi-valued scale are converted into a pair of harmonic scales by Harmonic alignment. Then, the scales are converted into a pair of non-relational constraint hierarchies, and relationally aligned and then converted into a single relational constraint hierarchy.

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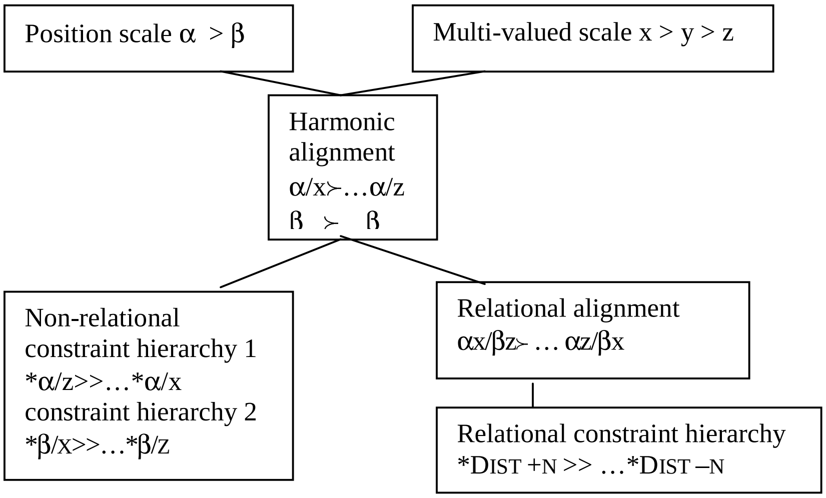
[5] This is a major difference between Local Conjunction approaches to relational hierarchies (Aissen and Baertsch) and Relational alignment (Gouskova 2002).

(17) *Harmonic and relational alignment in CON*



Fixed constraint hierarchies make certain predictions, to which I now turn. Specifically for SC, I discuss the typology that results when the hierarchy interacts with other OT constraints.

4. Case studies: the typological predictions of the hierarchy

The constraints within the SC hierarchy are in a universally fixed ranking, but they can be freely interspersed with other markedness and faithfulness constraints. The result is that languages can vary incrementally with respect to acceptable sonority distance by selecting different cutoff points along the hierarchy. Thus, some languages are predicted to allow sonority to rise but cap the degree. Icelandic and Faroese are languages of this sort (Gouskova 2002). Others will let sonority be flat but ban it from rising (Kazakh, section 3.1). Still others will require sonority to drop, and set a minimum on how much the drop must be (Sidamo, Kirgiz).

(18) *Languages select different cutoff points*

←————————————rise——flat——drop————————→
...*D+5>>*D+4>>*D+2>>*D+1>>*D0>>*D–1>>*D–2>>*D–3>>*D–4...
↑ ↑ ↑ ↑ ↑
Icel. Faroese Kazakh Sidamo Kirgiz

The hierarchy approach also makes an implicational prediction: all other things being equal, the presence of the marked implies the presence of the unmarked. For example, if a language allows *at.na*, it must allow *at.sa* and *an.ta*, but not necessarily *ak.la* and *ak.wa*. These predictions are borne out in Kazakh (section 3.1), where only heterosyllabic sequences with a sonority drop of at least 1 are well-formed. The next section discusses Sidamo, which minimally differs from Kazakh in requiring sonority to drop at least 2 points along the sonority scale. This kind of variation, I argue, is impossible in the non-hierarchical Two-Constraint Theory.

4.1. Sidamo: a minimum on sonority drop

In Sidamo (Hudson 1995, Rice 1992, Vennemann 1988), metathesis and gemination conspire to accomplish the same goal: ensuring that heterosyllabic sonority drops at least 2 points on the surface. Sequences with the sonority drop of 2 or more surface faithfully (19). However, underlying obstruent-sonorant sequences metathesize to avoid rising sonority (20), while sequences of two obstruents or two sonorants, in which sonority drops less than 2 points, geminate (21). For convenience, sonority distance is indicated next to each output form, except for geminates (fn.1).

(19) *Sufficiently dropping sonority: just place assimilation* (Moreno 1940)

/maɾ-tôti/	maɾ.tôti (–5)	‘non andare’
/ful-te/	ful.te (–5)	‘essendo tu uscito’
/qaram-tino/	qaran.tino (–4)	‘essa si afflisse’

(20) *Sonority rise: metathesis*

/duk-nanni/	duŋ.kanni (–4)	‘portano’
/hutʃ-nanni/	hun.tʃanni (–4)	‘pregano’
/has-nemmo/	han.semmo (–3)	‘cerchiamo’
/hab-nemmo/	ham.bemmo (–2)	‘dimentichiamo’

(21) *Insufficient sonority drop: gemination*

/af-tinonni/	affinonni (—)	‘avete visto’
/lelliʃ-tôti/	lelliʃʃôti (—)	‘non mostrare’
/ful-nemmo/	fullemmo (—)	‘usciamo’
/maɾ-nonni/	marronni (—)	‘andarono’
/um-nommo/	ummommo(—)	‘we have dug’ (Bender 1976)

The generalization for Sidamo is that sonority must drop at least 2 points. If sonority rises, metathesis is used. Whenever metathesis fails to produce the necessary improvement, gemination is deployed instead.

This conspiracy arises from the conflict between the SC hierarchy on the one hand and the constraints against heteromorphemic metathesis (ANTECEDENCY (Horwood, this volume)) and gemination (IDENT-F, *GEMINATE) on the other.

Constraints against rising sonority (*DIST+7-*DIST+1) compel metathesis by dominating ANTECEDENCY. The obstruent and sonorant swap places, and the resulting output has dropping sonority (at the expense of a faithfulness violation). Tableau (22) only shows that *DIST+2 dominates ANTECEDENCY, but all the higher-ranked *DIST constraints also dominate it through transitivity. Any sequence with rising sonority will metathesize.

(22) *Metathesis for rising sonority*: *DIST +2>> ANTECEDENCY

/hab$_1$-n$_2$emmo/	*DIST +2	ANTECEDENCY
g.☞ham$_2$.b$_1$emmo		*
h. hab$_1$.n$_2$emmo	*!	

Metathesis cannot improve inputs with flat sonority, and actually makes things worse for falling sonority inputs: /af-tinonni/ → [affinonni], *[atfinonni] 'avete visto.' Their sonority violations are instead resolved by gemination.

(23) *Flat and dropping sonority*: *DIST–1>>IDENT[F],*GEMINATE

/af-tinonni/	*DIST–1	IDENT [F]	*GEMINATE
a. af.tinonni	*!		
b. ☞af.finonni		*	*

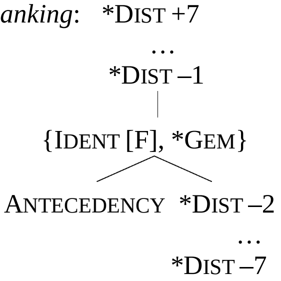
Gemination could be used across the board, but isn't: /has-nemmo/ → hypothetical *[has.semmo]. This is because constraints against gemination dominate ANTECEDENCY, so gemination is employed only when metathesis fails.

(24) *Metathesis is preferred to gemination*: IDENT [F], *GEM >> ANTECED.

/has-nemmo/	IDENT [F]	*GEM	ANTECEDENCY
a. has.semmo	*!	*	
b. ☞han.semmo			*

The summary ranking for Sidamo is given in (25). Notice how the *DIST hierarchy is interrupted by Faithfulness, resulting in a threshold effect.

(25) *Sidamo Ranking*:



Sidamo supports the detailed hierarchy view of SC: not only must sonority drop—it must drop 2 points or more. This result is impossible in theories of SC that view it as a simple requirement for sonority to drop (Davis and Shin 1999, Davis 1998, Rose 2000): they predict that inputs with falling sonority, e.g. /ful-nemmo/, should surface faithfully, since a faithful parse would satisfy the constraint that requires sonority to drop:

(26) *Two-Constraint Theory: cannot distinguish degrees of son. drop*

/ful-nemmo/	‘Sonority must drop’	Ident [F]
a. ☞ (wrong winner) fulnemmo (–1)	✓	
b. (actual winner) fullemmo (—)	✓	*

The case of Sidamo makes another point: only *relative sonority* matters for SC. Thus the alternations affect all clusters with the same sonority profile, even though they might be quite different in terms of segmental content (e.g., *ʃ.t* and *l.n*, which both geminate). The sonority of the individual onsets and codas is not as important as the overall sonority shape of the sequence, just as expected in the relational *DISTANCE theory.

5. Conclusion

Relational hierarchies as conceived here are detailed enough to produce the necessary distinctions for Syllable Contact, and are argued to be an improvement upon the overly restrictive Two-Constraint Theory (Bat-El 1996, Davis and Shin 1999, Davis 1998, Rose 2000). In order to account for the range of attested distinctions, the Two-Constraint Theory must resort to powerful language-specific constraints (see, for example, Rose’s (2000) analysis of Chaha dialects). However, under the Relational hierarchy theory, fine-grained variation with respect to sonority distance is expected and supported by the typology. This brings Syllable Contact back into the fold with other sonority constraints, which are widely assumed to be hierarchical: nucleus sonority, coda sonority, onset sonority distance.

Syllable Contact belongs to a class of context-sensitive sequence constraints. These constraints do not evaluate in isolation—instead, they compare adjacent positions with respect to a scale. These relational constraints are not sensitive to the individual properties of the compared elements—instead, they evaluate the overall shape of the sequence.

The theory of relational constraints proposed here is general, not meant for Syllable Contact alone. Any natural scale can give rise to a relational hierarchy, just as natural scales give rise to non-relational constraint hierarchies in Prince and Smolensky (1993). All of the relational hierarchies discussed in section 2 can be derived by Relational alignment, without

Local Conjunction: person-subject hierarchy in syntax (Aissen 1999), onset sonority distance (Baertsch 1998), tone (DeLacy 1999), and others.

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