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Retroflex Harmony in Kalasha: Agreement or Spreading?[*]

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1. Introduction

In this paper we investigate co-occurrence restrictions on coronal consonants in Kalasha (Indo-Aryan), evaluating two current theories of consonant harmony: local feature spreading (Gafos 1999) and long distance agreement by correspondence (Hansson 2001; Rose & Walker 2004). Our study reveals that Kalasha roots exhibit a pattern of retroflex consonant harmony (and possibly coronal consonant harmony, more broadly) that is sensitive to the relative similarity of coronals in terms of their manner of articulation. We argue that the data are consistent with the typology and predictions of the agreement by correspondence model, which encodes featural similarity, but are not predicted by the feature spreading model in its current form.

2. Background: Retroflex Consonant Harmony

Retroflex consonant harmony is an assimilatory effect or co-occurrence restriction holding between consonants that are separated by a vowel, and possibly other segments, resulting in identical retroflex or non-retroflex features/gestures on those consonants.

Previously identified cases of retroflex consonant harmony involve either coronal stops or coronal sibilants (affricates and/or fricatives). For instance, in Malto (Dravidian), coronal stops within a root must be either retroflex or dental, as illustrated in (1). In Gimira (Afro-Asiatic), posterior sibilant affricates and/or fricatives within a root must be either retroflex or palato-alveolar, as illustrated in (2).

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(1) Retroflex harmony in Malto (Mahapatra 1979; Hansson 2001)

a.	ʈuːɖ	‘tiger’	dudu	‘mother’
	ɖanɖa	‘staff’	toːtotri	‘quickly’

b. *ʈ...t, *d...ɖ, etc.

(2) Retroflex harmony in Gimira (tones omitted) (Breeze 1990; Rose & Walker 2004)

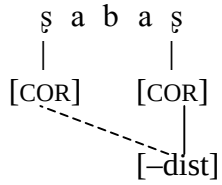
a.	ʂaʂ	‘vein’	ʃatʃ	‘stretcher’
	ʈʂ’uʈʂ’	‘louse’	ʧ’aʃt	‘be pierced’

b. *ʂ…ʃ , *ʧ…ʈʂ, *ʂ…ʧ, etc.

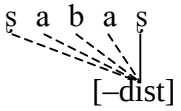
Current theories of consonant harmony can be classified into two broad groups: those that treat harmony as feature *spreading* and those that treat it as feature *agreement*. In feature spreading models, the harmonic feature spreads locally to segments that are adjacent (in some sense) within a given domain. All segments within the domain that are contrastive for the spreading feature are either triggers, targets or blockers of harmony. In one variation of this approach, adjacency is defined in terms of autosegmental tiers, as in (3a). According to this definition, intervening segments are transparent to harmony if they are underspecified for the relevant tier, which is the coronal tier in (3a) (Shaw 1991). In another variation of the spreading approach, adjacency is defined in strict segmental terms, as illustrated in (3b). According to this view, the spreading feature permeates all intervening segments in the harmony domain. Intervening segments may appear transparent if the spreading feature has little or no audible effect on them (Gafos 1999).

(3) Harmony as local feature spreading

a. Tier-based locality

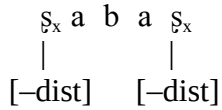


b. Strict segmental locality



A competing model of consonant harmony is known as agreement by correspondence, or simply ABC (Hansson 2001; Rose & Walker 2004). In this model, a correspondence relation is established between segments in an output string based on their relative similarity. Agreement for the harmonic feature is enforced between corresponding segments. Segments that do not enter into the correspondence relation are transparent. The ABC model is illustrated in (4), where coindexation represents the correspondence relation.

(4) Harmony as feature agreement by correspondence (ABC)



Both models of consonant harmony can account for the patterns of retroflex harmony exhibited in languages like Malto and Gimira. In these languages, retroflex harmony holds between all coronal segment types that exhibit contrastive retroflexion. However, in each case the contrast between retroflex and non-retroflex consonants is limited to one manner class: either to stops, as in Malto (5a), or to (a subset of) sibilant affricates and fricatives, as in Gimira (5b).

(5) Coronal obstruents in Malto (a) and Gimira (b) (Mahapatra 1979; Breeze 1990)

a.

ʈ ɖ	ʈ ɖ	
		tɕ dʑ
s ð		

b.

t t’ d	t^{j} t’^{j} d^{j}			
ts ts’			ʈʂ ʈʂ’	tʃ tʃ’
s z	s^{j} z^{j}	s^{w}	ʂ ʐ	ʃ ʒ

The two models make different predictions about harmony in languages where retroflexion is contrastive for both stops *and* sibilant affricates and fricatives. The ABC approach relies crucially on featural similarity of participating segments. Thus, it predicts that consonants sharing the same manner of articulation (e.g., two stops, two fricatives, etc.) are more likely to harmonize than consonants with different manners of articulation (e.g., a stop and a fricative, etc.). The spreading approach does not encode similarity, and, consequently, does not predict similarity effects. Rather, all segments contrastive for retroflexion – regardless of manner – are expected to participate in the harmony.

Until now, these predictions have not been tested, largely due to the fact that languages with contrastive retroflexion in stops, affricates and fricatives are typologically rare (Maddieson 1984) and relatively under-studied. In this paper we present new data from a language of precisely this kind. The data have an important bearing on the theoretical debate concerning the mechanisms of retroflex consonant harmony.

3. Coronal Obstruent Contrasts in Kalasha

Kalasha is an Indo-Aryan language of the Dardic sub-group spoken in northern Pakistan. It has a rich inventory of coronal obstruents that includes dental and retroflex stops, affricates, and fricatives, as well as ‘palatal’ (i.e., alveolopalatal) affricates and fricatives, as shown in (6) (based on Bashir 2003; Heegård & Mørch 2004; Mørch & Heegård 1997; Trail & Cooper 1999).

(6) Coronal obstruents in Kalasha

dental	retroflex	palatal
t t^{h}	ʈ ʈ^{h}	
d (d^{ɦ})	ɖ (ɖ^{ɦ})	
ts ts^{h}	ʈʂ ʈʂ^{h}	tɕ tɕ^{h}
dz	ɖʐ	dʑ (dʑ^{ɦ})
s	ʂ	ɕ
z	ʐ	ʑ

In a collection of notes on the historical development of Kalasha consonants, Morgenstierne (1973: 201) observed a few cases of "assimilation at a distance", most of them involving retroflexion (e.g., ʂiʂ 'head' < *ɕiːʂ). To the best of our knowledge Morgenstierne's passing observation is the only reference to Kalasha consonant harmony in the published literature. The present study is the first attempt to investigate the full extent of consonant harmony in the language.

4. A Study of Retroflex (Coronal) Harmony in Kalasha

4.1 Method

To determine whether Kalasha shows synchronic co-occurrence restrictions on coronal obstruents, we compiled a corpus of roots with relevant consonants. The data was drawn from an updated copy of the electronic database used by Trail and Cooper (1999) for their dictionary of Kalasha. An initial search of the data revealed 591 instances of word-initial C_1VC_2 sequences, where both C_1 and C_2 are coronal obstruents. For the purpose of statistical analysis, this list was reduced to a more restrictive set of 218 items as follows:

1. Duplicate lexemes were excluded.
2. Derived forms were excluded if their relationship to another form was morphologically transparent (i.e., duplicates of a single root).
3. Morphologically complex words were excluded if C_1 and C_2 belong to separate morphemes.
4. Loanwords from non-Indo-Aryan sources such as Arabic, Persian and English were excluded. However, potential loanwords from related Indo-Aryan languages such as Khowar and Urdu were retained on the grounds that these languages share historical roots and developments.

None of the excluded items were exceptional with respect to the pattern of retroflex (and coronal) harmony that emerged from the study.

All 218 items from the set were classified as belonging to one of 36 logically possible combinations of 8 C_1/C_2 place and manner classes (i.e., dental fricatives, palatal fricatives, retroflex fricatives, dental affricates, etc.), collapsing over laryngeal features and C_1/C_2 order. For example, the words ɕat 'oath, claim', ʑadri 'co-wife', and daɕ 'ten' were all classified as representing a combination of palatal fricatives with dental stops.

Counts of roots for each consonant pair are referred to as 'observed values' (O). These were used to derive 'expected values' (E), or values that would be statistically expected under random occurrence of the phonemes. Further, observed-to-expected ratios (O/E ratios) were computed for each consonant combination to determine whether some combinations were under- or over-represented in the corpus (Frisch et al. 2004). An O/E ratio of 1.0 shows that there is no difference between observed and expected frequency, that is, there is no apparent co-occurrence effect. A ratio of more that 1.0 shows that the combination is over-represented. A ratio of less than 1.0 shows under-representation of the combination, and an O/E value of 0.0 indicates categorical under-representation (i.e., complete absence). For the purposes of this paper, we limit ourselves to an informal discussion of the main results, leaving a more detailed statistical evaluation of the data for further study.

4.2 Results

The results of the study are listed in the tables below. Table 1 lists the observed counts for each of the 36 possible C_1/C_2 combinations. Table 2 lists the values that would be expected under random distribution of consonants. Table 3 lists the observed-to-expected ratios. (It should be noted that due to the overall relatively small size of the corpus, some of the expected values are small, below 5.00, and thus may result in less reliable O/E values for corresponding cells.)

Table 1. Observed counts of coronal obstruents in #CVC sequences (n=218)

C1/C2	s z	ɕ ʑ	ʂ ʐ	ts tsʰ dz	tɕ tɕʰ dʑ dʑʱ	ʈs ʈsʰ ɖz	t tʰ d dʱ	ʈ ʈʰ ɖ ɖʱ
s z	6	2	0	1	20	0	22	11
ɕ ʑ		7	0	0	4	0	15	5
ʂ ʐ			9	0	10	3	8	3
ts tsʰ dz				1	1	0	4	1
tɕ tɕʰ dʑ dʑʱ					9	0	17	15
ʈs ʈsʰ ɖz						13	7	0
t tʰ d dʱ							9	0
ʈ ʈʰ ɖ ɖʱ								15

Table 2. Expected values, based on a random distribution of consonants

C1/C2	s z	ɕ ʑ	ʂ ʐ	ts tsʰ dz	tɕ tɕʰ dʑ dʑʱ	ʈs ʈsʰ ɖz	t tʰ d dʱ	ʈ ʈʰ ɖ ɖʱ
s z	5.30	6.24	6.59	1.39	13.19	5.61	14.24	10.15
ɕ ʑ		1.83	3.85	0.83	7.80	3.30	8.35	5.96
ʂ ʐ			1.95	0.92	8.46	3.50	8.56	6.21
ts tsʰ dz				0.08	1.65	0.73	1.95	1.36
tɕ tɕʰ dʑ dʑʱ					8.03	6.95	18.12	12.78
ʈs ʈsʰ ɖz						1.48	7.56	5.38
t tʰ d dʱ							9.36	13.49
ʈ ʈʰ ɖ ɖʱ								4.83

Table 3. Ratios of observed/expected values (shaded cell = categorical absence)

C1/C2	s z	ɕ ʑ	ʂ ʐ	ts tsʰ dz	tɕ tɕʰ dʑ dʑʱ	ʈʂ ʈʂʰ ɖʐ	t tʰ d dʱ	ʈ ʈʰ ɖ ɖʱ
s z	1.13	0.32	0.00	0.72	1.52	0.00	1.54	1.08
ɕ ʑ		3.82	0.00	0.00	0.51	0.00	1.80	0.84
ʂ ʐ			4.62	0.00	1.18	0.86	0.93	0.48
ts tsʰ dz				12.11	0.61	0.00	2.05	0.73
tɕ tɕʰ dʑ dʑʱ					1.12	0.00	0.94	1.17
ʈʂ ʈʂʰ ɖʐ						8.77	0.93	0.00
t tʰ d dʱ							0.96	0.00
ʈ ʈʰ ɖ ɖʱ								3.10

Three key observations emerge from the study. First, most combinations of two stops, two fricatives, and two affricates that *agree* in retroflexion/non-retroflexion are statistically over-represented. This includes combinations of two retroflexes – fricatives (O/E = 4.62), affricates (O/E = 8.77), and stops (O/E = 3.10), or two non-retroflexes – palatal fricatives (O/E = 3.82) and dental affricates (O/E =12.11). Second, combinations of two stops, two fricatives, and two affricates that that *disagree* in retroflexion are categorically absent. There are no instances of retroflex fricatives co-occurring with dental or palatal fricatives (O/E = 0.00), retroflex affricates co-occurring with dental or palatal affricates (O/E = 0.00), or retroflex stops co-occurring with dental stops (O/E = 0.00). Third, different-manner combinations (i.e., stops with fricatives, stops with affricates, or fricatives with affricates) do not show such categorical restrictions and, overall, are not clearly under-represented or over-represented. Representative examples are listed in (7–12).

(7) Fricative/fricative combinations (harmony)

s…s	sastirik	‘to roof a house’	ʑ…ɕ	ʑoɕi	‘Spring festival’
s…z	sazu djek	‘to have a cold’	ʂ…ʂ	ʂiʂ	‘head, top’
ɕ…ɕ	ɕiɕoa	‘handsome’		ʂuʂik	‘to dry’

*s…ʂ, *ɕ…ʂ, *ʐ…ʑ, etc. (no retroflexes with non-retroflexes)

(8) Affricate/affricate combinations (harmony)

ts..ts	tsẽtsaw	‘squirrel’	ʈʂ..ʈʂ	ʈʂatʂukre hik	‘to hold tight’
tɕ..tɕ	tɕitɕilak	‘immature corn’	ʈʂ..ʈʂʰ	ʈʂuʈʂʰu	‘dried up’
tɕʰ..tɕ	tɕʰatɕi hik	‘to take care of’	ʈʂʰ..ʈʂ	ʈʂʰiʈʂik	‘to learn’
dʑ..dʑ	dʑadʑ	‘hair, fur’	ɖʐ..ʈʂ	ɖʐaʈʂ	‘spirit beings’

*ts …ʈʂ, *tɕ…ʈʂ, *ɖʐ…dʑ, etc. (no retroflexes with non-retroflexes)

(9) Stop/stop combinations (harmony)

t…t	da˜u tatu	‘festival of beans’	ʈ…ʈ	ʈoʈ	‘apron’
tʰ…d	tʰedi	‘now’	ʈʰ…ʈ	ʈʰeʈ karik	‘to scatter’
d…d	dodak hik	‘to wait’	ɖ…ɖ	ɖuɖik	‘to sleep’

*t …ʈ, *d…ɖ, *ʈ…d, etc. (no retroflexes with non-retroflexes)

(10) Stop/affricate combinations (no harmony)

ʈʂ…t	ʈʂat	‘moment’	ʈ…tɕ	ʈõtɕuk	‘active’
d…ʈʂ	diʈʂ	‘period of abstinence’	ts…ʈ	tsaʈẽgik	‘to move’
tɕ…ʈ	tɕuʈik	‘to touch’			

(11) Stop/fricative combinations (no harmony)

t…ʂ	tuʂ	‘straw, chaff’	ɖ^{ɲ}…ɕ	ɖ^{ɲ}uɕak	‘a dance’
ʂ…t	ʂit	‘tight-fitting’	ʈ…s	ʈosu djek	‘to peck’
ɕ…ʈ^{h}	ɕoʈ^{h}a	‘a growth’	s…ʈ	saʈuk	‘apple sauce’

(12) Affricate/fricative combinations (no harmony)

tɕ…ʂ	tɕaʂ ~ tɕaʂʈ	‘lunch’	ʂ…tɕ	ʂatɕ	‘shelter’

Restrictions on same-manner combinations may go beyond the retroflex/non-retroflex contrast. Combinations of two non-retroflex fricatives or two non-retroflex affricates that *disagree* in anteriority/posteriority are also absent or very infrequent. The three examples in (13) are the only exceptions in the database with combinations of dental and palatal obstruents that share the same manner of articulation.[1]

(13)

tɕ…ts	tɕitse maik	‘to talk about this and that’
s…ɕ	suɕ, suʑ	‘needle’
ʑ…z	ʑazir ~ zazir	‘broken down’

In sum, the results of the study reveal that Kalasha roots exhibit retroflex consonant harmony, or coronal place harmony more generally, but only when participating consonants have the same manner of articulation. Thus, the language prohibits morpheme-internal combinations of retroflexes and non-retroflexes with the same manner of articulation (e.g., *s…ʂ, *ɕ…ʂ, etc.), and possibly combinations of anterior/posterior coronals with the same manner (e.g., *s…ɕ, *ʑ…z, etc.).

4.3 Discussion

Coronal consonant harmony can arise through feature agreement or spreading. However, some other forms of consonant harmony cannot be the result of spreading. For instance, nasal and laryngeal consonant harmony can hold between consonants over long domains without affecting intervening segments, even when those segments are potential targets for nasality or laryngeal features (Hansson 2001, Rose & Walker 2004). Moreover, such cases of long distance assimilation are always sensitive to the relative similarity of participating consonants, while local assimilation is not. For this reason, Rose & Walker (2004) posit a typological distinction between similarity-sensitive assimilation, which is

[1] Exceptions of this kind also occur in morphologically complex forms such as *ɕ-ase* ‘EMPH-that’ (Bashir 2003: 856).

the product of agreement by correspondence, and similarity-insensitive patterns, which are the product of local feature spreading. To the extent that a pattern of coronal harmony exhibits similarity effects comparable to other forms of harmony, which can only be attributed to agreement, Rose & Walker suggest that it is also the result of agreement by correspondence.

Our study reveals that similarity, in terms of manner of articulation, plays a critical role in Kalasha coronal harmony. Following Rose & Walker, we argue that the data are more compatible with the typology and predictions of agreement by correspondence than with those of feature spreading. The ABC model relies crucially on featural similarity of participating segments. Thus, it predicts that pairs of consonants sharing the same manner of articulation (i.e., the same values for [±continuant, ±strident]) are more likely to harmonize than pairs with different manners of articulation. While retroflex harmony could be implemented as feature spreading, there is nothing in the spreading approach that would predict harmony between two stops but not between a stop and a fricative, when retroflexion is contrastive for both. Thus, in the remainder of this paper we develop an ABC account of consonant harmony in Kalasha.

5. Historical Sources of Harmony in Kalasha

Consonant harmony in Kalasha is manifested as a static morpheme structure constraint. We have found no evidence of active alternations in the synchronic grammar. Limited diachronic evidence concerning the source of harmony is listed in (14).

(14) Evidence of diachronic harmony in fricatives (based on Trail & Cooper 1999)

a.	s → s			
	sastirik	‘to roof a house’	< sãstara-	‘layer of grass/leaves’
b.	s → ɕ			
	ɕiɕoa	‘handsome’	< *suśōbha-	‘splendid’
c.	s, ɕ(ś) → ʂ			
	ʂuʂut, ʂuʂutr	‘ornate headband’	< *suṣūtra-	‘having fine thread’
	ʂiʂ	‘head, top’	< śīrṣá-	‘head, skull’
	ʂuʂik	‘to dry’	< śúṣyati	‘becomes dry’
	ʂuʂṭa	‘dry, dried’	< *śuṣṭa-	‘dried’

The evidence in (14) is compatible with either (i) “anticipatory” right-to-left directional harmony and/or (ii) an asymmetry among coronal places in which retroflexes are dominant, dentals are recessive, and palatals are intermediate. In the account that follows, we tentatively assume the later interpretation for two reasons. First, similar dominant-recessive asymmetries occur in patterns of local coronal assimilation in Old Indo-Aryan (i.e., Sanskrit). In those cases, direction is not a factor (Whitney 1967 [1889]: 68). Second, the apparent directionality in (14) might be a by-product of the fact that word-initial retroflexes were rare in Old-Indo-Aryan (Masica 1991: 157).

6. An ABC Account of Kalasha Consonant Harmony

The ABC approach (Hansson 2001; Rose & Walker 2004) captures properties of consonant harmony systems using a set of Correspondence C↔C constraints, CC Faithfulness constraints, and traditional I/O Faithfulness constraints. Correspondence C↔C constraints impose a correspondence relation on two featurally similar segments co-occurring in an output string. For example, the constraint Corr-T↔Ṭ requires correspondence between any two coronal obstruents with the same manner of articulation.

(15) Corr-T↔Ṭ: any two coronal obstruents ([cor, ±son]) that have the same specifications for [±strid, ±cont] (regardless of differences in [±voi, ±ant, ±dist]) are correspondents of one another.

Correspondence constraints involving less similar segments are ranked below Corr-T↔Ṭ. These are defined in (16) and their relative ranking is shown in (17).

(16) a. Corr-Č↔Ṣ: any two coronal obstruents ([cor, ±son]) that have the same specifications for [±strid] (regardless of differences in [±cont, ±voi, ±ant, ±dist]) are correspondents of one another.
b. Corr-T↔ Ċ: any two coronal obstruents ([cor, ±son]) that have the same specifications for [±cont] (regardless of differences in [±strid, ±voi, ±ant, ±dist]) are correspondents of one another.
c. Corr-T↔Ṣ: any two coronal obstruents ([cor, ±son]) (regardless of differences in [±cont, ±strid, ±voi, ±ant, ±dist]) are correspondents of one another.

(17) Similarity-based correspondence hierarchy for [±distributed] in coronal obstruents

Corr-T↔Ṭ	»	Corr-Č↔Ṣ, Corr-T↔ Ċ	»	Corr-T↔Ṣ
same manner		*same stridency same continuancy*		*same soronancy*

CC Faithfulness constraints enforce identity for a harmonizing feature on all the segments in a correspondence relation. Together with IO Faithfulness constraints, they are part of the consonantal correspondence model, illustrated in (18).

(18) Input / t a ṭ /
⇳ IO Faithfulness
Output [t a ṭ]
⇘ ⇙
CC Faithfulness

(19) a. Ident-CC [±dist]: segments within a string that are correspondents of one another must have the same value for [±distributed].
b. Ident-IO [–dist]: segments specified for [–dist] in the input must have the same feature value in the output.

c. Ident-IO [+dist]: segments specified for [+dist] in the input have to have the same feature value in the output.

The ranking of Ident-CC[±dist] over IO Faithfulness (and Correspondence C↔C) ensures the application of harmony. The ranking of Ident-IO[–dist] over Ident-IO[+dist] ensures that retroflexes are triggers of harmony, while non-retroflexes are targets. The application of these constraints is illustrated in (20–22).

(20) Retroflex harmony applies in same-manner combinations: two stops

	/taʈ/	Id-CC [±dist]	Corr-T↔Ṭ	Id-IO [–dist]	Id-IO [+dist]	Corr-Č↔Ṣ	Corr-T↔Č
a.	$t_x a t_y$		*!			*	*
b.	$t_x a t_x$	*!					
c. ☞	$t_x a t_x$				*		
d.	$t_x a t_x$			*!			

(21) Retroflex harmony applies in same-manner combinations: two fricatives

	/ʂaɕ/	Id-CC [±dist]	Corr-T↔Ṭ	Id-IO [–dist]	Id-IO [+dist]	Corr-Č↔Ṣ	Corr-T↔Č
a.	$ʂ_x a ɕ_y$		*!			*	*
b.	$ʂ_x a ɕ_x$	*!					
c. ☞	$ʂ_x a ʂ_x$				*		
d.	$ɕ_x a ɕ_x$			*!			

(22) Retroflex harmony does not apply in different-manner combinations (e.g., an affricate and a stop)

	/tsaʈ/	Id-CC [±dist]	Corr-T↔Ṭ	Id-IO [–dist]	Id-IO [+dist]	Corr-Č↔Ṣ	Corr-T↔Č
a. ☞	$ts_x a t_y$						*
b.	$ts_x a t_x$	*!					
c.	$ʈʂ_x a t_x$				*		
d.	$ts_x a t_x$			*!			

The addition of posteriority harmony can be formally implemented by adding relevant CC Faithfulness and IO Faithfulness constraints on features [+ant] and [–ant].

(23) Posteriority harmony in same-manner combinations (e.g. fricative/fricative)

	/saɕ/	Id-CC [±dist]	Id-CC ([±ant])	Corr-T↔Ṭ	Id-IO [–dist]	Id-IO [–ant]	Id-IO [+dist]	Id-IO [+ant]
a.	$s_x a ɕ_y$			*!				
b.	$s_x a ɕ_x$		*!					
c. ☞	$ɕ_x a ɕ_x$							*
d.	$s_x a s_x$					*!		

In sum, the proposed ABC analysis successfully accounts for the key facts of coronal harmony in Kalasha roots, a pattern that is sensitive to the relative similarity of participating segments.

7. Conclusion

In this paper we examined co-occurrence restrictions on coronal obstruents in Kalasha. The findings reveal a robust pattern of retroflex harmony, or coronal place harmony more generally, that holds between coronal obstruents with the same manner of articulation, but not between those with different manners of articulation. To the best of our knowledge, this pattern has not been documented in previous studies of Kalasha (apart from a few brief observations by Morgenstierne (1973)), and no pattern like it has been reported for any language in the literature on retroflex consonant harmony. Thus, the study makes an important empirical contribution to the field.

Following Rose & Walker (2004) we argued that the similarity effect in Kalasha is more compatible with the typology and predictions of the ABC model than with those of feature spreading models. This is not to say that similarity effects are incompatible with feature spreading. A model in which feature spreading is triggered by similarity might well provide a satisfactory account of coronal harmony in languages like Kalasha. However, it is doubtful that such an account could be extended to all cases of consonant harmony, including cases of nasal or laryngeal harmony where intervening segments are clearly unaffected by the harmonic feature, even though they are potential targets (Hansson 2001; Rose & Walker 2004).

The present study was limited to initial CVC sequences, and many important questions remain unanswered. For instance: Does harmony hold over longer domains? If so, do intervening segments display transparency effects consistent with agreement or blocking effects consistent with spreading (Hansson 2001; Rose & Walker 2004; cf., Hansson 2007; Walker & Mpiranya 2005)? What are the phonetic properties of vowels in harmony domains? Is there any empirical evidence that retroflexion or other coronal gestures propagate through them? These and other questions are the subject of ongoing research. The answers to these questions may shed further light on the mechanisms of consonant harmony and assimilation in general.

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