

## Harmony via positive agreement: Evidence from trigger-based count effects

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### 1. Introduction

In most patterns of harmony and assimilation, a single segment triggers harmony to the left or right, until the end of the word or until some intervening blocker. Here, I classify the new subpattern of **trigger-based count effects**, in which *multiple* triggers are needed to induce harmony. For example, nasal assimilation in Kazakh requires *two* triggers: the onset of a suffix assimilates to a nasal-final stem exactly when the suffix also contains a nasal coda.

- (1) Nasal Assimilation (two triggers)
  - a. /adam-dan/ → [adam-nan] ‘from the person’
  - b. /χan-dəŋ/ → [χan-nəŋ] ‘of the king’
- (2) No Nasal Assimilation (only one trigger)
  - a. /adam-da/ → [adam-da] ‘at the person’
  - b. /χan-də/ → [χan-də] ‘king-ACC’
  - c. /bala-dan/ → [bala-dan] ‘from the child’
  - d. /χanʃa-dəŋ/ → [χanʃa-dəŋ] ‘of the queen’

Kazakh nasal assimilation is an instance of a larger class of patterns in which harmony is sensitive to the number of triggers. For example, in Classical Manchu and Oroqen (Walker 2001), rounding harmony of vowels requires a disyllabic trigger; in Cantonese (Flemming 2003), vowels are fronted between two coronal triggers.

Here, I propose an analysis of trigger-based count effects in Harmonic Grammar with Harmonic Serialism (HG: Legendre et al. 1990; HS: McCarthy 2000). Harmony is motivated by a positively defined constraint which rewards feature agreement. Non-local harmony is allowed, but the reward is reduced by a scaling factor based on distance.

The paper is organized as follows: Section 2 summarizes the cross-linguistic pattern. Section 3 addresses previous arguments about theories of harmony. Section 4 presents the proposal, with predictions that are shown to be borne out in the analysis in Section 5.

## 2. Harmonic Grammar: Evidence from harmony systems

Harmonic Grammar (Legendre et al. 2000) is a relative of Optimality Theory (Prince and Smolensky 1993/2004) in which constraints are *weighted*, as opposed to strictly ranked. Violations of constraints are multiplied by their weights, and summed to produce an overall “harmony score” ( $\mathcal{H}$ ) for each candidate. The grammar selects the candidate with the maximum harmony score. Thus, HG (unlike OT) can have additive effects: multiple violations of lightly-weighted constraints can accumulate to outweigh of a single violation of a more heavily weighted constraint.

In this section, I outline one particular class of additive patterns: *trigger-based count effects*, where harmony is sensitive to the number of triggers. In all of these examples, a faithfulness constraint prevents harmony from a single trigger but is beaten by the cumulative harmony that arises from multiple triggers.

### 2.1 Classical Manchu & Oroqen: Double triggers

Harmony in Classical Manchu and Oroqen (Walker 2001) is sensitive to the number of triggers. Both languages show rounding harmony, but the pattern is only triggered if there are *two* round vowels to the left of the target.

- (3) Spreading only after disyllabic triggers (Classical Manchu):
- |    |       |      |             |
|----|-------|------|-------------|
| a. | bɔtʃɔ | -ŋgɔ | ‘coloured’  |
| b. | tɔ    | -ŋga | ‘few, rare’ |
- (4) Spreading only after disyllabic triggers (Oroqen):
- |    |    |     |            |
|----|----|-----|------------|
| a. | ɔɔ | -wɔ | ‘fish-ACC’ |
| b. | mɔ | -wa | ‘tree-ACC’ |

Note that in this pattern, the triggers appear on the same side of the target, due to an independent constraint that [+round] spans always include the first syllable of the word.

### 2.2 Cantonese

In Cantonese (Flemming 2003), vowels are fronted when they appear between two dental or palatal consonant triggers (as in (5a)). A single trigger, either preceding or following the vowel (as in (5c) or (5d)), is not sufficient to motivate fronting.

- (5) Fronting only when surrounded by triggers:
- |    |                                 |                   |    |                               |             |
|----|---------------------------------|-------------------|----|-------------------------------|-------------|
| a. | t <sup>h</sup> y <sub>n</sub> t | ‘to take off’     | c. | k <sup>h</sup> u <sub>n</sub> | ‘bracket’   |
| b. | *t <sup>h</sup> u <sub>n</sub>  | <i>unattested</i> | d. | t <sup>h</sup> ɔk             | ‘bald head’ |

Flemming (2003) analyzes this as harmony of a phonological backness feature that may appear on both vowels and consonants. This is then another case of a trigger-based count effect: two [+front] triggers motivate harmony; a single one does not. It differs from Oroqen and Classical Manchu, though, in that the triggers appear on either side of the target.

### 2.3 Kazakh

In Kazakh, suffixes display a large degree of allophonic variation, depending on the phonological properties of the stem. Of relevance here is a pattern of nasal assimilation: in a small set of suffixes, the onset changes to agree with the nasality of the preceding consonant.

- (6) Nasal Assimilation:
- a. /bala-dan/ → [balad<sup>n</sup>] ‘from the child’
  - b. /adam-dan/ → [adam<sup>n</sup>] ‘from the person’

Critically, the suffixes which undergo nasal assimilation are exactly those which end in a nasal coda. Although there are only four such suffixes, this behavior is displayed by all and only the suffixes that have the /-CVN/ shape. The suffixes in (7) contrast with minimal pairs in (8).

- (7) /-CVN/ suffixes undergo nasalization:
- a. /adam-mən/ → [adamm<sup>n</sup>] ‘I am a person.’
  - b. /adam-men/ → [adamm<sup>n</sup>] ‘with the person’
  - c. /adam-dəŋ/ → [adamm<sup>n</sup>] ‘of the person’
  - d. /adam-dan/ → [adam<sup>n</sup>] ‘from the person’
- (8) Other suffixes do not undergo nasalization:
- a. /adam-məz/ → [adambəz] ‘We are people.’
  - b. /adam-ma/ → [adamba] ‘Is it a person?’
  - c. /adam-də/ → [adam<sup>n</sup>də] ‘the person’ (accusative)
  - d. /adam-da/ → [adam<sup>n</sup>da] ‘at the person’

In other words, a suffix onset only undergoes nasal assimilation if it is immediately preceded by a nasal segment in the root *and* it is followed by a nasal later in the suffix. Thus, in Kazakh, as in Cantonese, harmony requires multiple triggers that surround the target.

### 3. Harmony constraints: Previous arguments

Within constraint-based theories of phonology, theories of harmony have generally employed one of two main classes of constraints: SPREAD constraints<sup>1</sup>, which prefer multiply-linked feature spans (McCarthy 2011, Kimper 2011), or AGREE constraints, which prefer segments with matching feature specifications (Baković 2000, Hayes & Londe 2006). Under both constraint classes, (9a) is considered harmonic and (9c) disharmonic; however, (9b) is only considered harmonic under an AGREE constraint.

<sup>1</sup>I use the phrase “SPREAD constraints” to encompass both SHARE from McCarthy (2004, 2011) and SPREAD from Kimper (2011). Although McCarthy (2004) uses the term slightly differently, I use in this way here to draw parallels to Kimper’s (2011) proposal, which I follow in many respects.

- (9) a.  $\begin{array}{c} F \\ \diagup \quad \diagdown \\ \times \quad \times \end{array}$       b.  $\begin{array}{c} F \quad F \\ | \quad | \\ \times \quad \times \end{array}$       c.  $\begin{array}{c} F \\ | \\ \times \quad \times \end{array}$       SPREAD:  $3a > 3b, 3c$   
 AGREE:  $3a, 3b > 3c$

A basic formulation of each type of constraint is given in (10) and (11).

- (10) **AGREE(F)**: Assign one violation mark for every pair of adjacent segments that differ in their specification of F.  
 (11) **SPREAD(F)**: Assign one violation mark for every pair of adjacent segments that are not linked to the same token of F.

(see “SHARE” of McCarthy 2011)

The AGREE constraint in (10) has been shown to make incorrect typological predictions: it undergenerates, failing to derive attested patterns of partial feature spread (§3.1). McCarthy (2011) uses this as an argument for a SPREAD constraint. In §3.2, however, I show that an AGREE constraint escapes from this pathology if it is *positively defined*, following an innovation of Kimper (2011). As in Kimper 2011, Harmonic Serialism ensures the existence of a maximally harmonic candidate, thus escaping from the paradox of “infinite goodness” (§3.3) that accompanies positively defined constraints in frameworks with parallel evaluation.

### 3.1 Sour-grapes spreading: A pathology for (negatively defined) AGREE

McCarthy (2004, 2011) and Kimper (2011) observe that a standard definition of AGREE (as in (10)) is unable to account for harmony systems in which spreading may be blocked. The problem — called “sour-grapes” spreading — is that a violation of AGREE can only be resolved if the feature spreads all the way to the end of the word. If a word contains only partial spreading, then the spreading does not remove the violation of the constraint; it simply moves it to a different location.

For example, suppose that (12a) is the underlying form of a word, and that  $\times_3$  is a segment which blocks harmony. We should nevertheless expect our harmony constraint to motivate spreading from  $\times_1$  to  $\times_2$ , to give the form in (12b). However, AGREE does not distinguish the two forms: (12a) receives a violation mark for  $\times_1$  and  $\times_2$ , but (12b) receives a violation mark for  $\times_2$  and  $\times_3$ . The only way to eliminate the violation of AGREE is to spread to the end of the word, as in (12c).

- (12) a.  $\begin{array}{c} F \\ | \\ \times_1 \quad \times_2 \quad \times_3 \quad \times_4 \end{array}$       b.  $\begin{array}{c} F \\ | \quad \diagdown \\ \times_1 \quad \times_2 \quad \times_3 \quad \times_4 \end{array}$       c.  $\begin{array}{c} F \\ | \quad \diagdown \quad \diagdown \quad \diagdown \\ \times_1 \quad \times_2 \quad \times_3 \quad \times_4 \end{array}$

In other words, AGREE can generate patterns where spreading is complete, or not at all. It is unable to capture any of the attested patterns where partial spreading occurs but further spreading is blocked. In light of these incorrect typological predictions, McCarthy (2004, 2011) argues that harmony should be motivated using the SPREAD constraint in (11) (for him, “SHARE”). This constraint favors (12b), with two violations, over (12a), with three, so does not face the sour-grapes pathology.

### 3.2 A solution from positivity

Kimper (2011) proposes an alternative solution, which escapes from sour-grapes spreading with a SPREAD constraint that is *positively defined*: it rewards segments that share a feature instead of penalizing segments which don't. Intuitively, a positive weighting captures the insight that the constraint is blind to all segments which are not involved in the assimilatory process. The constraint is not affected by the fact that some segments do not undergo harmony; it simply rewards those ones which do.

Extending this innovation allows AGREE to escape from the sour-grapes pathology. To demonstrate, we consider an alternate definition of AGREE, in which the constraint gives a reward of +1 to segments which agree in F instead of giving a penalty of -1 to those that disagree. Under this new constraint, (12b) receives a score of +1, since  $\times_1$  and  $\times_2$  agree in F. The candidate is thus more harmonic than (12a), which receives no reward. The non-participants have no effect on the constraint, so the sour-grapes paradox does not arise.

### 3.3 The HS solution to “infinite goodness”

Prince (2007, f.n. 9) observes that positively defined constraints (i.e., rewards) are inconsistent with the assumptions of standard OT, and, more generally, of any relative of OT that has parallel evaluation. The problem — since titled “infinite goodness” — is that harmony scores have no upper bound, so a maximally harmonic candidate may not exist.

For example, suppose that a positively defined constraint rewards feature agreement, and that this constraint is ranked higher than the constraint against epenthesis. Under this ranking, every candidate will be less harmonic than a similar candidate in which an agreeing segment has been epenthesized. There is no maximally harmonic candidate.

Kimper (2011) shows that Harmonic Serialism provides a solution to this problem. Under Harmonic Serialism (McCarthy 2000, a.o.), outputs are derived incrementally, through a series of harmonically improving candidates. The problem of infinite goodness is removed because multiple steps are needed to insert the rewarded structure, some of which are not harmonically improving. That is, if we assume that epenthesis occurs one feature at a time (the reverse of McCarthy 2007's account of segment deletion), then the first step of epenthesis must be a featureless segment, as in (13). This segment does not agree with respect to F, so it is not harmonically improving, and the derivation converges.

$$(13) \quad \begin{array}{ccc} \text{F} & & \text{F} & & \text{F} & \text{F} \\ | & & | & & | & | \\ 1. \times & \rightarrow & 2. \times \times & \rightarrow & 3. \times \times & \times \times \end{array}$$

Thus, using a positive definition, AGREE escapes from “sour-grapes” spreading. Harmonic Serialism removes the paradox of “infinite goodness.” The theoretical decision to utilize SPREAD or AGREE must therefore come from other empirical evidence where predictions diverge. I describe these predictions in §4, where I argue that trigger-based count effects provide evidence for an AGREE constraint. An agreement-based analysis for these patterns is given in §5.

#### 4. Proposal: Serial Harmonic Grammar and POSITIVEAGREE

My proposal is framed within Serial Harmonic Grammar, which has the weighted constraints of Harmonic Grammar and the serial evaluation of Harmonic Serialism. Harmony is motivated by a positively defined constraint which rewards feature agreement. Non-local harmony is allowed, but the reward is reduced by a scaling factor based on distance. A precise definition is given in (14).

- (14) **POSITIVEAGREE(F)**: Assign a reward of +1 for every pair of segments which both bear feature F.
- (15) **Scaling Factor**: For each locus of satisfaction, multiply the reward by a factor of 0.5 for every segment intervening between the pair of agreeing segments.  
(For Scaling Factor, see Kimper 2011, pp 80)

As we saw in §3, POSAGREE escapes from the undergeneration problem observed for other AGREE constraints, thus making the agreement analysis on par with the spreading analysis with respects to previous diagnostics. In this section, I discuss further consequences of adopting POSAGREE; in the following sections, I argue that these predictions are borne out.

In §4.1, I discuss the properties of non-locality under POSAGREE. As with SPREAD (Kimper 2011), non-local harmony is allowed, subject to a scaling factor. Unlike SPREAD, however, POSAGREE can be satisfied in two ways: either by inserting a feature (a violation of DEP(F)) or by extending an existing feature span (a violation of DEP(Link)). I suggest that long-distance harmony is always an instance of feature insertion.

In §4.2, I discuss the prediction of trigger-based count effects.

##### 4.1 Non-locality under POSAGREE

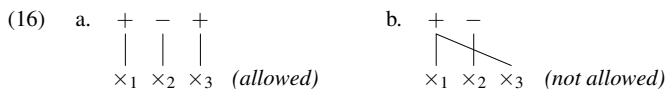
Both typological and experimental work supports the hypothesis that patterns of harmony allow non-locality. Kimper (2011b) argues that an analysis with strict phonetic locality overgenerates: it incorrectly predicts patterns where non-contrastive phonetic properties induce phonological alternations. Rose and Walker (2004) present a survey of long-distance patterns of consonant harmony; they argue that non-local patterns exist, and are typologically distinct from local assimilation. Walker (p.c.) suggests that, even in patterns of local spreading, harmony may be sensitive to the properties of a non-local trigger.

In light of such evidence, Kimper (2011) argues that harmony is *perceptually grounded*, a claim that is supported by a series of experiments which show that harmony facilitates vowel identification. Conceptually, then, harmony is a means of providing redundancy of information<sup>2</sup>: a feature is more easily perceived if it occurs on multiple segments.

Because POSAGREE rewards feature agreement (not feature spans) it can be satisfied either by spreading an existing feature span or by inserting a new feature. Consequently, we

<sup>2</sup>A parallel is drawn to the topic of Error Correcting Code in computer science (Hamming 1950), in which messages are encoded with redundant information in order to make them more robust over a noisy channel. Harmony systems can then be viewed as an instance of ECC in natural language.

can analyze all instances of long-distance harmony as instances of feature insertion. This permits us to maintain standard stipulations on autosegmental representations (Goldsmith 1976, and subsequent). In particular, split feature spans, as in (16b), are disallowed.



In contrast, under a non-local SPREAD analysis (in particular, Kimper 2011), representations like (16b) must be admitted, since (16a) is not considered harmonic under SPREAD.

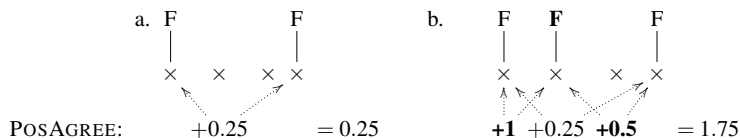
#### 4.2 Trigger-based count effects

A second critical aspect regarding the way that POSAGREE is calculated is the fact that it gives a reward for *every pair* of agreeing segments. Thus, a target can have multiple triggers; in fact, *every* F-specified segment is a trigger for harmony.

Examples (17) and (18) show the additive effect that arises from adding a feature to a target that has both a local and a non-local trigger. The benefit of adding the feature is an additional score of 1.5 (compared to the reward of 1 if there were only a local trigger). Because the constraint assigns a reward for every pair of agreeing segments, this reward is received regardless of whether the two triggers are on different sides of the target (as in (17)) or on the same side (as in (18)).

(NB: In the following examples, the dotted arrows below the  $\times$ es are merely expositional; they are not part of the phonological representation.)

#### (17) Multiple bilateral triggers (harmony difference of 1.5):



#### (18) Multiple unilateral triggers (harmony difference of 1.5):

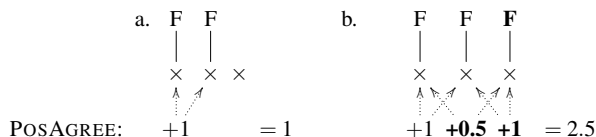


Tableau (19) demonstrates this with the Kazakh word /adam-dəŋ/, ‘person-ACC’. Here, (19a) receives three rewards from POSAGREE: [m] and [n], separated by no segments, receive a reward of  $(0.5)^0 = +1$ ; [n] and [ŋ], separated by one segment, receive a reward of  $(0.5)^1 = +0.5$ ; [m] and [ŋ], separated by two segments, receive a reward of  $(0.5)^2 = +0.25$ . The total reward, +1.75, is multiplied by the weight of 4 to get a final harmony score of 7.

(19)

		<b>4</b>	
	/adam-dəŋ/	POSAGREE([nas])	$\mathcal{H}$
a.	adamnəŋ	+1 + 0.5 + 0.25	<b>+7</b>
b.	adamdəŋ	+0.25	<b>+1</b>

Critically, trigger-based count effects arise from the fact that POSAGREE counts *pairs* of segments instead of individual segments. This means that each individual segment can be counted multiple times — once for each pair that it is part of. The total contribution of a particular segment is thus dependent on the number of other F-specified segments in the word<sup>3</sup>.

These trigger-based count effects are not predicted under SPREAD. Because SPREAD rewards every dependent instead of every pair, the reward for feature-spreading is the same, regardless of the number of other F-specified segments in the word. In all cases, the harmonic form receives a single reward, arising from the single new dependent of F.

## 5. Attested TBCEs: Evidence for POSAGREE over SPREAD

In the previous section, I presented the constraint POSAGREE, noting in particular the prediction of trigger-based count effects. In this section, I show that these patterns are attested in the languages described in §2. For each language discussed, I present an analysis using POSAGREE, and show that SPREAD (Kimper 2011) is unable to capture these patterns.

As we have already seen, POSAGREE adopts many innovations from Kimper’s (2011) SPREAD, but it critically differs by rewarding feature *agreement* instead of feature *sharing*. I repeat the two constraints here, for comparison:

- (20) **SPREAD(F)**: (*Kimper*) For each [instance of] feature F, assign a reward of +1 for each dependent of F.
- (21) **POSITIVEAGREE(F)**: Assign a reward of +1 for every pair of segments which both bear feature F.

In §5.1, I examine the pattern of disyllabic triggers in Classical Manchu and Oroqen, in which the two triggers appear on the same side of the target. Using POSAGREE, the one-sided pattern falls out naturally. The constraint SPREAD is unable capture these patterns.

In §5.2, I show that an analogous argument holds for patterns where the two triggers surround the target, as in Kazakh. POSAGREE is able to capture these patterns simply; SPREAD is not. More specifically, the (necessary) assumption of serial evaluation has the result that SPREAD cannot distinguish between spreading from a single trigger and spreading with a trigger on either side.

<sup>3</sup>Note, though, that since the scaling factor decreases the reward exponentially with distance, there is a guaranteed maximum reward that can be contributed by any single segment. This is because the infinite sum  $\sum_{i=0}^{\infty} n^i$  converges when  $0 < n < 1$ . This fact allows the system to escape from the pathological prediction that harmony can be forced in *any* language by using a word with sufficiently numerous triggers.



### 5.1 Unilateral triggers: Analysis of Classical Manchu/Oroqen

As we saw in §2.1, in Classical Manchu and Oroqen, rounding harmony requires multiple triggers to the left of the target. A single round vowel at the beginning of a word is not sufficient to motivate rightward spreading, but two round vowels *do* trigger spreading.

- (22) Spreading only after disyllabic triggers (Oroqen):
- a. /bot[o-ŋga/ → [botʃoŋgɔ] ‘coloured’
- b. /t<sub>o</sub>-ŋga/ → [tɔŋga] ‘few, rare’

Under POSAGREE, the pattern in Classical Manchu and Oroqen falls out naturally as part of the HG typology. The critical weighting is given in (23).

- (23) a.  $w(\text{DEP}(\text{Link})) > w(\text{POSAGREE})$
- b.  $1.5 \times w(\text{POSAGREE}) > w(\text{DEP}(\text{Link}))$

A single trigger is not heavy enough to change the roundness specification of a vowel, but a second, non-local trigger gives the extra weight that is necessary to override the faithfulness constraints.

(24)

	/do+na/	5 DEP(Link)	4 POSAGREE	$\mathcal{H}$
a.				0
b.		-1	+1	-1

(25)

	/dobo+na/	5 DEP(Link)	4 POSAGREE	$\mathcal{H}$
a.			+1	+4
b.		-1	+1 + 1 + 0.5	+5

Such an analysis is not possible under SPREAD. In order to generate the interaction, the advantage of spreading from two segments to three segments must be greater than the advantage of spreading from one segment to two segments. But, because SPREAD counts individual segments instead pairs of segments, it sees no difference between spreading from one segment or spreading from two. The difference between POSAGREE and SPREAD in this respect is shown in (26).

(26)	a.	$\begin{array}{c} + \quad + \\   \quad \diagdown \\ \times \times \quad \times \times \end{array}$	$\begin{array}{c} + \\   \\ \times \times \end{array}$	Total reward from spreading
		SPREAD: 0	+1	+1
		POSAGREE: 0	+1	+1
	b.	$\begin{array}{c} + \quad + \\ \diagdown \quad \diagup \\ \times \times \times \quad \times \times \times \end{array}$	$\begin{array}{c} + \\ \diagdown \quad \diagup \\ \times \times \times \end{array}$	
		SPREAD: +1	+2	+1
		POSAGREE: +1	+2.5	+1.5

Note that SPREAD gives the same reward to both (26a) and (b). Thus, there is no constraint weighting which will allow SPREAD to derive spreading from only disyllabic triggers.

**5.2 Bilateral triggers: Analysis of Kazakh**

Section 2 described two examples (Kazakh and Cantonese) in which harmony requires two triggers that surround the target. Here, I present an analysis of Kazakh. Although I do not discuss Cantonese, it is simple to construct a parallel analysis.

As we saw in §2.3, in Kazakh, nasal assimilation occurs exactly when a /-CVN/ suffix follows a nasal-final stem.

- (27) Nasal Assimilation only between two triggers (Kazakh):
- a. /adam-**dan**/ → [adam-**nan**] ‘from the person’
  - a. /adam-**da**/ → [adam-**da**] ‘at the person’
  - b. /bala-**dan**/ → [bala-**dan**] ‘from the child’

As before, because POSAGREE rewards agreement with all triggers, the typology includes a weighting that distinguishes between a single trigger and multiple triggers. The necessary weighting inequalities for Kazakh are given in (28). (It so happens that these are the same as for Classical Manchu/Oroqen above.)

- (28) a.  $w(\text{DEP}(\text{Link})) > w(\text{POSAGREE})$   
 b.  $1.5 \times w(\text{POSAGREE}) > w(\text{DEP}(\text{Link}))$

Agreement with a single trigger is not sufficient to drive harmony, but agreement with two local triggers does. An example weighting is given in (31)–(29).

- (29) Assimilation with two triggers:

	/adam+dan/	<b>5</b> DEP(Link)	<b>4</b> POSAGREE	$\mathcal{H}$
a.	$\begin{array}{c} + \quad + \\   \quad   \\ \text{adamdan} \end{array}$		+ .25	+1
b.	$\begin{array}{c} \text{as} \quad + \quad + \\ \diagdown \quad   \\ \text{adamnan} \end{array}$	-1	+1 + .5 + .25	+2

(30) No assimilation with a single trigger:

	/adam+da/	5	4	
		DEP(Link)	POSAGREE	$\mathcal{H}$
a.	$\begin{array}{c} + \\   \\ \text{adamda} \end{array}$			0
b.	$\begin{array}{c} + \\ \diagdown \\ \text{adamna} \end{array}$	-1	+1	-1

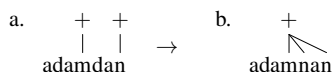
(31) No assimilation with a single trigger:

	/bala+dan/	5	4	
		DEP(Link)	POSAGREE	$\mathcal{H}$
a.	$\begin{array}{c} + \\   \\ \text{baladan} \end{array}$			0
b.	$\begin{array}{c} + \\ \diagdown \\ \text{balanan} \end{array}$	-1	+5	-3

SPREAD cannot capture this pattern. Since SPREAD only rewards segments which are part of the same feature span, it does not distinguish between (30b) and (29b); both receive a score of +1. So, under SPREAD, there is no weighting that will prefer (29b) over (29a), but still disallow spreading in a word with a single trigger (as in (30)).

Critically, we note that the representation in (32b) is not a possible candidate for the input in (29). Although this representation would receive a reward of +2 from SPREAD, the derivation in (32) is not valid under the assumption of Harmonic Serialism.

(32) Invalid derivation under Harmonic Serialism:



Harmonic Serialism dictates that a derivation proceed one step at a time — each step can only have one Faithfulness violation, but the derivation in (32) violates DEP(Link) twice.

We saw in §3.3 that Harmonic Serialism is necessary for SPREAD to avoid the paradox of infinite goodness. However, as we have seen here, Harmonic Serialism also prevents SPREAD from being able to capture the pattern of bilateral triggers.

## 6. Conclusion

In this paper, I examined a subclass of harmony patterns which display trigger-based count effects, including a previously unanalyzed pattern of nasal assimilation in Kazakh suffixes. I presented an analysis using Harmonic Grammar in which a positively defined harmony constraint rewards local and non-local feature agreement (POSAGREE). I showed that these patterns cannot be captured using SPREAD-class constraints, but arise naturally in the typology of POSAGREE.

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