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The nature of conspiracy: implications for parallel versus serial derivation

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The nature of conspiracy: implications for parallel versus serial derivation

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Abstract

The nature of conspiracy: implications for parallel versus serial derivation

Jeffrey Adler

I argue that there exists a class of phonological phenomenon that, while naturally expressed in parallel OT, remain recalcitrant in the serial instantiation of OT, Harmonic Serialism. The primary case study comes from Mohawk. In Mohawk, the typical foot is a disyllabic, monosyllable. Wherever the canonical stress position, the penult, is open, vowel lengthening occurs to supply the second mora. However, when a separate constraint against long epenthetic vowels blocks lengthening, a disyllabic foot emerges instead. This conspiracy on Mohawk foot structure cannot be derived in Harmonic Serialism, because the constraint driving the conspiracy, FOOTBINARITY, must be demoted, in the course of the derivation. I show that Mohawk is not an isolated case. Rather, the finer detail of Mohawk phonology can be abstracted away from and the sort of interaction Harmonic Serialism cannot derive turns out to be defineable in terms of abstract constraints and rankings. I also show attested cases from nasal spreading and assimilation that meet this abstract schema, and that they cannot be derived in HS. Thus, parallelism is a must to express conspiracy within violable constraint-based frameworks.

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- My family

The nature of conspiracy: implications for parallel vs. serial derivation

"Definitive adjudication between parallel and serial conceptions, not to mention hybrids of various kinds, is a challenge of considerable subtlety…and the matter can be sensibly addressed only after much well-founded analytical work and theoretical exploration."

(Prince & Smolensky 1993/2004, pg. 6)"

1 Introduction

We can distinguish between modes of explanation in phonology as roughly 'input-based' or 'output-based.' In a language in which /CVCCV/ surfaces [CV.CV], we could offer an input-based explanation in which a structure in the input, a CC cluster, triggers the deletion of a consonant, or we could offer an output-based explanation in which constraints on structures in the output, the syllable, drives deletion of a consonant to ensure that syllables do not have codas. Constraint-based models of phonology like Optimality Theory (henceforth OT; Prince & Smolensky 1993/2004) are intrinsically output-based. Phonological processes occur to satisfy constraints on possible structures in the output, at the expense of constraints on identity between outpts and inputs. What's the empirical support though, for output-based explanation over input-based explanation? Probably the strongest argument comes from *conspiracy*.

A conspiracy: a set of processes that occur to satisfy a single goal (Kisseberth 1970). To fully capture conspiracy, output-based explanation is a must. The goal must be explicitly stated, or the fact that the application of the set of processes produces the same structure in the output is coincidental. In a language in which /CVCCV/ surfaces [ˈCV.CV] and /CVC/ surfaces as [ˈCV.CV], an output-based explanation can appeal to constraints on syllable structure or perhaps higher level metrical structure to offer a unified account of the C deletion and V insertion processes. In an input-based explanation though, CC clusters simply trigger C deletion, and some different input structure, perhaps CVC, trigger V insertion. The application of such processes is essentially arbitrary. In this way, conspiracy vindicate output-based explanation. In this paper, I examine the nature of conspiracy and output-based explanation in greater detail. Specifically, I show that conspiracy do not only vindicate output-based explanation, but *parallelism* as well.

OT is an intrinsically output-based grammatical framework. In its classical implementation (henceforth parallel OT), it models grammar in terms of the parallel evaluation of all possible input~output candidates. In this way, phonological processes 'apply' in parallel. However, there is no necessary reason why OT has to be parallel. To that end, Prince & Smolensky consider a serial variant of OT 'Harmonic Serialism.' They ultimately adopt the parallel variant, but they clearly state that a constraint-based model of grammar need not necessarily assume parallel derivation. In this paper, I explore the relationship between constraint-based models of grammar and parallel derivation in greater detail. Specially, I argue that, to capture output-based explanation, typified by conspiracy, parallelism is in fact necessary.

This argument explores the nature of phonological conspiracy. It is only possibly to express conspiracy if complete output-based explanation is possible.

Otherwise, a conspiracy remains mysterious. In this paper, I show that complete output-based explanation, and by extension, the successful expression of conspiracy, is only possible in a parallel model of derivation.

The goal in making this argument is first and foremost to understand better what are the essential ingredients for conspiracy. Minimal constraint violation turns out to be insufficient; parallelism is a must as well. This leads to the other major goal of this argument though: to clearly delineate the limits of output-based explanation in different constraint based models of grammar. More specifically, I aim to show what types of phonological patterns can be expressed in parallel versus serial implementations of OT. Harmonic Serialism, as originally conceived in Prince & Smolensky, and then explored by various researchers (see especially McCarthy (2010b), Pater and McCarthy (2016), and references therein), retains the constraint-based nature of OT, but models derivation in terms of the serial application of phonological processes. If minimal constraint violation fully retains output-based explanation, then the expression of conspiracy should be no problem. I show though, that Harmonic Serialism is limited in its ability to capture output-based explanation. A certain well-defined class of conspiracy cannot be derived in HS. It leads to a ranking paradox. This same class of conspiracy can easily be derived however, parallel OT. Thus, this paper demonstrates that there is a class of phonological phenomenon, a specific type of conspiracy, that cannot be generated in HS. Conspiracy reveals the limits of output-based explanation in serial models of grammar, even where minimal constraint violation is retained.

This paper is organized as follows: in section 2, I offer a general constraint schema to characterize conspiracies. I then apply this characterization to a conspiracy in Mohawk. In Mohawk, multiple processes conspire to ensure that feet are bimoraic. Parallel OT naturally expresses this conspiracy. In section 3, I formally introduce Harmonic Serialism. I lay out the basic tenets of how it works, and then show that a derivation of the Mohawk conspiracy leads to a ranking paradox. In section 4, I discuss the particular property of the Mohawk conspiracy that makes it incompatible with HS. This property will then be extended to the general schema of conspiracy, to offer a characterization of the 'intrinsically parallel conspiracy.' That is, I lay out the character of the specific type of conspiracy that cannot be expressed in HS. In section 5, I defend and explore various assumptions about the analysis of Mohawk from sections 3 and 4. I will show the deeply output-based nature of the Mohawk conspiracy, and contrast it with input-based accounts of Mohawk, which ultimately are shown to be empirically inadequate. In section 6, I show that there are additional attested cases of IPCs in other domains of phonology too, including in assimilation and anti-gemination patterns, suppletive allomorphy, and harmony patterns. This will show that Mohawk is not an isolated case, but an example of a more general phenomenon. In section 7, I conclude.

2 Conspiracy

2.1 Conspiracy, schematically

Informally, let us conceive of a conspiracy in terms of four basic ingredients, listed in (1)

(1) *Goal:* The goal is some unviolated markedness constraint on the surface. Various lower-ranked constraints will be violated in order to satisfy the goal.

A goal drives a conspiracy .

Default: The default is the low-ranked constraint normally violated to ensure that the goal is unviolated.

The default repair is the main method of satisfying the goal.

Blocker: The blocker is some additional high-ranked constraint in the language that would be violated by whatever candidate violates the default, in specific contexts.

The blocker blocks the default repair from applying in certain contexts.

Alternative: The alternative is some constraint that will be violated to meet the goal, when the blocker blocks the default. In all contexts in which the goal can be satisfied through violation of the default, the alternative will be unviolated. But, when the blocker would be violated by any candidate violating the default, the alternative is violated instead.

The alternative is the other repair used, when the default repair is blocked.

The following ranking characterizes a conspiracy: *Goal, Blocker* >> *Alternative* >> *Default*. To demonstrate, imagine a language in which a prohibition on coda consonants is generally satisfied through consonant deletion. That is, an input /CVCCV/ maps to [CV.CV]. However, when deletion of a coda consonant would violate an independent ban against words smaller than CVC, a vowel is inserted instead. That is, an input /CVC/ maps to [CV.Ce] The *goal* in this case will be NOCODA, the *blocker* MINWORD, the *alternative* DEPV, and *default* MAXC. I assume these constraints are all well-known, and for space reasons, I will not define them here. The mapping /CVCCV/ → [CV.CV], shown in (2), shows that the *goal*, NOCODA, and the *alternative*, DEPV, must be ranked above the *default*, MAXC[1]. In (2a), for the winner to beat the faithful candidate, NOCODA must rank above MAXC. In (2b), for the candidate with consonant deletion to beat the candidate with vowel insertion, DEPV must be ranked above MAXC.

			GOAL	*ALTERNATIVE*	*DEFAULT*	*BLOCKER*
(2)	CVCCV		NOCODA	DEPV	MAXC	MINWORD
a.	CV.CV	CVC.CV	**W**	***e***	**L**	***e***
b.	CV.CV	CV.Ce.CV	***e***	**W**	**L**	***e***

[1] Comparisons are presented in comparative tableaux (Prince 2002) except where violation tableaux are appropriate. The comparative tableaux have the format:

Input		C1	C2	C3
Winner	Loser	**W**	**L**	***e***

In a comparative tableaux, for any given winner~loser comparison, there must be at least one constraint that awards the comparison a **W** that ranks above all constraints that award the comparison an **L**.

The mapping /CVC/ → [CV.C<u>e</u>], shown in (3), shows that the *blocker*, MINWORD, must be ranked above the *alternative*, DEPV. For vowel epenthesis occur, even when DEPV is ranked above MAXC, MINWORD has to rank above DEPV.

			GOAL	*BLOCKER*	*ALTERNATIVE*	*DEFAULT*
(3)	CVC		NOCODA	MINWORD	DEPV	MAXC
a.	CV.Ce	CV	***e***	**W**	**L**	**W**

Conceptually, this hypothetical language demonstrates the basic schema of a conspiracy: a *goal* is normally satisfied through the violation of some low-ranked, *default*. But, when violation of the *default* also entails a violation of a *blocker*, the *alternative* is violated instead. This is a conspiracy. Now let's apply this schema to a real conspiracy: the Mohawk stress-epenthesis interactions.

2.2 Mohawk stress-epenthesis interactions in parallel OT

The Mohawk stress-epenthesis interactions (henceforth MSEI) involve a complex set of processes in which an otherwise simple stress system displays surprising divergences when it interacts with independent processes of vowel epenthesis[2]. The crucial point for the purposes this paper is that these divergences are all driven by an unviolated constraint on foot well-formedness: FOOTBINARITY. I do not present the entire range of MSEI here, but only enough to demonstrate the basic conspiracy. Much more data is presented in Section 5. Most importantly though, the

[2] MSEI have been analyzed within many phonological frameworks. The reader should consult Postal (1968) and Michelson (1988) for treatments within general rule-based phonology, Michelson (1989) and Piggot (1995) for CV-phonology, Alderete (1995), Alderete (1999), Hagstrom (1997), Ikawa (1995) and Rawlins, (2006) for parallel OT, Elfner (2016) for Harmonic Serialism, and Rowicka (1998) for government phonology. However, I will adopt the analyses of Ikawa (1995) and Rawlins (2006). Justification for their analyses will come in section 5, along with consideration of Alderete and Elfner's accounts as well.

generalization that feet are always bimoraic is without exception. All data come from Michelson (1988), (1989), with foot structure inspired by Ikawa (1995) and Rawlins (2006).

In Mohawk, multiple processes conspire to guarantee that feet are bimoraic. (4) presents representative forms of the standard stress pattern: the patterns when there is no interaction with vowel epenthesis[3]. In forms with no vowel epenthesis, stress always falls on the penultimate syllable. (4a) shows that, when the penult is closed, it receives stress, and no other stress-related processes occur. The second mora is supplied by a moraic coda. (4b) shows that, when the penult is open, vowel lengthening occurs to supply the second mora.

(4)

		Standard Stress Pattern: simple penult stress			
a.	**Closed** σ:	/CV**CVC**CV/	[CV(ˈ**CVC**)CV] *Moraic Coda*	/k-ati**rut**-haʔ/ 1A-*pull*-HAB	[.ka.ti(ˈ**.rut.**)haʔ.] *'I pull'*
b.	**Open** σ:	/CV**CV**CV/	[CV(ˈ**CVː**)CV] *V-Lengthening*	/k-ha**ra**tat-s/ 1A-*lift*-HAB	[.kha(ˈ**.ra**ː**.**)tats.] *'I am lifting it up a little (with a lever)'*

In default forms, bimoraicity is guaranteed by a moraic coda or vowel lengthening. However, an independent, phonotactic process of vowel epenthesis into the penult blocks the latter of those strategies. In such cases though, all is not lost. Rather, the

[3] The data are presented in the following format: /schematized UF/ [schematized SF] /representative UF/ [representative SF]. The schematized forms will be used throughout to (hopefully) enhance readability.

language can recruit a disyllabic, trochaic foot (ˈCV.CV) from its arsenal of metrical pedicures.

[e]-insertion (to be contrasted with other processes of insertion in section 5) occurs to break up certain triconsonantal clusters, and diconsonantal clusters that are not acceptable tauto- or heterosyllabically due to constraints against rising sonority across syllable boundaries (see Clements (1990) and Gouskova (2004) on the 'Syllable Contact Law'). (5) shows the stress pattern for '[e]-forms:' forms with an epenthetic vowel in the penultimate syllable. When insertion leaves [e] in a closed syllable, nothing surprising happens. The penultimate syllable gets stressed, and the coda consonant supplies the second mora. (5a) is analogous to (4a). When insertion leaves [e] in an open syllable however, we do not get the expected stress pattern. Rather, stress appears on the antepenultimate syllable. Unlike (4b), where vowel lengthening occurred to allow for a monosyllabic, (H) foot on the penultimate syllable, in (5b), a disyllabic, trochaic (ˈLL) foot emerges on the antepenult-penult.

(5)

		[e̲]-Stress Pattern:			
a.	**Closed** σ:	/CV**CCC**V/	[CV**(ˈCeC)**CV] *Moraic Coda*	/wa**k-ny**ak-s/ 1P-*get married*-HAB	[.wa**(ˈ.ke̲n.)**yaks.] *'I get married'*
b.	**Open** σ:	/CV**Cr**V/	[**(ˈCV.Ce)**rV] *Stress shift!* *[CV. **(ˈCe:)**CV]	/w-a**kr**a-s/ NA-*smell*-HAB	[**(ˈ.wa.ke̲.)**ras.] *'It smells'*

In sum, when the penultimate syllable does not have a coda consonant, vowel lengthening usually occurs to supply a second mora. However, when vowel epenthesis blocks the possibility of vowel lengthening, a trochaic foot emerges instead (see Houghton (2015) on so-called metrical ‘switch’ languages). Thus, this is a typical example of a conspiracy. Fitting MSEI into the conspiracy schema from (4), the constraints in (6) will be necessary to derive Mohawk in parallel OT.

The constraints in (6) all are standard, except for DEPV:. DEPV: is a constraint that militates against epenthesizing long vowels. This will be crucial in understanding why vowel lengthening does not occur when an epenthetic vowel occupies an open penultimate syllable (ex. [**(ˈCV.Ce)**rV]). While not standard, DEPV: is typologically supported by the general lack of long epenthetic vowels cross-linguistically. It also may have phonetic grounding, in the sense of the P-map (Steriade, 2001/2008), in that it reduces the perceptual difference between the surface form and underlying form. Besides DEPV:, it is worth noting that FTBIN is parameterized to the level of the mora here. Finally, TROCHEE and IAMB, while standard, play a special role in Mohawk. They jointly derive the prefence for monosyllabic feet in default stress forms (ex. [CV**(ˈCVC)**CV], [CV**(ˈCV:)**CV]). Because both constraints accept feet of the form (ˈσ), a monosyllabic foot will satisfy both constraint, where either a disyllabic foot will necessarily incur a violation of either TROCHEE or IAMB.

(6)	*Goal:*	FTBIN	A foot contains two morae. *Assign a violation for each foot containing more or less than two morae.*
	Blocker:	DEPV:	A long vowel present in the output is present in the input.

Assign a violation for each long epenthetic vowel.

TROCHEE A foot takes the form (ˈσ σ) or (ˈσ).

Assign a violation for each foot of the form (σˈσ).

Alternative: IAMB A foot takes the form (σˈσ) or (ˈσ).

Assign a violation for each foot of the form (ˈσ σ).

Default: DEPμ A mora in the output is present in the input.

Assign a violation for vowel lengthening.

Where (6) outlines the constraint definitions in CON, (7) outlines the parameters by which candidates will vary in GEN. Candidates will differ in terms of whether a vowel is long or short (VOWEL LENGTH), whether the foot is mono- or disyllabic (FOOT SIZE), and whether a disyllabic foot is trochaic or iambic (FOOT HEADEDNESS). Candidates will not differ in terms of the location of the epenthetic vowel, or whether it or not a vowel is inserted at all. The details of vowel insertion are not important here, only the interaction with stress. Similarly, candidates will not differ in terms of the location of the foot; feet will always be right-aligned *modulo* NONFINALITY.

(7) a. VOWEL LENGTH: V, V:

b. FOOT SIZE: (σ), (σ σ)

c. FOOT HEADEDNESS: (ˈσ σ), (σ ˈσ)

(8) repeats the crucial mappings from the MSEI to be derived here. The ranking was calculated and verified in OTWorkplace (Prince, Tesar, & Merchant 2015). I entered

candidates manually according to the parameters in (7), and entered violation marks according to the constraint violations in (6). However, given these candidates and violations, OTWorkplace arrived at the ranking: TROCHEE, DEPV:, FTBIN >> IAMB >> DEPμ. For the sake of space, I do not show all comparisons, but only the most relevant.

			Standard Forms		[e]-forms	
(8)	a.	**Closed** σ	/CVCVCCV/	→ [CV(ˈ**CVC**)CV]	/CVCCCV/	→ [CV(ˈ**CeC**)CV]
	b.	**Open** σ	/CVCVCV/	→ [CV(ˈ**CV:**)CV]	/CVCrV/	→ [(ˈ**CV.Ce**)rV]

Standard, closed σ forms in MSEI win simply by the presence of FTBIN; (9) shows that no ERCs are entailed for such forms. It is worth noting how TROCHEE and IAMB prefer the winner, due to having a monosyllabic foot, in (9a) and (9b), respectively.

			GOAL	*BLOCKER*		*ALTERNATIVE*	*DEFAULT*
(9)	/CVCVCCV/		FTBIN	DEPV:	TROCHEE	IAMB	DEPμ
a.	.CV(ˈ.CVC.)CV.	(ˈ.CV.CVC.)CV.	**W**	***e***	***e***	**W**	***e***
b.	.CV(ˈ.CVC.)CV.	(.CVˈ.CVC.)CV.	**W**	***e***	**W**	***e***	***e***

More interesting are the standard, open σ forms. In these forms, we start to see the conspiracy ranking come into place. In (10a), we see that the *goal*, FTBIN, must rank above the *default*, DEPμ. In (10b), we see that the *alternative*, IAMB, must also rank above the *default*. This is crucial; it ensures that, in standard stress forms, vowel lengthening will occur to satisfy FTBIN, not the emergence of a trochaic foot. (10c) just shows that TROCHEE must also rank above DEPμ to ensure that an iambic foot also does not occur to satisfy FTBIN. TROCHEE will not play an important role in this analysis besides this though.

			GOAL	*BLOCK*		*ALT*	*DEFAULT*
(10)	/CVCVCV/		FTBIN	DEPV:	TROCHEE	IAMB	DEPμ
a.	.CV('.CV:.)CV.	.CV('.CV.)CV.	**W**	***e***	***e***	***e***	**L**
b.	.CV('.CV:.)CV.	('.CV.CV.)CV.	***e***	***e***	***e***	**W**	**L**
c.	.CV('.CV:.)CV.	(.CV'.CV.)CV.	***e***	***e***	**W**	***e***	**L**

FTBIN, IAMB >> DEPμ drives vowel lengthening to satisfy FTBIN in standard stress forms. Additional rankings are necessary though, to understand why vowel lengthening does not occur to satisfy FTBIN in [e]-forms. Firstly though, for completeness, (11) shows the comparisons for closed σ e-[forms]. (11) is basically identical to (9), and provides no ranking information.

			GOAL	*BLOC*		*ALT*	*DEFAULT*
(11)	/CVCCCV/		FTBIN	DEPV:	TROCHEE	IAMB	DEPμ
a.	.CV('.CeC.)CV.	('.CV.CeC.)CV.	**W**	***e***	***e***	**W**	***e***
b.	.CV('.CeC.)CV.	(.CV'.CeC.)CV.	**W**	***e***	**W**	***e***	***e***

The open σ e-[forms] however, complete the conspiracy. In (12a), we see that the *goal*, FTBIN, must rank above the *alternative*, IAMB. In (12b), we see that the blocker, DEPV:**,** must also rank above the alternative. Taken together, the ranking FTBIN, DEPV: >> IAMB expresses the fact that trochaic feet will emerge in order to satisfy FTBIN. While monosyllabic feet are generally preferred over disyllabic feet, when DEPV: blocks the option of satisfying FTBIN through vowel lengthening, a disyllabic, trochaic foot will emerge instead. (12c) just shows that TROCHEE must rank above IAMB, to ensure that a trochaic foot, not an iambic foot emerges.

			GOAL	*BLOCK*		*ALT*	*DEFAULT*
(12)	/CVCrV/		FTBIN	DEPV:	TROCHEE	IAMB	DEPμ
a.	(ˈ.CV.Ce.)CV.	.CV(ˈ.Ce.)CV.	**W**	***e***	***e***	**L**	***e***
b.	(ˈ.CV.Ce.)CV.	.CV(ˈ.Ce:.)CV.	***e***	**W**	***e***	**L**	**W**
c.	(ˈ.CV.Ce.)CV.	(.CVˈ.Ce.)CV.	***e***	***e***	**W**	**L**	***e***

The total ranking FTBIN, DEPV: >> IAMB >> DEPμ captures the Mohawk conspiracy, in accordance with the general schema *Goal, Blocker >> Alternative >> Default*. Foot bimoraicity is normally met through vowel lengthening, but when a constraint against long epenthetic vowels blocks the option of vowel lengthening, a trochaic foot emerges instead. In this way, we see how parallel OT naturally expresses MSEI in terms of output-based terms: different lower-ranked constraints are violated, all to satisfy some unviolated constraint on foot form, a structure in the output. In the next section, we will see that the same is not true of Harmonic Serialism.

3 MSEI in Harmonic Serialism

In this section, I show that the MSEI conspiracy cannot be expressed in HS. While we saw that parallel OT had no trouble doing so, the same will not be true of the derivational implementation of OT. I will first introduce the basic tenets of HS. Then, I will demonstrate that a ranking paradox emerges in trying to derive MSEI in HS.

3.1 Harmonic Serialism

In this section, I introduce the basics of HS. HS is a serial implementation of OT that can model phonological phenomena in terms of the serial application of processes, while still making the transparent typological predictions that OT provides. In this way, it is possible to capture interactions more easily expressed in serial models of phonology, without losing the predictive power of OT. The serial nature of HS comes out of two core properties:

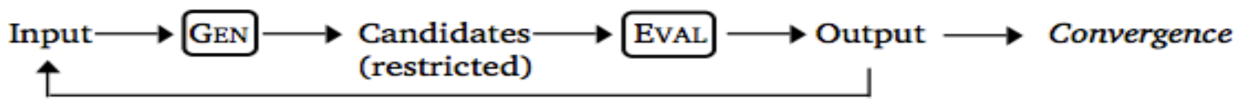
1. LIMITED GEN: GEN only produces candidates that differ from the input by the application of maximally one phonological *operation*, and any number of *free processes*. Whether or not two processes can occur simultaneously or not in a derivation will be determined by which phonological processes are deemed operations, and which are deemed free processes. McCarthy (2008a), for example, argues that foot building and vowel deletion are operations, while syllabification is a free process. Thus, for an input /CVCVCV/, GEN can produce candidates with foot structure present in the output, [(CV.CV)CV] or a vowel deleted in the output, [CV.CVC], but not a candidate with both foot structure and a vowel deleted in the output *[(CV.CVC)].

2. GEN-EVAL LOOP: A derivation consists of multiple linearly ordered IO mappings. The winner of one mapping becomes the input to the next, till the derivation converges. Recall that, in HS, outputs are limited in how much they can differ from input. So, to capture the fact that surface forms (SF) often differ from underlying forms (UF) in terms of the application of many phonological processes, HS models the derivation from UF to SF in terms of serially ordered IO mappings. The UF forms the input to the first IO mapping, or *step*, of the derivation. GEN produces a limited candidate set from this input, and EVAL selects a winner given some ranked constraint

set. The winning output then is passed onto the next IO mapping as input. This cycle continues until a faithful mapping occurs. The winner of the faithful mapping is the surface form.

The graphic in (13) depicts this process. [4]

(13)



By limiting GEN and dividing a derivation into multiple IO mappings, HS expresses phonological phenomena in serial terms. This allows for a natural expression of certain phonological phenomena that are more easily expressed in serial terms than parallel terms (see, among others, McCarthy 2008b). As we will see in the following section though, this comes at the alternative of not being able to capture more complex output-basex explanation, in the form of conspiracies.

3.2 MSEI in HS: Ranking Paradox

In this section, I demonstrate that the derivation of MSEI in HS leads to a ranking paradox. This demonstration will require the constraints in (14). These constraints should all be familiar from the discussion of MSEI in parallel OT, except for PWDHD. PWDHD is the constraint that demands prosodic structure. In HS, phonological processes do not occur simultaneously, but rather, in a sequential fashion. Thus, there will have to be some specific point in the derivation where prosodic structure is

[4] Graphic taken from Elfner 2008

applied. The ranking of PWDHD relative to other constraints will determine when in the derivation prosodic structure is applied. Because Mohawk only has one foot per word, assigning prosodic structure really just means assigning the single foot.

(14)

(14)		PWDHD	A word has prosodic structure *Assign a violation for any form that does not have a foot.*
	Goal:	FTBIN	A foot contains two morae. *Assign a violation for each foot containing more or less than two morae.*
	Blocker:	DEPV:	A long vowel present in the output is present in the input. *Assign a violation for each long epenthetic vowel.*
		TROCHEE	A foot takes the form (ˈσ σ) or (ˈσ). *Assign a violation for each foot of the form* (σˈσ).
	Alternative:	IAMB	A foot takes the form (σˈσ) or (ˈσ). *Assign a violation for each foot of the form* (ˈσ σ).
	Default:	DEPμ	A mora in the output is present in the input. *Assign a violation for vowel lengthening.*

(14) displays the constraints relative to the derivation of MSEI in HS. However, also crucial to any HS derivation is a designation of phonological processes as operations and free processes. In other words, to define GEN. (15) shows which processes in Mohawk are operations, and which are free processes. Footing, vowel insertion and vowel lengthening are all assumed to be operations, while syllabification is assumed to be a free process. In section 5, the consequences of abandoning these assumptions will be explored. We will see that the ranking paradox that emerges in HS *is* avoidable if the operations in (15) are instead designated as free processes, but this

amounts to making HS parallel, further strengthening the central argument of this paper.

(15)

OPERATIONS	a.	FOOTING	An input differs from the output only *wrt* foot structure.	*Foot building is a step*
	b.	VOWEL INSERTION	An input differs from the output only *wrt* vowel insertion.	*Vowel insertion is a step*
	c.	VOWEL LENGTHENING	An input differs from the output only *wrt* lengthening.	*Vowel lengthening is a step*
FREE PROCESS	a.	SYLLABIFICATION	An input freely differs from the output *wrt* syllable structure.	*Syllabification occurs simultaneously with other processes and operations*

With these definitions at hand, we are ready to attempt to derive MSEI in HS. This derivation will reveal the central reason why certain conspiracies cannot hold: due to the existence of intermediate forms, the ranking *Goal* >> *Alternative* does not hold. Rather, the opposite ranking *Alternative* >> *Goal,* is entailed. Because the *goal* is no longer the highest-ranked constraint, it will not always be satisfied[5]. This stands in contradiction to the reason why conspiracies happen at all: to ensure that the *goal* is always satisfied. Before we see where this ranking is entailed though, we start with the simple closed σ, default stress forms (i.e. /CVCVCCV/ → [.CV(ˈCVC)CV.]). At the first step of the derivation, shown in (16), the candidate with a single monosyllabic foot wins. Like in the derivation of the same forms in parallel OT, no

[5] McCarthy, Pater, & Pruitt (2016) discuss a highly related issue they deem 'violation of the surface true.' This will be discussed in great detail in section 4.

ranking information is provided by such forms. (16a) shows that the simple existence of PWDHD compels foot building at the first step of the derivation; no constraint demands that any other type of process occur, and no constraint disfavors prosodic structure. (16b-c) show how FTBIN, TROCHEE, and IAMB all prefer a monosyllabic (ˈCVC) foot to a disyllabic foot, trochaic or iambic.

				GOAL	*BLOC*		*ALT*	*DEF*
(16)	/CVCVCCV/		PWDHD	FTBIN	DEPV:	TROCHEE	IAMB	DEPμ
a.	.CV(ˈ.CVC.)CV.	.CV.CVC.CV.	**W**	***e***	***e***	***e***	***e***	***e***
b.	.CV(ˈ.CVC.)CV.	(ˈ.CV.CVC.)CV.	***e***	**W**	***e***	***e***	**W**	***e***
c.	.CV(ˈ.CVC.)CV.	(.CVˈ.CVC.)CV.	***e***	**W**	**e**	**W**	***e***	***e***

In the following step of the derivation, shown in (17) the derivation converges. There is no interesting competitor to the faithful candidate, because the faithful candidate satisfies all constraints[6].

				GOAL	*BLOC*		*ALT*	*DEF*
(17)	/.CV(ˈ.CVC.)CV./		PWDHD	FTBIN	DEPV:	TROCHEE	IAMB	DEPμ
a.	.CV(ˈ.CVC.)CV.	*No Comp*	**W**	***e***	***e***	***e***	***e***	***e***

No ranking information is provided by the derivation of standard, closed σ forms. Their derivation merely involves two steps, one in which penult stress is assigned,

[6] In both **Error! Reference source not found.** and **Error! Reference source not found.**, I am leaving out comparisons between the winner and candidates with long vowels (ex. [.CV.CV:C.CV.] and [.CV(ˈ.CV:C.)CV.], respectively. There is no constraint favoring vowel lengthening unless a foot would otherwise be monomoraic, thus, the constraints will incur gratuitous violations of Depμ.

and another in which the derivation converges on the faithful candidate. Because an underlying consonant provides the mora, no processes need to occur to satisfy FTBIN. In the examination of standard, open σ forms though ,we will gain ranking information. Specifically, we will get the pathological ranking that serial derivation burdens us with: IAMB (*Alternative)* >> FTBIN (*Goal*).

In standard, open σ forms, the requisite second mora is supplied through lengthening the tonic vowel (i.e. /CVCVCV/ → [CV(ˈCVː)CV]). Observe how, according to our designation of FOOT BUILDING and VOWEL LENGTHENING as operations[7], the mapping from underlying form (UF) /CVCVCV/ to surface form (SF) [CV(ˈCVː)CV] will involve the application of two different operations: foot building, and vowel lengthening. Because the two operations do not apply in parallel, this entails that there will be a form in the derivation [CV(ˈCV)CV], which contains a monomoraic foot. No such form is entailed in the derivation of MSEI in parallel OT, and the necessary existence of a such a form will ultimately be the reason why HS cannot express MSEI.

At the first step of the derivation for standard, open σ forms, the candidate with one of the two operations, FOOT BUILDING and VOWEL LENGTHENING, will win. It must be the case that the candidate with foot structure though, [.CV(ˈ.CV.)CV.], is the winner, not [.CV.CVː.CV.]. This is because, since lengthening happens to satisfy FTBIN, if there is no foot to satisfy, lengthening happens gratuitously. This is a formal

[7] This assumption will be discussed in section 5. The main point though is that, for HS to capture the types of generalization more amenable to serial analysis, like those in Aguaruna (McCarthy 2008b), FOOT BUILDING and VOWEL LENGTHENING *must* be operations, not free processes. Because the theory of GEN is supposed to be universal, if FOOT BUILDING and VOWEL LENGTHENING happen in parallel in Mohawk, then it will be impossible to capture serial generalizations in other languages.

truth expressed in terms of harmonic bounding. (18) shows that, for an input /CVCVCV/ the candidate with lengthening applied, [.CV.CVː.CV.], is harmonically bounded by the faithful candidate [.CV.CV.CV.]. Therefore, at the first step of the derivation [.CV.CVː.CV.] cannot win. The winner at the first step is [CV(ˈ.CV.)CV.]. The relevant comparisons are shown in (19).

			GOAL	*BLOCKER*		*ALTERNATIVE*	*DEFAULT*
(18)	/CVCVCV/	PWDHD	FTBIN	DEPVː	TROCHEE	IAMB	DEPμ
a.	.CV.CVː.CV.	*			*!		
b.	.CV.CV.CV.	*					

To repeat, the winner at the first step of the derivation from [CV(ˈ.CV.)CV.] from UF /CVCVCV/ to SF [CV(ˈCVː)CV] must be [CV(ˈ.CV.)CV.]. The relevant comparisons at this step are shown in (19).

					ALT	***GOAL***	*BLOC*	*DEF*
(19)	/CVCVCV/		PWDHD	TROCHEE	IAMB	FTBIN	DEPVː	DEPμ
a.	CV(ˈ.CV.)CV	.CV.CV.CV	**W**	***e***	***e***	**L**	***e***	***e***
b.	CV(ˈ.CV.)CV	.CV.CVː.CV	**W**	***e***	***e***	**L**	***e***	**W**
c.	CV(ˈ.CV.)CV	(.CVˈ.CV.)CV	***e***	**W**	***e***	**L**	***e***	***e***
d.	CV(ˈ.CV.)CV	(ˈ.CV.CV.)CV	***e***	***e***	**W**	**L**	***e***	***e***

(19a) shows that, for foot building to occur at all, PWDHD must rank above FTBIN. This ranking expresses the fact that foot structure is built, even if the foot is not bimoraic. This is necessary if the language is to have stress at all in forms with vowel lengthening. While PWDHD >> FTBIN may seems alarming because it already means that FTBIN is violated in Mohawk, it actually is not problematic. PWDHD does not interact with other constraints. (19b) shows simply that either PWDHD or DEPμ must dominate FTBIN. We already know PWDHD dominates FTBIN. We will see in the following step that FTBIN ranks above DEPμ. In sum, PWDHD >> FTBIN compels vowel insertion, even where a foot is not bimoraic.

(19c-d) provide the crucial ranking information that make the derivation of MSEI in HS distinct from the derivation of MSEI in parallel OT. Recall that, for MSEI in parallel OT, the ranking IAMB >> DEPμ expresses the default preference for vowel insertion to satisfy FTBIN, over building a trochaic foot. This was a ranking of the form *Alternative* >> *Default*, in keeping with a typical conspiracy. For MSEI in HS, this preference cannot be expressed by the same ranking. (19c-d) show that, because vowel lengthening cannot occur simultaneously with foot building, to ensure that the derivation of standard, open σ forms lands on the attested surface form [CV(ˈCV:)CV], TROCHEE, IAMB must outrank FTBIN[8], which they do not in parallel OT. TROCHEE >> FTBIN is not a problematic ranking. It expresses a preference for non-iambic feet over a preference for foot binarity. The language does indeed never have iambic feet, so this is not problematic. IAMB >> FTBIN though, is problematic. It expresses a preference for non-trochaic feet over a preference for foot binarity. This

[8] There is a subtle step in the argument here that, since the surface form [CV(ˈCV:)CV] contains a monosyllabic foot, at the step where foot building applies, the candidate with a monosyllabic foot, [.CV(ˈ.CV.)CV.], must win. Otherwise, the derivation will converge on the pathological form [(ˈ.CV.CV.)CV.]. However, one could propose that perhaps [(ˈ.CV.CV.)CV.] beats [.CV(ˈ.CV.)CV.] at the first step of the derivation, but then some foot 'adjustment' occurs, such that the derivation eventually converges on the attested form [CV(ˈCV:)CV]. I discuss this possibility in section 5 as well, and show that it will not help.

runs directly contrary to the key generalization about MSEI that a trochaic foot will emerge to build a binary foot, when vowel lengthening is blocked. IAMB >> FTBIN is schematically *Alternative* >> *Goal*. This ranking makes the expression of the MSEI conspiracy impossible.

IAMB >> FTBIN expresses a preference for non-trochaic feet over a preference for foot binarity. While this preference does not reflect a true fact about the language, it is not actually problematic for the derivation of SF /CVCVCV/ to UF [CV(ˈCV:)CV], under examination curectly. While a surface unviolated constraint FTBIN is violated by the intermediate form [.CV(ˈ.CV.)CV.], the violation will be remedied in the following step of the derivation. In the second step of the derivation of standard, open σ forms, the candidate with vowel lengthening will win, satisfying FTBIN. This is shown in (20). FTBIN >> DEPμ selects the candidate with vowel insertion over the faithful candidate. Thus, foot binarity is correctly predicted to be satisfied by vowel insertion in standard forms.

					ALT	***GOAL***	*DEF*	*BLOC*
(20)	/.CV(ˈ.CV.)CV./		PWDHD	TROCHEE	IAMB	FTBIN	DEPμ	DEPV:
a.	.CV(ˈ.CV:.)CV.	.CV(ˈ.CV.)CV.	***e***	***e***	***e***	**W**	**L**	***e***

In the final step of the derivation, shown in (21), the derivation converges on the attested form. The winning, faithful candidate incurs zero violations of any constraint. Thus, it has no noteworthy competitors.

				ALT	***GOAL***	*DEF*	*BLOC*
(21	/.CV(ˈ.CV:.)CV./	PWDH	TROCHE	IAM	FTBI	DEP	DEPV

)			D	E	B	N	µ	:
a.	.CV('.CV:.)CV.	*No Competitor*	***e***	***e***	***e***	***e***	***e***	***e***

HS successfully derives the standard forms of MSEI, although not without certain seemingly problematic rankings. (22) though lists all the rankings made so far. That they are different from the rankings entailed in the derivation of MSEI in parallel OT is not itself problematic; HS and parallel OT are different, some differences will arise. However, it is the specific nature of (some of) these rankings that is problematic. To go through them though, (22a) expresses the fact that feet are built, even when FTBIN cannot be immediately satisfied. (22b) is common across HS and parallel OT, and expresses the fact that vowel lengthening occurs to ensure foot binarity. (22c-d) are unique to MSEI in HS. They express the fact that a monosyllabic foot will be built, at the expense of violating FTBIN, even where a disyllabic foot could have immediately satisfied FTBIN. None of these rankings are problematic looking only at standard forms. In the following section though, we will see that IAMB >> FTBIN is problematic, once the entire MSEI is considered. Because a preference for monosyllabic feet trumps a preference bimoraic feet, the attested trochaic foot will never emerge. More generally, because the *Alternative* is higher ranked than the *Goal*, the *Alternative* will, *contra* reality, not be violated to satisfy the *Goal*.

(22) a. PWDHD >> FTBIN: Foot structure is preferred, even if the foot is not binary.

b. FTBIN >> DEPµ: Vowel lengthening occurs to make a foot binary.

c. TROCHEE >> FTBIN: A monosyllabic foot is preferred over an iambic foot.

d. IAMB >> FTBIN: A monosyllabic foot is preferred over a trochaic foot.

In attempting to derive the [e]-forms of the MSEI, we will now see the result of the IAMB >> FTBIN ranking, and more generally, the consequences of adopting serial derivation for capturing output-based explanation in conspiracies.

The derivation for closed σ , [e]-forms, (i.e. /CVCCCV/ → [.CV(ˈCeC)CV.]) is just like the derivation for the analogous closed σ standard forms (i.e. /CVCVCCV/ → [.CV(ˈCVC)CV.])[9]. (23) and (24) show the first and second steps of the derivation of closed σ [e]-forms, respectively. They are equivalent to (16) and (17) above, although the constraints are partially ordered in (23) and (24). No ranking information is provided.

					ALT	***GOAL***	*DEF*	*BLOC*
(23)	/CVCeCCV/		PWDHD	TROCHEE	IAMB	FTBIN	DEPμ	DEPV:
a.	.CV(ˈ.CeC.)CV.	.CV.CeC.CV.	**W**	***e***	***e***	***e***	***e***	***e***
b.	.CV(ˈ.CeC.)CV.	(ˈ.CV.CeC.)CV.	***e***	***e***	**W**	**W**	***e***	***e***
c.	.CV(ˈ.CeC.)CV.	(.CVˈ.CeC.)CV.	***e***	**W**	**e**	**W**	***e***	***e***

[9] This is true under the assumption that epenthesis always precedes stress assignment. This is obviously not a trivial assumption. Since [e]-foms involve the application of two phonological processes, vowel insertion and foot building, one process must follow the other. In this section, I will precede under the assumption that vowel insertion always precedes foot building. However, I will formally justify this assumption in section 4.2, in the comparison of this analysis with that of Elfner (2016). Elfner also analyzes MSEI in HS, but relies crucially on the idea that processes of vowel insertion can be interleaved in the derivation with respect to stress assignment. In 4.2, I show that this analysis, while a successful demonstrate of the power of HS, turns out to be empirically inadequate. And, an empirically adequate account of MSEI must order epenthesis before stress assignment.

					ALT	***GOAL***	*DEF*	*BLOC*
(24)	/.CV(ˈ.CeC.)CV./		PWDHD	TROCHEE	IAMB	FTBIN	DEPµ	DEPV:
a.	.CV(ˈ.CeC.)CV.	*No Competitor*	**W**	***e***	***e***	***e***	***e***	***e***

HS can successfully express closed σ [e]-forms; IAMB >> FTBIN does not play a role here. However, HS cannot successfully express open σ [e]-forms (i.e. /CVCrV/ → [(ˈCV.Ce)rV]); IAMB >> FTBIN predicts that either of the pathological candidates *[CV(ˈ.Ce)rV] or *[CV(ˈ.Ce:)rV] will win, depending on the ranking of DEPV:. In the first step of the derivation from UF /CVCrV/ to SF [(ˈCV.Ce)rV], we want the candidate [(ˈCV.Ce)rV] to win. IAMB >> FTBIN however, incorrectly predicts that [CV(ˈ.Ce)rV] will win. This is shown in (25).

In (25), IAMB >> FTBIN chooses [CV(ˈ.Ce)rV] over [(ˈCV.Ce)rV]. The former satisfies IAMB, while the latter satisfies FTBIN. In this way, the ranking entailed previously by the comparison above, in (19d), of the intermediate form [CV(ˈ.CV)CV] and [(ˈCV.CV)CV] makes it impossible to express the fact that feet are always bimoraic on the surface. For [CV(ˈ.CV)CV] to beat [(ˈCV.CV)CV], IAMB had to rank above FTBIN. This means that, throughout the language then, monosyllabic feet are preferred over trochaic feet, even if the feet are not bimoraic.

					ALT	***GOAL***	*DEF*	*BLOC*
(25)	/.CVCrV./		PWDHD	TROCHEE	IAMB	FTBIN	DEPµ	DEPV:
a.	💣.CV(ˈ.Ce.)rV.	☹ (ˈ.CV.Ce.)rV.	***e***	***e***	**W**	**L**	***e***	***e***

In the following step of the derivation, either the derivation will converge on the pathological candidate [.CV(ˈ.Ce.)rV.], or the pathological candidate [.CV(ˈ.Ce:.)rV.]. The two options are shown in (26) and (27), respectively. (26) shows that, if DEPV: ranks above FTBIN, then the derivation converges on *[.CV(ˈ.Ce.)rV.]. Such a candidate conforms to the generalization that epenthetic vowels cannot be long in Mohawk, but incorrectly has s monosyllabic, monomoraic foot. (27) shows that, if FTBIN ranks above DEPV:, then [.CV(ˈ.Ce:.)rV.] wins. The derivation would converge on the pathological form *[.CV(ˈ.Ce:.)rV.] in the next step, shown in (28)[10]. Thus, once [.CV(ˈ.Ce.)rV.] is chosen over [(ˈ.CV.Ce.)rV.] at the first step in the derivation, shown above in (25), the derivation will necessarily converge on a pathological candidate.

Note that DEPV: does not play the role it is meant to of blocking vowel lengthening, and motivating the emergence of a trochaic foot. This is because, in the crucial comparison in (25); it assigns the violation an ***e***, and the derivation cannot ‘look-ahead’ to know that DEPV: will eventually make it impossible to satisfy FTBIN. That is, the *blocker* cannot play its role if, as HS necessitates, all possible candidates are not evaluated globally, in parallel.

			ALT	*BLOCK*	***GOAL***	*DEF*

[10] As mentioned in footnote 8, this argument may seem to assume that feet cannot change shape when applied. I will show in 4.4 however, that allowing for foot reshaping will not help. For a ranking to choose an (H) foot in the first place, some ranking must prefer (H) over (LL). Thus, that same ranking will prevent an (H) foot from reshaping into (LL), even if GEN could produce candidates with reshaped feet.

(26)	/CV(ˈ.Ce.)rV./		PWDHD	TROCHEE	IAMB	DEPV:	FTBIN	DEPμ
a.	💣.CV(ˈ.Ce.)rV.	.CV(ˈ.Ce:.)rV.	***e***	***e***	***e***	**W**	**L**	**W**

					ALT	***GOAL***	*BLOCK*	*DEF*
(27)	/CV(ˈ.Ce.)rV./		PWDHD	TROCHEE	IAMB	FTBIN	DEPV:	DEPμ
a.	.CV(ˈ.Ce:.)rV.	.CV(ˈ.Ce.)rV.	***e***	***e***	***e***	**W**	**L**	**L**

					ALT	***GOAL***	*BLOCK*	*DEF*
(28)	/.CV(ˈ.Ce:.)rV./		PWDHD	TROCHEE	IAMB	FTBIN	DEPV:	DEPμ
a.	💣.CV(ˈ.Ce:.)rV.	*No Competitor*	***e***	***e***	***e***	***e***	***e***	***e***

To derive the attested form for open σ [e]-forms, we need the ranking FTBIN >> IAMB. (29) shows that such a ranking correctly predicts the candidate with a trochaic foot. To predict the right forms for [e]-forms, we need the ranking FTBIN >> IAMB. However, to predict the right forms for standard form, we need the ranking IAMB >> FTBIN. Therefore, a ranking paradox emerges in attempting to express the MSEI in HS.

				GOAL	***ALT***	*BLOCK*	*DEF*
(29)	/CV(ˈ.Ce.)rV./	PWDHD	TROCHEE	FTBIN	IAMB	DEPV:	DEPμ

a.	('.CV.Ce.)rV.	.CV('.Ce.)rV.	***e***	*e*	**W**	**L**	***e***	***e***

This concludes the demonstration of MSEI in HS. A ranking paradox emerges in trying to account for the entire MSEI conspiracy. This was a result of having intermediate forms that entail a ranking *Alternative* >> *Goal*. Since a necessary component of a conspiracy is the ranking *Goal* >> *Alternative*, the conspiracy cannot be expressed. In the following section, I will delve more closely into the reasons why the expression of MSEI in HS is impossible. This will shed light on the nature of IPCs. Also, for the skeptic, in section 5, I will thoroughly defend various assumptions made in the general descriptive analysis of MSEI and in the theoretical implementation of MSEI within HS. Doing so will show that the ranking paradox was not simply a result of specific assumptions up for reinterpretation, but that Mohawk has to be analyzed as I have done so here.

4 Intrinsically Parallel Conspiracy

The last section demonstrated the impossibility of deriving MSEI in HS. In this section, I explore what aspects of HS make the derivation impossible. This section will be organized as follows. In 4.1, I introduce a relevant notion from McCarthy, Pater, and Pruitt (2016) of 'violation of the surface true.' Violation of the surface true refers to the notion that, in a serial implementation of OT like HS, certain constraints that are never violated on the surface will be violated by intermediate forms. This situation is just what happened in the last section: the intermediate form [CV('.CV.)CV] violated the surface unviolated FTBIN. In 4.2, I connect this idea of violation of the surface true to conspiracy, and show that the type of conspiracy that are inexpressible in HS are conspiracy in which the default cannot apply right away, thus entailing violation of the surface. In other words, I show that conspiracy *plus* violation of the surface true *equals* Intrinsically Parallel Conspiracy. While HS can derive conspiracies that do not entail violation of the surface true, we will see that there are limits in its ability to capture output-based explanation.

4.1 McCarthy, Pater, and Pruitt (2016): violation of the surface true

McCarthy, Pater, and Pruitt (henceforth MPP, 2016) introduce the notion of the 'violation of the surface true.' Violation of the surface true is a consequence of adopting a serial implementation of OT, like HS. It refers to the fact that, in the derivation from some UF to some SF, there may be some necessary intermediate form (IF) that violates some constraint that is never violated on the surface. In other words, violation of the surface true refers to the fact that IFs, which only exist within serial frameworks of grammar, will sometimes violate constraints that are never violated on the surface in a language. We saw an example of violation of the surface true in the derivation from UF /CVCVCV/ to SF [CV(ˈCVː)CV] above, by IF [CV(ˈCV)CV].

In HS, as long as foot building and vowel lengthening are both operations, the derivation from /CVCVCV/ to [CV(ˈCVː)CV] will necessarily involve at least two steps (besides the convergence step): 1. The step at which a foot is built: /CVCVCV/ → [CV(ˈCV)CV] and 2. the step at which lengthening occurs: /CV(ˈCV)CV/ → [CV(ˈCVː)CV]. At the first step, the winning candidate violates the surface true: it violates FTBIN.

MPP show that violation of the surface true entails a ranking that would not otherwise hold in parallel OT, since parallel OT does not have intermediate forms. Comparison between [CV(ˈCV)CV] and [(ˈCV.CV)CV] entailed just such a ranking: IAMB >> FTBIN. This is repeated from above in (30). [(ˈCV.CV)CV] immediately satisfies FTBIN, while [CV(ˈCV)CV] does not. Thus, FTBIN has to be demoted, so that [CV(ˈCV)CV] wins. More informally, the problem is that, because building a trochaic foot immediately satisfies FTBIN, while vowel lengthening does not, some ranking has to allow FTBIN to be violated until vowel lengthening applies. This ranking though, makes it so that a trochaic foot will never emerge, even when vowel lengthening will be blocked.

					ALT	**GOAL**	*BLOC*	*DEF*
(30)	/CVCVCV/		PWDHD	TROCHEE	IAMB	FTBIN	DEPV:	DEPμ
a.	.CV(ˈ.CV.)CV	(ˈ.CV.CV.)CV	***e***	***e***	**W**	**L**	***e***	***e***

MPP admit the existence of these HS-specific rankings. They argue though, that such constraints are not problematic, because, by the end of the derivation, the violation of the surface violated constraint will be remedied. That is, while [CV(ˈCV)CV] violates FTBIN, the final form of the derivation from /CVCVCV/ to [CV(ˈCVː)CV] will not violate FTBIN. Thus, on the surface, FTBIN still goes unviolated. They are correct in arguing that the violation of the surface unviolated constraint will be remedied, *within the derivation where violation of the surface true occurred.* In other words, the derivation from /CVCVCV/ to [CV(ˈCVː)CV] will converge on the correct form

[CV(ˈCV:)CV], which does not violate FTBIN, even though, in the path of the derivation, the IF [CV(ˈCV)CV] does violate FTBIN. They incorrectly argue though, that this makes violation of the surface true unproblematic. Crucially, they do not consider the implication of violation of the surface true for conspiracies, like those of MSEI.

4.2 Conspiracy

MSEI is a conspiracy. Recall from section 2 that the general ranking necessary to express a conspiracy is *Goal, Blocker* >> *Alternative* >> *Default*. In Mohawk, this schema was filled in with FTBIN, DEPV: >> IAMB >> DEPμ. This expresses the idea that the default process to satisfy FTBIN is vowel lengthening, but when a constraint against long epenthetic vowels block the possibility of vowel lengthening, a trochaic foot emerges instead. This ranking was easily arrived at in parallel OT. However, in HS, a contradictory ranking emerged: IAMB >> FTBIN. This ranking is very ranking entailed by violation of the surface true. In this way, violation of the surface true, an inescapable consequence of adopting a serial adaptation of HS (as argued by MPP), renders the expression of certain conspiracies impossible. In other words, those conspiracies in which the default repair will entail violation of the surface true are those conspiracies that are inexpressible in HS In this way, conspiracy + violation of the surface true = Intrinsically Parallel Conspiracy. Violation of the surface true entails a ranking *Alternative* >> *Goal*, in contradiction to the necessary ranking to express conspiracies, *Goal* >> *Alternative.* This is the essential problem with IPCs and HS.

4.3 Output-based explanation

Output-based explanation is not just matter of implementing violable constraints on outputs. HS has such constraints, but cannot fully capture output-based explanation. Why not? There is a formal reason, expressed in terms of ranking:

The key to expressing conspiracies in parallel OT lies in the following rankings: there are (at least) two possible candidates that satisfy the unviolated *goal* constraint. One violates the *default* constraint, the other the *alternative*. The candidate that violates the *default* is generally preferred, because the *default* is ranked lower than the *alternative*. Just this situation in Mohawk is shown below in (31), repeated from above. A candidate that satisfies FTBIN through vowel lengthening is better than the candidate that satisfies FTBIN through a trochaic foot, because IAMB is ranked above DEPμ.

			GOAL	*BLOC*		*ALT*	*DEFAULT*
(31)	/CVCVCV/		FTBIN	DEPV:	TROCHEE	IAMB	DEPμ
b.	.CV('.CV:.)CV.	('.CV.CV.)CV.	***e***	***e***	***e***	**W**	**L**

Alternative >> *default* generally prefers a candidate that satisfies *goal* through violation of the latter than the former. But, in certain contexts, the candidate that violates the *alternative* turns out to be optimal. This is in the context where violation of the *default* entails violation of the higher ranked *blocker*. This situation in Mohawk is repeated below in (32), repeated from above. The candidate with a trochaic foot beats the candidate with vowel lengthening, because the high-ranked DEPV: is necessarily violated by a violation of the lower ranked DEPμ. Thus, DEPV: >> IAMB will favor a candidate with the otherwise-dispreferred repair, a trochaic foot. And, more generally, the ranking *blocker* >> *alternative* will condition the emergence of the alternative repair.

			GOAL	*BLOCK*		*ALT*	*DEFAULT*
(32)	/CVCerV/		FTBIN	DEPV:	TROCHEE	IAMB	DEPμ
b.	(ˈ.CV.Ce.)CV.	.CV(ˈ.Ce:.)CV.	***e***	**W**	***e***	**L**	**W**

We have now seen two essential ranking conditions we need to derive a conspiracy: *alternative* >> *default*, and *blocker* >> *alternative*. The problem for HS, is that neither of these ranking conditions hold. And, this is a result of serial derivation: because the application of certain phonological processes cannot co-occur, we will never have the same comparisons we see above in (31) and (32). And, different comparisons lead to different rankings. Consider (31): the two input~output candidates under comparison are: /CVCVCV/~[CV(ˈCV:)CV] and /CVCVCV/~[(ˈCV.CV)CV]. The first of these input~output candidates, /CVCVCV/~[CV(ˈCV:)CV], is impossible to generate in HS, under the assumption that foot building and lengthening are both phonological operations that cannot co-occur (again, this assumption is discussed in section 5.2). Thus, we instead have to compare /CVCVCV/~[CV(ˈCV)CV] and /CVCVCV/~[(ˈCV.CV)CV]. We know that the former must win, because the derivation must converge on [CV(ˈCV:)CV], but we will need a different ranking to choose it. This comparison is shown below in (33), repeated from above.

(33) is not at all analgous to (31): different comparisons, and crucially different rankings. (31) provided the ranking *alternative* >> *default*, in keeping with a conspiracy. In (33) however, the *default* assigns the comparison in (33) an ***e***, it plays no role in the decision. Instead, the decision is made by *alternative* >> *goal.* This contradicts the ranking necessary for a conspiracy: *goal* >> *alternative*.

					ALT	***GOAL***	*BLOCKER*	*DEF*
(33)	/CVCVCV/		PWDHD	TROCHEE	IAMB	FTBIN	DEPV:	DEPμ
a.	.CV(ˈ.CV.)CV.	(ˈ.CV.CV.)CV.	***e***	***e***	**W**	**L**	***e***	***e***

Consider the other ranking necessary to capture a conspiracy that (12) showed: *blocker* >> *alternative*. The comparison is between /CVCerV/~[(ˈCV.Ce)rV] and /CVCerV/~[CV(ˈCe:)rV]. Again, the second of these candidates cannot be generated in HS; an output cannot differ from an input with respect to both foot building and vowel lengthening. We instead have to compare /CVCerV/~[(ˈCV.Ce)rV] and /CVCerV/~[CV(ˈCe)rV]. This comparison is shown below in (34), repeated from above. To understand the significance of this comparison, recall what was going in (32): the candidate with a trochaic foot win, because a constraint against long epenthetic vowels blocked the availability of vowel lengthening. In other words the ranking *blocker* >> *alternative* preferred the candidate with the alternative repair. Now, see (34). The *blocker* has no role to play. The losing candidate does not have a long epenthetic vowel. Instead, the *goal* plays a role. Crucially, *goal* >> *alternative* chooses the winner over the loser. While this ranking is not actually unfaithful to a conspiracy in of itself, it stands in contradiction to the ranking from (33), *alternative* >> *goal.* We do not get the ranking we need: *blocker* >> *alternative.* In this way, serial derivation makes it impossible to express certain conspiracies: sequential application of phonological processes makes certain crucial candidates unavailable at the point in the derivation where they 'need' to be to get the ranking that expresses a conspiracy.

					GOAL	***ALT***	*BLOCK*	*DEF*
(34)	/CV(ˈ.Ce.)rV./		PWDHD	TROCHEE	FTBIN	IAMB	DEPV:	DEPμ
a.	(ˈ.CV.Ce.)rV.	.CV(ˈ.Ce.)rV.	***e***	*e*	**W**	**L**	***e***	***e***

This concludes the exploration of what makes ICPs inexpressible in HS, and more generally, the limits of output-based explanation in a serial constraint-based framework.

5 In defense of conspiracy in Mohawk

In this section, I defend various assumptions about the analysis from 3. Firstly, in 5.1, I defend the assumption that MSEI is actually a conspiracy on foot binarityy. If MSEI is not actually a case of conspiracy, a case could be made that the type of conspiracies that are apparently problematic for HS are not actually attested. I will give extended arguments for the idea that MSEI must indeed be a conceived of as a conspiracy to satisfy FTBIN. I also show in 5.1 why epenthesis must precede stress assignment for an analysis of Mohawk in HS to even get off the ground. In section 5.2, I defend the assumption that vowel lengthening and stress assignment must both be designated as

OPERATIONS in HS. One way to escape the ranking paradox shown in 3 is to allow the two processes to operate in parallel. I show however, that this renders the power of HS to express serial phenomena inert, and brings HS closer to parallel OT. This bolsters the argument that conspiracy can only be expressed in parallel OT. In section 5.3, I show that the assumption that foot structure cannot be altered once applied is irrelevant to whether or not HS can derive MSEI. Even if GEN can build candidates that have corresponding feet in the input and output of different shape, the same forms are predicted as were predicted in section 3. This will shed light on the relevance of the lack of look-ahead in HS.

This section is interesting in discussing the theoretical consequences of assumptions we may or may not adopt, and also interesting in displaying a fuller range of the complex MSEI. However, if reader who is not interested in very particular details of the analysis in 3, and of the MSEI, she or he may safely skip this section and move on to 6.

5.1 MSEI as conspiracy; epenthesis before stress

In this section, I justify two major assumptions in the preceding analysis of MSEI. The first is that MSEI actually is a conspiracy to ensure that feet are always bimoraic. The second is that, to possibly express this conspiracy in HS, epenthesis must always precede foot building. I will first give general justification for these assumptions, then explore them further through a comparison with Elfner (2016).

The puzzle in MSEI is basically why stress appears on the antepenultimate syllable when an epenthetic vowel appears in an open penult (ex. [ˈ.wa.ke.ras] 'It smells'), but on the penultimate syllable when the epenthetic vowel appears in a closed penult (ex. [.wa(ˈ.ke̱n.)yaks.] 'I get married') Following Ikawa (1995) and Rawlins (2006), I assume that antepenultimate stress emerges because a right-aligned (*modulo* NONFINALITY) disyllabic foot yields foot bimoraicity. Because the default method of providing a second mora, vowel lengthening, is blocked because of a constraint against long epenthetic vowels, a disyllabic foot emerges instead (i.e. [(ˈ.wa.ke̱.)ras], *[(ˈ.wa.ke̱ː.)ras]). Stress falls on the epenthetic vowel when it occupies a closed penult, because the coda consonant can supply the second mora. This is one of many possible explanations for why epenthesis into an open penult correlates with antepenult stress, and why epenthesis into a closed penult correlates with penult stress. Alderete (1995, 1999), offers an alternative explanation in which antepenultimate stress emerges because of a constraint against placing epenthetic vowels in the head position of a foot, HEADDEP. Michelson (1988,1989) and Elfner (2016) offer an explanation in terms of derivational opacity: when the epenthetic vowel receives stress, epenthesis has occurred before stress placement. When the epenthetic vowel does not receive stress, epenthetic has occurred after stress placement. I will first give evidence why the conspiracy account is the best interpretation of MSEI, then briefly discuss the failings of Alderete's analysis, then discuss Elfner's account in depth.

Only the conspiracy interpretation of MSEI provides a unified account stress, multiple processes epenthesis, vowel lengthening, and syllable open/closedness. In [e]-forms, the epenthetic vowel receives stress it occupies a closed penult, and does not receive stress when it occupies a closed penult. The same is true of [a]-forms, shown in (35). [a] is an epenthetic vowel, often referred to as the 'joiner' vowel, that is inserted in hiatus contexts between two morphemes in noun incorporation and verb derivation. (35a) shows that, when [a] occupies a closed penult, it receives stress. When it occupies an open penult, it does not receive stress. Thus, we can understand the [a]-stress pattern just as we understand the [e]-stress pattern: when a coda consonant cannot supply a second mora, an alternative foot emerges. In (35b), we see that a monosyllabic foot emerges, because the antepenult happens to be closed.

(35)

		[<u>a</u>]-Stress Pattern:			
a.	**Closed** σ:	/CV**C-** **C**CV/	[CV(ˈ**CaC**)CV]	/te-wak-iʔtsyu**k-** **ny**u-s/ DU-1P-*sneeze*-DIST-HAB	[.te.wa.keʔt.syu(ˈ**.k<u>a</u>n.)**yus.] *'I'm sneezing'*
b.	**Open** σ:	/CV**CC-** **C**V/	[(ˈ**CVC**).Ca.CV]	/wak-nu**hs-y**ʌ-Ø/ 1P-*house-put, own*-STAT	[.wa.ke(ˈ**.nuh**.)s<u>a</u>.yʌ.] *'my house'*

[e]-forms and [a]-forms thus receive a unified explanation in the conspiracy account. However, this evidence is not necessarily strong. We could understand the parallel behavior in [e]-forms and [a]-forms also as a result of some other constraint like HEADDEP. However, that FTBIN is the key to understanding MSEI becomes clear when we look at the corners of the language in which [e]-forms do not pattern with

[a]-forms. [e]-forms and [a]-forms display different behavior when both the antepenult and penult are open.

Recall that, when [e] occupies an open penult, stress appears on the antepenult. The antepenult is usually open in these forms. It always receives stress, and no additional processes like lengthening occur (36a). In [a]-forms however, when both the penult and antepenult are open. The antepenult receives stress, and *the tonic vowel is lengthened* (36b). Thus, an asymmetry emerges in the otherwise parallel [e] and [a] forms when both the penult and antepenult are open. In [e]-forms, the antepenult stays short, while in [a]-forms, the antepenult is lengthened. Foot structure provides an obvious explanation for this asymmetry: low-sonority vowels like [e] are good non-head foot members, while high-sonority vowels like [a] are not (see de Lacy 2004 on sonority-driven stress). Feet are preferably right-aligned, but when this would result in a highly sonorous vowel in the non-head position of a foot, the foot instead retracts a syllable, and vowel lengthening must occur to supply a second mora.

(36) *[e] and [a] pattern comparison: open penult, open antepenult*

a.	[e]-forms:	/w-a**kr**a-s/ NA-*smell*-HAB	[(ˈ.wa.k<u>e</u>.)ras.] *‘It smells’*	*[(ˈ.waː).k<u>e</u>.ras.]
b.	[a]-forms:	/te-ka-nakeʔt-ke-Ø/ DU-NA-container-be many-STAT	[.te.ka.na(ˈ.keː.).t<u>a</u>.ke] *‘Two containers’*	*[.te.ka.na(ˈ.ke.t<u>a</u>.)ke]

Mohawk also recruits multiple processes of epenthesis for subminimal word augmentation, shown in (37). We can unify the account of subminimal word augmentation with the standard forms, [e]-forms, and [a]-forms, if the minimal word is understood as a (bimoraic) foot + extrametrical syllable. Normally, a prothetic-[i] is inserted to augment a word that would otherwise be monosyllabic. When this places [i] into a closed syllable, it receives stress, and nothing else occurs. This is shown in (37a). If the word contains a Cr cluster however, that would result in bad syllable contact, epenthetic-[e] is inserted instead. This is shown in (37b) We can understand the appearance of [e] instead of [i] in terms of dually ensuring that minimal word requirements are met, and avoidance of bad syllable contact. The interesting pattern however, comes when [e]-insertion into a subminimal word places [e] in an open syllable. In such forms, prothetic-[i] is inserted as well. This is shown in (37c). We can make sense of the pattern in (37) under the assumption that the minimal word in Mohawk is a foot + extrametrical syllable, and crucially, a foot is a strictly bimoraic foot. If a coda consonant supplies the second mora, as in (37a-b), no other processes need occur. However, when there is no coda consonant to supply the second mora, as in (37c), prothetic-[i] is inserted. In this way, the idea that feet in Mohawk are strictly bimoraic offers a way to unify separate patterns of subminimal word augmentation.

(37)

Subminimal Word Augmentation					
a.	[i]:	/k-yʌ-s/	[(ˈ.ik.)yʌs.]	1SG.AGT-put-HAB	*'I put it'*
b.	[e]:	/k-rho-s/	[(ˈ.ser.)hos]	2A-coat, something-HAB	*'you coat it with something'*

c.	[i] + [e]:	/s-riht-Ø/	[(ˈ.i̱.se̱.)riht.]	2A-cook-IMP	*'Cook!'*

Note that, in forms where [i] is inserted into an open penult, [i] actually gets lengthened (ex. [(ˈ.i̱ː.)reʔs.] *'He goes'*). This may seem to defy another important assumption in Mohawk, that epenthetic vowels cannot be long, but we can understand this isolated case of a long epenthetic vowels as a result of language-wide bans against 1. non-initial onsetless syllables (i.e. *[(ˈ.i̱.i)reʔs.]) and 2. consonant insertion (i.e. *[(ˈ.i̱ʔ̱)reʔs.]). Lengthening an epenthetic vowel is a repair the language recruits only when backed against a wall. This also gives additional evidence for the absolute undominated nature of FTBIN in Mohawk.

These patterns constitute the independent evidence for MSEI as a conspiracy to satisfy FTBIN. Such an account offers a unified account of vowel lengthening, antepenultimate stress, asymmetry in [e] and [a]-forms, and subminimal word augmentation. This actually does not exhaust the full range of MSEI, and for the reader curious to indulge in a truly beautiful set of phonological interactions, see Adler 2012. These data suffice though, to show why alternative accounts fail.

Alderete's account relies on a constraint against having epenthetic vowels in the head position of a foot, HEADDEP. Basically, because HEADDEP ranks above ALIGNR, the stress moves off the epenthetic vowel, onto the antepenultimate syllable. When stress does fall on the penultimate syllable, it is because Weight-to-Stress ranks above HEADDEP. This account suffices to derive [e]-forms, but it offers no explanation of why vowel lengthening occurs in open syllable, standard forms, or of the asymmetry noted above between [a] and [e]-forms, or of the subminimal word patterns. The crucial notion is not a general dispreference for stressed epenthetic vowels, it is related to foot binarity. I do not doubt that some amount of engineering and addition of further constraints could work to derive MSEI in parallel OT under the HEADDEP account, but it is simply dispreferred to the conspiracy account on the basis of theoretical parsimony: the conspiracy account relies on utterly well-understood, typical constraints. No extra HEADDEP constraint is required.

More interesting, for the sake of this paper is Elfner's (2016) account, inspired by the original rule-based analysis from Michelson (1988,1989). Recall that [e] is inserted for two reasons: to break up illicit tricconsonantal 'CCC' clusters and to break up Cr clusters that cannot be syllabified tauto- or heterosyllabically, due to constraints on syllable contact. Elfner emphasizes the fact that [e]-epenthesis is driven for two different reasons to explain the behavior of stress in [e]-forms. The crucial point is that insertion into a CCC cluster always leads to [e] receiving stress (ex. /wa**k-ny**aks/ → [waˈ.**ken**.yaks.]), and insertion into a Cr cluster always leads to [e] not receiving stress (ex. /wa**k-r**as/ → [ˈ.wa.**ke.r**as]). For Elfner, the open/closed status of the syllable that [e] occupies is accidental, or orthogonal to why stress does or does not fall on [e]. For her, the location of stress is related to the differential ordering of the epenthesis processes with respect to stress assignment. (38) shows how this works. When [e] is stressed, insertion occurred before stress assignment. When [e] is not stressed, insertion occurred after stress assignment. At the point where stress was applied, the penult does indeed get stress, but the subsequent application of epenthesis pushes that syllable into the antepenultimate position. Because there are actually two distinct processes of vowel insertion for [e]-forms, this interpretation of the facts is reasonable. However, it is clearly empirically inadequate. Not to mention that it would not given any sort of explanation to why vowel lengthening and other processes occur, it makes the wrong predictions for [a]-forms.

(38)	*Underlying Form*	/wak-nyaks/	/wak-ras/
	*CCC	wa.ken.yaks	-
	PENULTSTRESS	waˈ.ken.yaks	ˈwak.ras
	*CR	-	ˈwa.ke.ras
	Surface Form	[waˈ.ken.yaks.]	[ˈ.wa.ke.ras]

[a]-insertion is only driven by a single constraint: ONSET (or some constraint against hiatus). Thus, there is only one process of [a]-insertion. If the location of stress is thus related to the ordering of the insertion process relative to stress assignment, we would thus expect that [a] either always get stress or never get stress, depending on whether [a]-insertion process occurs before or after stress assignment, respectively. However, as was shown in (30) above, the location of stress in [a]-forms does indeed vary: when [a] occupies an open syllable, it does not receive stress (ex. [.wa.ke(ˈ**.nuh**.)s<u>a</u>.yʌ.]), when it occupies a closed syllable, it does (ex. [.te.wa.keʔt.syu**(ˈ.k<u>a</u>n.)**yus.]). One process of insertion, two possible stress patterns. Syllable open/closedness, not underlying clusters, predicts the location of stress in MSEI. This is because MSEI are a conspiracy to satisfy FTBIN. An account that does

not incorporate FTBIN will not be able to account for the full range of facts. This concludes the justification for assumption that MSEI involve a conspiracy to satisfy FTBIN. However, before moving on, it is illuminating to note a particular quality of Elfner's analysis of MSEI: it is wholly 'input-based.' Underlying consonant clusters, structures in UFs, are seen as the crucial predictors of the location of stress. This is stark contrast to the output-based, conspiracy analysis, which emphasizes syllable structure. I will not give the formal derivation here, but Elfner clearly shows that input-based analysis of MSEI is naturally expressed in HS. And, she shows it would not be in parallel OT. In this paper, we have seen that the output-based, conspiracy analysis of MSEI is naturally expressed in parallel OT, but not HS. Thus, we see the strong coupling of serialism with input-based explanation, and of parallelism with output-based explanation.

In this section, we have seen that the open/closedness of the syllable that the epenthetic vowel occupies is the key structure that predicts the location of stress. It is this empirical truth that justifies the assumption that, to (try to) derive MSEI in HS, epenthesis must precede stress assignment. Since the open/closed status of the syllable containing the epenthetic vowel predicts the location of stress, the open/closed status of the syllable must be 'known' in the derivation at the point where stress is applied, to make the correct computation about where the foot should be built. For this information to be available in the derivation at the point where foot structure is applied, epenthesis must always precede stress assignment. This concludes the justification of the assumptions that MSEI involves a conspiracy to satisfy FTBIN, and that epenthesis must precede stress assignment in a serial derivation of MSEI. In section 4.4, Elfner's account will be revisited, but for now, I continue to justify further assumptions about the analysis in section 3.

5.2 LENGTHENING and FOOT BUILDING as free processes

As discussed in section 4, conspiracies cannot be expressed in HS when violation of the surface true results in a *Alternative* >> *Goal* ranking. In HS, this ranking is IAMB >> FTBIN. This ranking arises because on the path from the underlying form /CVCVCV/ to the surface form [CV(ˈCVː)CV], there is some intermediate form [CV(ˈCV)CV] that violates FTBIN. The comparison with this candidate and the candidate [(ˈ.CV.CV.)CV.] entails IAMB >> FTBIN, repeated yet again, in (39).

					ALT	***GOAL***	*BLOCKER*	*DEF*
(39)	/CVCVCV/		PWDHD	TROCHEE	IAMB	FTBIN	DEPVː	DEPμ
a.	.CV(ˈ.CV.)CV.	(ˈ.CV.CV.)CV.	***e***	***e***	**W**	**L**	***e***	***e***

As long as foot building and vowel lengthening cannot co-occur, this mapping is an inevitability, and we are left with violation of the surface true. However, there is no necessary reason why foot building and vowel lengthening must not co-occur; one or both of them could be 'free processes.'

Part of the research program of HS is figuring out which phonological processes are operations and which are free processes. McCarthy (2010) suggests that, when a given derivation leads to a ranking paradox, it may be the case that some process designated as an operation must actually be a free process. By designating foot building or lengthening as a free process, there will be no intermediate form [CV(ˈCV)CV], and the problematic mapping in (39) will never occur. If foot building or lengthening is a free process, then, for an input /CVCVCV/, GEN can produce the candidate [CV(ˈCVː)CV]. The comparison between [CV(ˈCVː)CV] and [(ˈCV.CV)CV], does not entail the problematic ranking IAMB >> FTBIN. (40) shows that the comparison between [CV(ˈCVː)CV] and [(ˈCV.CV)CV] only entails IAMB >> DEPμ. This ranking matches the *Alternative* >> *Default* ranking necessary to express a conspiracy. Thus, making vowel lengthening or foot building a free process avoids the ranking paradox encountered in (34). However, this is not really a challenge to the argument made here. Rather, it supports it.

					GOAL	*BLOC*	*ALT*	*DEF*
(40)	/CVCVCV/		PWDHD	TROCHEE	FTBIN	DEPVː	IAMB	DEPμ
a.	.CV(ˈ.CVː.)CV.	(ˈ.CV.CV.)CV.	***e***	***e***	***e***	***e***	**W**	**L**

The fact that designating foot building or lengthening a free process allows for the expression of MSEI in HS highlights the affinity between parallelism and conspiracy. Labeling foot building or lengthening as a free process just makes the two operations happen in parallel. Thus, this solution to the problem of expressing conspiracies in terms of serial derivation is just to express them in terms of parallel derivation. This is a fine option, and perhaps MSEI constitute a good argument for why foot building or vowel lengthening should be labeled a free process. The problem however, is that, these operations must be operations to express the sorts of interactions that HS is designed to derive.

McCarthy (2008b), for example, shows that, by labeling stress assignment and syncope as phonological operations, HS can capture an interaction between the two processes that is not easily expressed in parallel OT. In Aguaruna (Payne, 1990), iambs are parsed left to right, and all non-initial metrically weak vowels are deleted. This is exemplified by the form in (41). Vowels-to-be-deleted are bolded in the underlying form.

(41) /itʃin**a**kan**a**/ [(iˈtʃin)(ˌkan)] *'pot'* (acc.)

The generalization that metrically weak vowels are deleted on the surface is not easy to capture in parallel OT. (42), while simplistic, displays the basic problem: since metrical structure and vowel deletion occur simultaneously in parallel-OT[11], there is no natural way to target the weak-members of an iambic parse for deletion[12]. Assume *WEAKV is the constraint that disfavors metrically weak vowels. When *WEAKV is ranked above MAXV, weak vowels are deleted. (42a) is the candidate with the attested vowels deleted. However, *WEAKV cannot distinguish (42a) from (42b), which has the incorrect vowels deleted. Because both candidates have no metrically weak vowels present in the output, the constraint is satisfied.

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[11] It may be unfaithful to the spirit of GEN to describe processes as 'occuring' in OT, but I will use term throughout to differentiate parallel and serial models of grammar.

[12] Alderete (2001) however, does offer an analysis of Aguaruna in parallel OT, however. In his analysis, the problem depicted in (2) is overcome by assuming that deleted vowels leave a mora slotin the foot. Since the deleted vowel's mora is present, feet are disyllabic and the attested winner is chosen by IAMB >> TROCHEE. Regardless of whether or not we want to assume that syllables are preserved in vowel deletion, McCarthy's point that certain phenomena are more naturally interpreted as the result of the serial application of phonological processes is well taken.

(42)

/itʃinakana/	*WEAKV	MAXV
a. ☞ (iˈtʃinX)(ˌkanX.)	*	**
b. ☞ (iˈtʃXna)(ˌkXna)	*	**

HS can easily derive these interactions in terms of the serial application of stress assignment and syncope. I will not show the formal derivation, but in short, in the first step of the derivation, the input /itʃinakana/ is first parsed into feet [(iˈtʃin)(aˌkan)a]. In the second step, the input /(iˈtʃin)(aˌkan)a/ maps to the candidate with the correct vowels deleted: [(iˈtʃin)(ˌkan)]. The derivation will converge in the following step. Basically, be deriving the Aguaruna stress-syncope interactions serially, metrical structure can be present in the input at the point where syncope applies. Thus, the correct vowels will be targeted for deletion.

The derivation of the stress-syncope interactions in Aguaruna relies crucially on the idea that foot building and syncope do not co-occur. If foot building were a free process though, they would co-occur. In this case, HS would run into the same problem that parallel OT does, shown above in (42). Thus, foot building must not be a free process.

Returning to Mohawk, perhaps vowel lengthening is a free process, not foot building. This is one option, and I do not have a similar example to show why it must be an operation in order to derive some other serial interactions. However, this solution is still short-sighted. Imagine a language Mohawk-X. Mohawk-X also has a conspiracy to satisfy FTBIN. However, in Mohawk-X, the default repair is not vowel lengthening, but coda consonant insertion. Thus, for an underlying form /CVCVCV/, the surface form is [CV('CVt)CV]. When a constraint antigemination constraint against inserting [t] where it would be adjacent to another homorganic consonant blocks [t] insertion though, a trochaic foot emerges. In other words, the underlying form /CVCVnV/ maps to [('CV.CV)nV]. These interactions will be impossible to express, if consonant insertion and foot building are both operations. In the derivation from /CVCVCV/ to the surface form [CV('CVt)CV], there will be an intermediate form [CV('CV)CV]. The comparison between [CV('CV)CV] and [('CV.CV)nV] will result in IAMB >> FTBIN, shown in (43)

					ALT	***GOAL***	*BLOCK*	*DEF*
(43)	/CVCVCV/		PWDHD	TROCHEE	IAMB	FTBIN	NOGEM	DEPC
a.	.CV('.CV.)CV.	('.CV.CV.)nV.	***e***	***e***	**W**	**L**	***e***	***e***

The ranking IAMB >> FTBIN will make the wrong prediction for the derivation from underlying form to surface form [('CV.CV)nV]. At the first step of the derivation, shown in (44), IAMB >> FTBIN will choose [CV('.CV)nV] over [('CV.CV)nV]. In the following step in the derivation, the derivation will converge on either *[CV('.CV)nV] or *[CV('.CVt)nV], depending on the ranking of NOGEM relative FTBIN.

					ALT	***GOAL***	*BLOCK*	*DEF*
(44)	/CVCVnV/		PWDHD	TROCHEE	IAMB	FTBIN	NOGEM	DEPC
a.	💣CV('.CV)nV	☹ ('CV.CV)n	***e***	***e***	**W**	**L**	***e***	***e***

	V						

In sum, designating foot building and consonant insertion as phonological operations that cannot co-occur makes it impossible to derive Mohawk-X. Perhaps then, consonant insertion should also be a free process, along with vowel lengthening. Now consider Mohawk-Y. Mohawk-Y also has a conspiracy to ensure that FTBIN is unviolated on the surface. But, in Mohawk-Y, vowels can be underlying long. When the penult contains a long vowel and coda consonant, the coda consonant deletes, to ensure that the foot is not trimoraic. That is, the underlying form /CVCCVVCCV/ surfaces as [CVC(ˈCVV)CV]. However, when consonant deletion is blocked due to a constraint against deleting coronal consonants, the foot appears on the antepenult instead. That is, the underlying form /CVCCVVtCV/ surfaces as [(ˈ.CVC)CVVt.CV]. The point should be obvious by now: if consonant deletion and foot building are both operations, a ranking paradox will emerge. /CVCCVVtCV/ will be predicted to surface as *[CVC(ˈCVVt)CV] or *[CVC(ˈCVV)CV]. So, perhaps consonant deletion must be a free process as well. I can go on: Mohawk-Z is exactly like Mohawk-Y, except trimoraic syllables are reduced to bimoraic by vowel shortening, not consonant deletion. When vowel shortening is blocked, the foot moves instead. A ranking paradox will emerge, should vowel shortening also then, be a free process?

These cases are all obviously contrived, to varying degree of unreality. However, the point is clear: proposing that the MSEI conspiracy problem can be overcome by labeling lengthening (or foot building) a free process only suffices to derive MSEI. It does not actually provide a solution to express IPCs in general. MSEI is not the only attested case of an IPC, section 6 will show many more. If, for every real-world case of an IPC we label the relevant process(es) as free operations, then eventually all phonological processes will be designated as free processes. In other words, HS will become formally equivalent to parallel OT.

5.3 Foot structure as malleable

One final counter-argument I will consider is the idea that, once feet are built, then can be changed into different shapes. In this way, even though the ranking IAMB >> FTBIN predicts that an input /CVCrV/ maps to the undesired output [CV(ˈCV)CV], instead of [(ˈCV.CV)CV], at a later step in the derivation, [CV(ˈCV)CV] could then map to [(ˈCV.CV)CV]. Imagine some faithfulness constraint on foot shape: FAITH-FT. Informally, FAITH-FT will assign a violation for any foot in an output that has more or less syllables than the corresponding foot in the input. The ranking FTBIN >> FAITH-FT would thus choose the unfaithful candidate [(ˈCV.CV)CV] over the faithful candidate [CV(ˈCV)CV]. However, this will not fix the problem, because the complete ranking IAMB >> FTBIN >> FAITH-FT will still favor *[CV(ˈCV)CV]. Thus, even if foot can change shape, the same ranking that initially chose the candidate with the ill-formed foot will ensure that that foot is optimal throughout the derivation. So, changing foot shape will not help alleviate the problem that MSEI presents for HS.

This concludes the defense of various assumptions about MSEI itself, and its implementation in HS. Hopefully, this has convinced the reader that MSEI presents a *bon a fide* problem for HS. In the next section, I will show that additionally, this problem is not specific to MSEI. Rather, there are attested examples of IPCs in different domains, all of which produce the same ranking paradox in HS.

6 IPCs outside Mohawk

In this section, I present additional examples of attested IPCs, outside of Mohawk. None of these cases will be discussed in nearly as much detail as Mohawk. However, they suffice to show Mohawk is not an isolated case, and to further demonstrate the hallmarks of IPCs: conspiracy with violation of the surface true.

6.1 Lithuanian

Zymet (2016) discusses the problem Lithuanian assimilation and antigemination patterns present for HS. The original analysis of Lithuanian comes from Bakovic (2005), and the first mentio that Lithuanian might be problematic for HS comes from Albright & Flemming 2015. Note that, while Zymet and Albright & Flemming both note that Lithuanian presents a problem for HS, they do not couch the explanation within conspiracy, as I do.

Lithuanian has a conspiracy to ensure that adjacent obstruents agree in palatality and voicing. The default repair is to assimilate the first obstruent in a pair to the second for palatality and voicing. This drives alternations of the verbal prefixes /at/ and /ap/, shown in (45).

(45)	/at/		/ap/	
	at-praʃ^{j}i:t^{j}i	'to ask'	ap-ʃauk^{j}t^{j}i	'to proclaim'
	ad-buk^{j}t^{j}i	'to rise'	ab-dras^{j}k^{j}i:t^{j}i	'to tear'
	at^j-p^{j}aut^{j}i	'to become blunt'	ap^j-t^{j}em^{j}d^{j}i:t^{j}i	'to obscure'

ad^j-b^{j}ek^{j}t^{j}i ‘to get back’ ab^j-g^{j}i:d^{j}i:t^{j}i ‘to heal’

However, when palatality and voicing assimiliation are blocked due to a constraint against geminates, a vowel is inserted between the two obstruents instead. Epenthesis works to ensure that adjacent obstruents agree in voicing and palatality by simply making the obstruents non-adjacent. This is shown in (46). Note that /at/ is realized as [at^j] and /ap/ as [ap^j] in the epenthetic contexts due to palatalization before a high vowel.

(46) /at/ /ap/

at^{j}i-t^{j}eis^{j}t^{j}i ‘to adjudicate’ ap^{j}i-put^{j}i ‘to grow rotten’

at^{j}i-duot^{j}i ‘to give back’ ap^{j}i-b^{j}er^{j}t^{j}i ‘to strew all over’

Thus, Lithuanian is a canonical conspiracy: two different processes, assimilation and epenthesis, both occur to satisfy the same high-ranked markedness constraint. We can fit this in the conspiracy schema, and show that parallel-OT easily expresses these facts:

Goal: AGREE([pal]&[voice]): Adjacent obstruents agree in the features [palatal] and [voice]

Default: IDENT ([pal]&[voice]): A segment in the output has the same value for [palatal] and [voice] as its correspondence in the input.

Blocker: NOGEM(INATE): Adjacent obstruents do not have the same place of articulation

Alternative: DEPV: A vowel in the output has a correspondent in the input.

(47) shows that the ranking AGREE, DEPV >> IDENT predicts that that assimilation will occur as the default repair, to satisfy AGREE. This is an instance of *Goal, Alternative >> Default.*

			GOAL	*BLOCKER*	*ALTERNATIVE*	*DEFAULT*
(47)	/at-b^{j}ek^{j}t^{j}i/		AGREE	NOGEM	DEPV	IDENT
a.	ad^{j}b^{j}ek^{j}t^{j}i	atb^{j}ek^{j}t^{j}i	**W**	***e***	***e***	**L**
	ad^{j}b^{j}ek^{j}t^{j}i	atib^{j}ek^{j}t^{j}i	***e***	***e***	**W**	**L**

(48) shows that AGREE, NOGEM >> DEPV will force epenthesis to occur to satisfy AGREE, when NOGEM blocks the default option of assimilation.

			GOAL	*BLOCKER*	*ALTERNATIVE*	*DEFAULT*
(48)	/ap^j-b^{j}er^{j}t^{j}i/		AGREE	NOGEM	DEPV	IDENT
a.	ap^{j}ib^{j}er^{j}t^{j}i	ap^j-b^{j}er^{j}t^{j}i	**W**	***e***	**L**	***e***
	ap^{j}ib^{j}er^{j}t^{j}i	ab^{j}b^{j}er^{j}t^{j}i	***e***	**W**	**L**	**W**

In this way, parallel OT naturally expresses the conspiracy on adjacent obstruent agreement in Lithuanian. The same will not be possible though, in HS, under the assumption that palatal and voicing assimilation both constitute phonological operations. If palatal and voicing assimilation cannot co-occur, then, at the first step of the derivation from /at-b^{j}ek^{j}t^{j}i/ to [ad^{j}b^{j}ek^{j}t^{j}i], the winner will either be [adb^{j}ek^{j}t^{j}i] or [at^{j}b^{j}ek^{j}t^{j}i]. It does not matter which of the two possible output wins, the crucial point is just that, because palatal and voicing assimilation cannot co-occur, there will be some intermediate form that has only undergone one of the two assimilation processes. I will assume that voicing assimilation occurs at the first step of the derivation, so that [ad-b^{j}ek^{j}t^{j}i] wins. (49) shows the crucial comparisons for the step of the derivation.

(49a) shows that, for the candidate with voicing assimilation to the beat the faithful candidate, which has not assimilated at all, AGREE must rank above IDENT. This is a reasonable ranking, it expresses the fact that assimilation occurs to satisfy AGREE. In (49b) however, we see that the *Alternative* constraint, DEPV, must outrank the *Goal* constraint, AGREE. This is because, for the candidate with voicing assimilation to win, which does not fully satisfy AGREE, it must beat the candidate which fully satisfies AGREE at the first step, through vowel insertion. This is a classic violation of the surface true situation: for voicing and palatality assimilation to both apply, there must be some intermediate step where only one applies. At the step, the surface unviolated constraint, AGREE, will be violated. This demotes the *Goal* constraint below the *Alternative.*

			ALTERNATIVE	***GOAL***	*BLOCKER*	*DEFAULT*
(49)	/at-b^{j}ek^{j}t^{j}i/		DEPV	AGREE	NOGEM	IDENT
a.	adb^{j}ek^{j}t^{j}i	atb^{j}ek^{j}t^{j}i	***e***	**W**	***e***	**L**
b.	adb^{j}ek^{j}t^{j}i	atib^{j}ek^{j}t^{j}i	**W**	**L**	***e***	**L**

This makes the wrong predictions for the forms that actually do employ epenthesis to satisfy AGREE. In (50), we see that DEPV >> AGREE will choose the candidate with voicing assimilation over the candidate that satisfies AGREE through vowel insertion. Note that NOGEM cannot play a role, because the assimilated consonant does not yet form a full geminate with the following obstruent. In the next step(s), the derivation will converge either on either *[abb^{j}er^{j}t^{j}i] or *[ab^{j}b^{j}er^{j}t^{j}i], depending on the relative ranking of NOGEM and AGREE, not shown here.

			ALTERNATIVE	*GOAL*	*BLOCKER*	*DEFAULT*
(50)	/ap-b^{j}er^{j}t^{j}i/		DEPV	AGREE	NOGEM	IDENT
a.	💣 abb^{j}er^{j}t^{j}i	☹ apib^{j}er^{j}t^{j}i	**W**	**L**	***e***	**L**

Lithuanian involves a conspiracy on voicing and palatality agreement in adjacent obstruents. The default repair, assimilation, cannot satisfy the goal in a single step. An alternative repair though, epenthesis could. This leads violation of the surface true, in which the constraint against epenthesis, DEPV, has to be ranked above AGREE, to ensure that epenthesis does not apply, and the default repair does instead. This ranking incorrectly predicts though that epenthesis will thus never occur in the language. Thus, the conspiracy cannot be expressed in HS. We have thus seen an IPC in a different domain of phonology than Mohawk, assimilation and antigemination patterns. In the following section, we will see an IPC in a harmony pattern.

6.2 Gurindji

Stanton (2016) identifies an interesting pattern of nasal harmony in Gurindji in which a nasal feature generally spreads regressively, but when in certain environments nasal spreading is disprefered, the nasal feature is simply deleted. In this section, we will see that this is prototypical IPC, however, in the domain of harmony.

In Gurindji, [nasal] spreads regressively from nasal codas through all [-continuant] segments. This is shown in (51).

(51) /kajira-mpal/ [kãj̃ĩr̃ãmpal] 'across the North'

However, in sequences of $NC_1 \ldots NC_2$, where all intervening segments are [+continuant], the N in the second cluster is deleted. This is shown in (52). In (52a), we see that if NC_2 are homorganic, the nasal consonant simply deletes. In (52b) we see that, if they are heterorganic, N simply loses its [nasal] feature.

(52) a. /kankula-**mp**a/ [kãnkula**p**a] *Deletion of* N_2

b. /jan-ku-ji-**n**-**p**u/ [jankuji**tp**u] *Loss of [nasal]*

Stanton argues that deletion of the nasal coda or loss of [nasal] feature in $NC_1 \ldots NC_2$ environments occurs because a phonotactic constraint against NCṼ clusters blocks the availability of spreading. Thus, when the constraint that compels spreading cannot be satisfies through spreading, the spreading trigger is simply deleted, also thereby satisfying the constraint compelling spreading. Note that, where [-continuant] segments do intervene between NC_1 and NC_2, partial spreading up the [-continuant] segment occurs. This is shown in (53). It is only when there is no [-continuant] segment to stop a NCṼ cluster that we get deletion of the nasal trigger.

(53) a. /nampijiʈa-wuɲɟa/ [nãmpijiʈãw̃ũɲɟa] *'(animal) lacking in a female'*

Stanton provides a thorough exploration of these patterns, but I will simplify the discussion to the relevant details. The relevant constraints, fit into the conspiracy schema, are as shown in (54).

(54) *Goal*: AGREE[nasal]R Assign a violation for each non-[nasal] segment immediately followed by a [nasal]

		segment
Default:	DEP-LINK[nasal]	Assign a violation for any segment linked to a [nasal] feature that was not linked to a [nasal] feature in the input
Blocker:	NCṼ	Assign a violation for any sequence of the form NCṼ
Alternative:	DEP[nasal]	Assign a violation for any nasal consonant or [nasal] feature in the input that lacks a corresponding nasal consonant or [nasal] features in the output

(55) shows that, in parallel OT, forms with nasal spreading give the ranking AGREE[nasal]R, DEP[nasal] >> DEP-LINK [nasal]. In other words, we get the appropriate conspiracy ranking: *Goal, Alternative* >> *Default.*

			GOAL	*BLOCKER*	*ALTERNATIVE*	*DEFAULT*
(55)	/kajira-mpal/		AGREE[nasal]R	NCṼ	DEP[nasal]	DEP-LINK[nasal]
a.	kãj̃ĩr̃ãmpal	kajirampal	**W**	***e***	***e***	**L**
b.	kãj̃ĩr̃ãmpal	kajirapal	***e***	***e***	**W**	**L**

(56) shows that, forms with deletion of the nasal trigger give the ranking AGREE[nasal]R, NCṼ >> DEP[nasal]. In other words, we get the other appropriate conspiracy ranking: *Goal, Blocker* >> *Alternative.*

			GOAL	*BLOCKER*	*ALT*	*DEFAULT*
(56)	/kankula-mpa/		AGREE[nasal]R	NCṼ	DEP[nasal]	DEP-LINK[nasal]
a.	kãnkulapa	kankulampa	**W**	***e***	**L**	***e***
b.	kãnkulapa	kãnkũl̃ãpa	***e***	**W**	**L**	**W**

Thus, in parallel OT, the derivation of nasal spreading and deletion in Gurindji yields the total ranking: AGREE[nasal]R, NCṼ>> DEP[nasal] >> DEP-LINK[nasal]. This in line with the general ranking for conspiracies: *goal, blocker* >> *alternative* >> *default*. The same ranking will not hold though, in HS. Rather, a ranking paradox will emerge.

As long as feature spreading is an operation that occurs iteratively, as argued for in the HS harmony literature (see Kimper, McCarthy, etc…), and deletion is an operation, then HS cannot derive nasal spreading and deletion in Gurindji[13]. Consider the forms in which spreading occurs, shown in (57). Because spreading cannot all occur in one step, at the first step of the derivation, when [nasal] has only spread to a single segment, the winning candidate, [kajirãmpal] will violate AGREE[nasal]R. A losing candidate though, [kajirapal], can satisfy AGREE[nasal]R right away, through deletion of the [nasal] trigger. For this candidate to lost then, DEP[nasal] will have to rank above AGREE[nasal]R. In other words, the *alternative* will have to be ranked above the *goal*, out of keeping with the general conspiracy ranking schema.

			BLOCKER	*ALTERNATIVE*	*GOAL*	*DEFAULT*
(57)	/kajira-mpal/		NCṼ	DEP[nasal]	AGREE[nasal]R	DEP-LINK[nasal]
a.	kajirãmpal	kajirapal	***e***	**W**	**L**	***e***

[13] Stanton also identifies the difficulty of nasal spreading and deletion in Gurindji for HS.

In a way that should now be unsurprising, this ranking will make the wrong prediction for forms where nasal deletion is indeed supposed to happen. This is shown in (58). The pathological candidate with partial spreading will be incorrectly predicted to beat the candidate with the nasal segment deleted. The *blocker* cannot play a role, because the [nasal] feature has not yet spread far enough for NCṼ to be violated.

			Block	*Alt*	*Goal*	*Default*
(58)	/kankula-mpa/		NCṼ	Dep[nasal]	Agree[nasal]R	Dep-Link[nasal]
a.	💣kankulãmpa	☹ kankulapa	***e***	**W**	**L**	***e***

In the next step(s) of the derivation, not shown here, either the candidate with full nasal spreading up to C will win, *[kãnkũl̃ãpa], or *[kãnkul̃ãpa] a candidate with spreading up to V, depending on the ranking of NCṼ. Both candidates are pathological. Crucially, at the later point where NCṼ can play a role, it will be too late. It will not be able to compel deletion of the [nasal] segment/feature, because Dep[nasal] >> Agree[nasal]R still prefers the candidate that is faithful to nasality. In this way then, Gurindji shows that IPCs also show up in harmony patterns.

7 Conclusion

This paper has explored a particular consequence of adopting a serial implementation of OT, HS. The narrow point is that HS cannot express conspiracies where the default repair entails violation of the surface true. This clearly delineates one type of pattern that HS cannot generate. I have argued in detail that this pattern does indeed exist in

Mohawk, and we have also seen that these patterns seem to exist in other domains as well.

A broader point is that output-based explanation – the bread and butter of Optimality Theory – is not just a consequence of minimal constraint violation. HS is purported to incorporate OT's ability to understand the application of phonological processes as being driven by constraints on marked structures in the output because it retains the minimal constraint violation computational schema of OT. In this paper, we have seen though, minimal constraint violation is not sufficient to express output-based explanation. MSEI involve a conspiracy to satisfy the markedness constraint FTBIN. The crucial predictor of the location of stress is a structure in the output: syllable open/closedness of the syllable containing the epenthetic vowel. In parallel OT, this is straightforward to express. In HS, it is not. The addition of intermediate representation limits the expression of output-based explanation. To that end, recall Elfner's analysis of MSEI in HS discussed above. She emphasizes the consonant clusters

–structures in the *input* – as the crucial predictor of the location of stress. Regardless of it's empirical adequacy, it is quite telling that her input-based explanation is quite easily expressed in HS (shown in her paper). As she shows, it would receive no such expression in parallel OT. In this way, we see that output-based explanation, where conspiracies live and breath, is strongly connected with parallelism. Input-based explanation, where the sorts of derivational opacity accounts that Elfner gives for Mohawk live and breath, is strongly connected with serialism. Minimal constraint violation does not suffice to fully capture output-based explanation. Parallelism is necessary as well.

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