# Opacity in Mojeño Trinitario Reduplication: An Argument for Harmonic Serialism without Serial Template Satisfaction

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**Abstract.** In Mojeño Trinitario, an Arawak language spoken in Amazonian Bolivia, reduplication interacts with rhythmic vowel deletion in an opaque way (Rose, 2014). Based on data from MT which has not been taken into consideration in reduplicative theory before, I argue for a Harmonic Serialism account of reduplication with standard constraints as they are also used in parallel Optimality Theory (Prince & Smolensky, 1993). Crucially, the standard faithfulness contraint MAXBR has the double function of triggering reduplication and protecting the reduplicant vowel from deletion later in the derivation. Whereas a HS system with standard constraints can fully account for the opacity in the MT reduplicative pattern, serial rule-based approaches to reduplication (e.g. Frampton, 2009), standard parallel OT as well as HS with Serial Template Satisfaction (McCarthy et al., 2012) all fail to derive the pattern. Furthermore, I show that Harmonic Serialism with faithfulness constraints is the only framework to correctly derive other attested patterns of reduplication.

## 1 Introduction

In this paper I argue for a reduplicative theory in the framework of Harmonic Serialism (McCarthy, 2016) including standard faithfulness constraints, and against Serial Template Satisfaction McCarthy et al. (2012) by showing that it makes wrong predictions for the opaque interaction of reduplication and syncope in Mojeño Trinitario.

In Mojeño Trinitario (MT), an Arawak language spoken in Amazonian Bolivia, reduplication interacts with rhythmic vowel deletion in an opaque way (Rose, 2014). Rhythmic syncope underapplies in the reduplicant vowel but counts the reduplicant vowel for the deletion of subsequent vowels, as opposed to the base vowel, which is deleted transparently. This special kind of underapplication constitutes a problem for serial rule-based theories of reduplication (such as distributed reduplication, Frampton (2009)) since no relative ordering of reduplication and vowel deletion can derive the inability of the reduplicant vowel to delete, while the base vowel is accessible for deletion. It is also a problem for parallel Optimality Theory (henceforth OT, Prince and Smolensky (1993)) due to the impossibility to apply a copy process as well as deletion process to the same element in parallel.

Based on the reduplicative pattern in MT, which has not been taken into consideration in reduplicative theory before, I propose a novel version of reduplication in Harmonic Serialism (McCarthy, 2000, 2010, 2016) making use of standard faithfulness constraints as they are also used in parallel OT. Crucially, the standard faithfulness contraint MAXBR has the double function of triggering reduplication and protecting the reduplicant vowel from deletion later in the derivation. Whereas a HS system with standard constraints can fully account for the opacity in the MT reduplicative pattern, serial rule-based approaches to reduplication (e.g. Frampton, 2009), standard parallel OT as well as HS with Serial Template Satisfaction (STS, McCarthy et al. (2012)) all fail to derive the pattern. Furthermore, Harmonic Serialism is able to account for a range of attested reduplicative patterns that STS fails to derive, some of which are also problematic for parallel OT.

This paper is structured as follows: Section 2 presents background information on the rhythmic vowel deletion process as well as the reduplicative pattern in Mojeño Trinitario and how the interaction of those processes yields an opaque surface form. In section 3 I discuss why this opacity is problematic for previous accounts of reduplication and in section 4 I show how these problems can be solved in Harmonic Serialism account with standard faithfulness constraints. Section 5 extends this account to other attested patterns of reduplication, showing that STS undergenerates and is not able to account for a range of attested patterns, including Mojeño Trinitario.

## 2 Opacity in Mojeño Trinitario Reduplication

Mojeño Trinitario belongs to the Moxo language family, along with the endangered dialect Ignacio Trinitario, and the two extinct dialects Loretano and Javeriano. The Moxo language family has approximately 32,000 speakers, with around 3,220 speakers of Trinitario and Ignaciano (Crevels & Muysken, 2009, Rose, 2014). Trinitario has been documented since the early 18th century in Marbán (1701), later a handbook and dictionary was published (Gill, 1957). The morphophonology of reduplication and rhythmic syncope has been describend and analyzed in detail in Rose (2014), from which all data in this paper is taken. This section provides information and data about the relevant phonological processes that interact with each other. I will first address metrical parsing, stress and rhythmic vowel deletion and then present the reduplicative pattern. I will then show how their interaction yields an opaque form in which syncope underapplies in the reduplicant.

### 2.1 Stress, metrical parsing and rhythmic syncope

Mojeño Trinitario displays penultimate stress, left-aligned iambic metrical parsing and a pattern of metrically-conditioned syncope applying to all underlying forms. Syncope is a process by which the properties of the metrical structure determine which vowels delete (McCarthy, 2008). The type of syncope MT exibits is rhythmic sycope, which targets vowels of weak positions in iterative feet. Since MT is an iambic language, syncope targets all odd-numered vowels of a word, starting with the first one. The syllable of the final vowel is always preserved (Rose, 2014: 378). This pattern can be schematically exemplified in (1) as well as in the MT example in (2) below, in which $V_1$ and $V_3$ are deleted, whereas $V_5$ is preserved due to its word-final position.

(1) $(CV_1C\grave{V}_2)(CV_3C\grave{V}_4)(CV_5C\acute{V}_6)(C\grave{V}_7) \xrightarrow{VowelDeletion} (CC\grave{V}_{2)}(CC\grave{V}_4)(CC\acute{V}_6)(C\grave{V}_7)$

(2) *nomxiko*[1]
nu$_1$-o$_2$mo$_3$-xi$_4$-ko$_5$
1SG-carry-CLF-ACT
'I am carrying it.' (Rose 2014: 381)

This phonological process applies to all words in MT and thus blurs the morphological structure of words. In Table 1, more examples are given.

| Underlying representation | Surface representation | Translation |
|---|---|---|
| pokure | 'pkure | 'canoe' |
| su-pokure | 'spokre | 'her canoe' |
| nu-tʃokojo | 'nʃokro | 'I am close' |
| nu-ko-tʃokojo | nkoʃ'kojo | 'I got close' |
| ti-ko-xuma | 'tkoxma | 'he/she/it is sick' |
| ti-a-koxuma | tak'xuma | 'may he/she/it be sick' |

Table 1: Vowel deletion (Rose, 2014: 378)

[1]Abbreviations: ACT–active, APPL–applicative, CAUS–causative, CLF–classifier, F–feminine, IRR–irrealis, NEG–negation, PFV–perfective, PLURAC–pluractional, PRON–pronoun, RED–reduplicant, SG–singular, VZ–verbaliser.

The preservation of the final vowel can be attributed to the presence of a word-final monosyllabic foot in the case of an odd number of syllables. This is the case in (2), which underlyingly exibits the stress pattern in (3-a). Main stress is assigned to the penultimate foot. The fact that the surface form exhibits penultimate stress also fits into this pattern: If the number of syllables is even, the final foot is bisyllabic and its first vowel is deleted, so the strong vowel of the penultimate foot results as the penultimate vowel in the surface form. This is schematised in (3-b), which is an underlying form with 6 syllables in which main stress is assigned to the antepenultimate foot, and in the surface representation in (3-c) after vowel deletion, it is the penultimate syllable that is stressed. If the number of syllables is odd, the final foot is monosyllabic and thus not affected by vowel deletion, and the final vowel of the penultimate foot, bearing main stress, is also the penultimate vowel in the surface form.

(3)
a. (nu.ò)(mo.xí)(kò)
b. $(CV_1.C\grave{V}_2)(CV_3C\acute{V}_4)(CV_5C\grave{V}_6)$ *underlying representation*
c. $(CC\grave{V}_2)(CC\acute{V}_4)(CC\grave{V}_6)$ *surface representation*

Some prefixes are excluded from the vowel deletion rule and preserve their vowels, even if they are odd-numbered. Those prefixes include ma-, ɲi-, ta– and na-. Morover, some stems have a lexically determined deletion pattern, preserving some vowels. This can be attributed to the fact that those roots exhibit lexically marked stress (cf. Rose, 2014). However, the majority of root classes follows the general, iambic pattern, and those are the ones I will be concerned with in this paper.

## 2.2 Reduplication

The reduplicative pattern in Mojeño Trinitario and its interaction with rhythmic sycope is described in Rose (2014). Reduplication in Mojeño Trinitario modifies the meaning of the verb root, its semantic functions include attenuation (deintensification and approximation) and frequentation (event repetition). MT displays two patterns of reduplication, the more frequent of which is suffixing -CV reduplication. In these reduplicated forms, the last syllable of the verbal stem is copied and attached to it. Rose (2014) analyses the reduplicated copy as part of the stem, together with classifiers and voice marking:

(4) MT verbal stem structure (Rose, 2014: 395)
CAUS-root-RED-CLF/N-PLURAC-ACT/CAUS/APPL

An example of a reduplicated form of the pattern -CV is given in (5).

(5)
a. *psoppoxkonu*
pi-sopo-po-xi-ko-nu
2SG-believe RED-CLF-ACT-1SG
'You half-believe me.' (Rose, 2014: 383)

b. *esu tkox'mamaxi*
esu ti-ko-xuma ma-xi
PRON.F 3-VZ-sickness-RED-CLF
'She is sickly (not real sick but is often rather sick). (Rose, 2014: 384)'

As it is evident in (5), reduplicated forms are affected by rhythmic syncope, deleting every odd-numbered vowel, starting with the first one. However, the vowel of the reduplicant can never be deleted, regardless of its numbering. In (5-b), the reduplicant is the fith vowel and thus target for deletion, but it is preserved whatsoever. (5-a) shows that this does not hold for the base: if the base vowel is targeted by deletion, it is deleted transparently, but the corresponding reduplicant vowel still surfaces.

The second, less frequent reduplicative pattern is -CVCV reduplication, which is exemplified in (6) below. Here, the final syllable of the stem is copied and suffixed to the stem twice.

(6) *wo takxum'mamaxi*
wo ti-a-ko-xuma mama-xi
NEG 3-IRR-VZ-sickness-RED2-CLF
'He is not always sick.' (Rose, 2014: 394)

According to Rose (2014), it remains an open question whether the semantics of -CVCV reduplication differs from the one of -CV reduplication. Rose (2014) hypothesises that the double-copy pattern is triggered in those cases where the stem-final vowel is deleted. For the purpose of this paper, the important point is that just as in -CV reduplication, all vowels of the reduplicant are immune to the rhythmic syncope process and cannot be deleted. In (6) above, it is the second vowel of the reduplicant that is targeted by deletion, but is preserved whatsoever.

### 2.3 Opaque Interaction of Reduplication and Rhythmic Syncope

As mentioned above, the reduplicant always preserves its vowel in rhythmic syncope, which implies that the reduplicant is "invisible" for the vowel deletion rule. It does, however, influence the deletion of the following vowels, since it is present in the counting of the vowels. If the RED-vowel is odd-numbered, it does not get deleted. However, deletion does not simply skip RED and delete the following vowel, but instead applies to the next odd-numbered vowel. This is schematised in an hypothetical example in (7) and illustrated in (8-10), examples which show this pattern.

(7) ~~CV$_1$~~.CV$_2$.(~~CV$_3$~~.CV$_4$)$_{\text{Stem}}$ - (CV$_5$)$_{\text{RED}}$ - CV$_6$.~~CV$_7$~~.CV$_{\text{FIN}}$

(8) *sittutupikripo*
s~~u~~$_1$-i$_2$t~~V~~$_3$tu$_4$-**tu**$_5$-pi$_6$-k~~o~~$_7$-ri$_8$po$_9$
3-learn-RED-CLF-ACT-already
'She is learning little by little.' (Rose, 2014: 394)

(9) *tanistutupakwoko* [2]
ta$_1$-ni$_2$s~~V~~$_3$tu$_4$-**tu**$_5$-pa$_6$-k~~o~~$_7$-wo$_8$ko$_9$
'They are biting the branches into pieces.' (Rose, p.c.)

(10) *naettotogieʔpo*
na$_1$-e$_2$t~~V$_3$~~to$_4$-**to**$_5$-gie$_6$-ʔ~~o$_7$~~-po$_8$ (Rose, p.c.)
'They have shaken (the leg).'

If the reduplicant was completely invisible for vowel deletion, vowel deletion would target V$_6$, since it would be the next odd-numbered vowel if RED was not present. Instead, V$_7$ is deleted, which implies that the vowel deletion rule can in fact "see" the reduplicant as part of the morphological structure. It does, however, not get deleted by the vowel deletion rule, as it would be

[2]The prefixes involved in (9) and (10) belong to the few ones that exeptionally preserve their vowel, as mentioned above.

expected. This leads to a rule-ordering problem since it is neither possible to have vowel deletion ordered before nor after the reduplication process.

(11) a. Reduplication > Vowel Deletion
b. Vowel Deletion > Reduplication

Assuming the rule odering in (11-a) vowel deletion should also delete the vowel of the reduplicant, whereas the ordering in (11-b) would predict that vowel the reduplicant is completely invisible for vowel deletion and does not influence the ordering. Additionally, the copy would already contain material where vowels have been deleted.

Contrary to what is claimed in Rose (2014) the reduplicant is not invisible for stress assignment and can in fact bear main stress (Rose p.c.). (12) is an example for such a form. The reduplicant corresponds to the strong syllable of the penultimate foot and consequently bears main stress. The fact that in many reduplicated forms main stress falls on the antepenultimate syllable, as in some further examples (e.g. (5-b)), can be explained by the fact that the reduplicant is blocked from deletion, so that in these forms the underlyingly penultimate syllable is exceptionally present in the surface form. The fact that reduplicant is not excluded from the stress domain but is transparently parsed along with all other phonological material indicates that metrical parsing takes place after reduplication.

(12) *tje:'repo*[3]
ti-jere-re-po
3-last-RED-PFV
'It was lasting very long.' (Rose, p.c.)

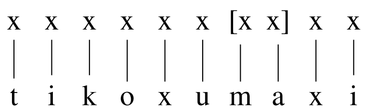
In the following section I will show that neither serial rule-based approaches to reduplication, such as Distributed Reduplication (Frampton, 2009) nor standard parallel OT (Prince and Smolensky, 1993) can account for the kind of opacity which Mojeño Trinitario shows.

# 3 Problems for reduplicative theory

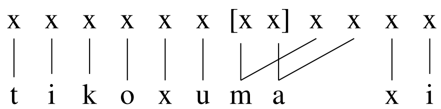
## 3.1 Problems for serial rule-based approaches

In the model of *Distributed Reduplication* (Frampton, 2009), the reduplication process is split up into different sub-processes, which can be ordered differently and thus account for over- and underapplication in reduplicative forms. The three core steps are *juncture insertion* (13-a) into the timing slots, *transcription* of phonological material (13-b) and the repair operation of the *No Crossing Constraint* (NCC) (13-c).

(13) a. *Juncture Insertion*




b. *Transcription*




[3]In addition to rhythmic syncope, compensatory lengethening has applied to the first vowel of the surface form, cf. (Rose, 2014: 390)

c. *NCC Repair*

```
x x x x x x [x x] x x x x
| | | | | | |  |  | | | |
t i k o x u m  a  m a x i
```

Opacity is accounted for by the application of phonological rules between Transcription and NCC repair. At this point, both base and reduplicant vowel are linked to the same timing slot. Rules which apply at this point lead to overapplication, since they affect the timing slots linked to both base and reduplicant material. The deletion of the respective timing slot would yield a form in which both stem and reduplicant are deleted. Early application of rules, that is before transcription, produce overapplication, whereas rules ordered after transcriptions yield normal application.

Underapplication is more problematic in Distributed Reduplication because it requires a mechanism that prevents the respective rule from applying. For this mechanism, Frampton (2009) makes use of the *geminate inalterability*.

(14) *Geminate Inalterability* (Frampton, 2009; Schein and Steriade, 1986; Hayes, 1986)
Elements that are linked to more than one timing slot cannot be altered by phonological rules.

Underapplication of rules results when a rule is ordered to apply a the crossed structure that exists after transcription. In this case, rule application is constrained by the *geminate inalterability constraint*, which prohibits rule application to elements that are linked to more than one timing slot. The structure in (13-b) thus does not satisfy the structural description of the rule and the rule cannot apply.
In Mojeño Trinitario, however, geminate inalterability does not solve the problem because the base vowel can actually be deleted and it is only the reduplicant vowel which is inalterable by rhytmic syncope. This pattern is problematic for the theory. At the point in time in which vowel deletion is supposed to apply, namely after transcription, only one segment for both base and reduplicant vowel is actually present in the structure. Its deletion will lead to the deletion of both base and reduplicant vowel, whereas its preservation would lead to both vowels being preserved. Having vowel deletion apply after NCC Repair would yield normal application. Deleting only one of the vowels is not possible the Frampton system, thus a structure as in MT, in which deletion applies to the base, but not to the reduplicant, cannot be derived.

## 3.2 Problems for Standard Parallel OT

As for parallel OT, some problem arise which are mainy concerned with the need to have ordered rule application. In Mojeño Trinitario, three rules are involved which partially depend on each other, namely metrical parsing, rhythmic syncope and reduplication. An opaque interaction of these rules imposes certain challenges for a fully parallel system.
First of all, it has been previously observed that rhythmic syncope is a general problem for parallel OT (McCarthy, 2008; Bowers, 2015), since it involves an interaction between stress and deletion, in which deletion is conditioned by stress assignment, but deletion alters the foot structure it originally depends on. In other words, "the stress pattern is negated on the surface, but is present in an intermediate representation. For this reason, serial evaluation is needed for rhythmic syncope." (Bowers, 2015: 132). Thus, rhythmic syncope itself is problematic for OT, without reduplication even coming into play.
Secondly, the interaction of deletion and reduplication is opaque in a way that an element that is copied, undergoes deletion at the same time. This is not possible in the basic model of OT, which lacks an Input-Reduplicant faithfulness relation. The full model, including this faithfulness

relation, is able to have the reduplicant being protected by an I-R-Maximality constraint, and delete the base vowel in the output.

(15) Basic Model

Input: /$Af_{RED}$ + Stem/

↑↓ *I-O Faithfulness*

Output: R ⇄ B

*B-R Identity*

(16) Full Model

Input: /$Af_{RED}$ + Stem/

*I-R Faithfulness* ↗↙ ↑↓ *I-B Faithfulness*

Output: R ⇄ B

*B-R Identity*

McCarthy and Prince (1995) base their reduplicative theory on the basic model. Their main argument for the exclusion of I-R faithfulness is the fact that it gives rise to a factorial typology that predicts patterns of underapplication which are not actually attested. More specifically, the ranking of I-R faithfulness higher than B-R faithfulness predicts affixes (such as the reduplicant affix) to be more marked than roots and less likely to be affected by changes, which contradicts the reality observed in most languages. Based on these general markedness properties, McCarthy & Prince impose a metaconstraint on the ranking of root-faithfulness and affix-faithfulness constraints, according to which root-faithfulness must always outrank affix-faithfulness.

(17) *Root-Affix Faithfulness Metaconstraint* (McCarthy and Prince, 1995)
Root-faith » Affix-faith

If we apply the full model to Mojeño Trinitario, however, I-R-faithfulness has to dominate I-B-faithfulness in order to protect the reduplicant vowel from deletion, but allow the deletion of the base vowel. Parallel OT can only account for the MT data in the full model without the Root-Affix Faithfulness Metaconstraint, having I-R-faithfulness outranking I-B-faithfulness. This would in turn give rise to a reversal of universal markedness constraints of roots versus affixes and is therefore not the optimal solution.

# 4 MT Reduplication in Harmonic Serialism

## 4.1 Background: Harmonic Serialism

Harmonic Serialism (HS, Prince and Smolensky (1993); McCarthy (2000), McCarthy (2016)) is a framework which combines the parallel, constraint-based architechture of Optimality Theory (OT, Prince & Smolensky 1993) with a serial derivation.
Two main properties distinguish HS from classical, parallel OT. First of all, GEN in HS is restrained by a *gradualness* condition on candidate generation by which candidates only introduce one single modification with respect to the (latest) input. The exact definition of one modification is still a matter of controversy. While it is defined as 'a single basic faithfulness constraint violation' in (McCarthy 2007), other versions are considered in McCarthy (2010), Torres-Tamarit (2012) argues in favor of an operation-based definition of gradualness. I adopt a weaker definition of one "operation" in considering footing and reduplication to represent one operation as the targets of these processes are discrete entities. I assume that GEN is powerful enough to copy

a complex reduplicant consisting of more than one segment in one step. This is also a standard assumption in Serial Template Satisfaction (McCarthy et al., 2012), where the size of the copied string depends on the ranking and specification of *COPY(x). As for vowel reduction, one could conceive of one step as the reduction of one feature in one vowel, the reduction of all features of one vowel, or the reduction of all weak vowels. A similar situation arises with metrical parsing, where the parsing of a single foot could represent one operation; alternatively all feet could be parsed at once. I will leave this question open since it does not make any crucial difference; serial deletion of place features in one vowel after another will lead to the same result as parallel reduction. For notational concenience will summarise vowel deletion and foot parsing in one tableau for each process that applies.

Secondly, the input is mapped to output via a GEN-EVAL loop until *convergence* on the fully faithful candidate is achieved, meaning that no further harmonic improvement is possible. As opposed to Stratal OT (Kiparsky, 1998, 2000), EVAL imposes the same constraint hierarchy at every step of the derivation. In each derivational step the candidates are submitted to the ranked constraint set and an optimal candidate emerges through normal evaluation.

## 4.2 Constraints

The constraints are presented here grouped into three different categories: reduplication, metrical parsing and stress and vowel deletion. (18) summarises the constraints on reduplication, which adjust the position, shape and size of the reduplicant.

(18) Constraints on Reduplication (McCarthy and Prince (1995))

a. **MAX(PLACE)-BR**
   Place features of the base have correspondents in RED (Assign a * for every segment in the base that lacks the corresponding place features in RED)

b. **RED=SYL**
   The reduplicant is a syllable.

c. **ANCHORINGBR-RIGHT**
   The right peripheral element of R corresponds to the right peripheral element of B

d. **ALIGNRED-RIGHT**
   Align the right edge of the reduplicant with the right edge of the PRWD.

e. **REDFORM**
   Cover constraint (ANCHORINGBR-RIGHT, ALIGNRED-RIGHT)

f. Internal Ranking: RED=SYL » MAX(PLACE)-BR »REDFORM

MAXBR triggers reduplication, that is, copying segments from the base into the reduplicant. It is specified here as MAX(PLACE) because it will play an important role in preventing the reduction of features in the reduplicant vowel. For notational convenience, I do not assign a violation for each feature missing in the reduplicant, but rather for each segment in the reduplicant that is missing one or more place features of his correspondant in the base. Note that this constraint, contrary to BR-IDENT, does not require total identity of base and reduplicant; it only penalises the deletion of features or segments in the reduplicant, which are present in the base, not in the other direction.

The constraints in (19) ensure the metrical parsing in left aligned, iambic metrical feet. The ranking PARSESYL » ALLFTL ensures an an iterative foot parsing. RIGHTMOST assigns stress to the rightmost foot, and since the higher-ranked non-finality constraint ¬FIN(F,$\omega$) prohibits main stress on the final foot (Prince & Smolensky 1993/2002: 43), main stress is always assigned to the penultimate foot. This derives us penultimate stress in the output form since the first vowel on the final foot is always deleted in case the foot is bisyllabic.

(19) Constraints on Metrical Parsing and Stress (cf. Kager (1999))

a. **¬FIN(F,$\omega$)**
The head foot of the PrWd must not be final.

b. **PARSESYL**
Syllables must be parsed into feet.

c. **RIGHTMOST**
The head foot is rightmost in PrWd.

d. **FTBIN**
Feet are binary.

e. **RHTYPE=I**
Feet are right-headed.

f. **ALL-FT-L**
All feet must stand at the right edge of PrWd.

g. **FTFORM**
Cover constraint (RIGHTMOST, FTBIN, RHTYPE=I)

h. Internal Ranking: ¬FIN(F,$\omega$) » PARSESYL » FTFORM » ALL-FT-L

In order to derive Rhythmic Syncope, I follow Kager (1997) in interpreting vowel deletion as a reduction of vocalic features in weak vowels, triggered by REDUCE. Reduction of vowels arises from the interaction of REDUCE and IDENT, which penalises the loss of features of between input und output.

(20) Constraints on Vowel Deletion (cf. Kager (1997))

a. **REDUCE**
Weak syllables dominate no vocalic features.

b. **IDENT**
Input features must be represented in the output.

As opposed to the deletion of the whole segment as in McCarthy (2008) reduction preserves syllabicity and the reduction does not affect foot structure. The reason for favouring reduction over deletion this is the fact that a total deletion of the vowel would necessarily result in resyllabification and therefore also in refooting, since the new foot structure would introduce new violations of FTFORM.

(21) a. $(C\bullet_1.C\grave{V}_2)(C\bullet_3.C\grave{V}_4)(C\bullet_5.C\acute{V}_6)(C\bullet_7.C\grave{V}_8)$
b. $(CC\grave{V}_2)(CC\grave{V}_4)(CC\acute{V}_6)(CC\grave{V}_8)$
c. $(CCV_2C.C\acute{V}_4C)(CV_6C.C\grave{V}_8)$

A deletion of whole segments would yield a structure as in (21-b), which would violate FTBIN and thus give rise to refooting as in (21-c), which again would feed further deletion of weak vowels. Even if there was a way to prevent multiple application of vowel deletion, refooting as in (21-c) would predict the wrong stress pattern, since main stress falls on the penultimate syllable in the surface form ($V_6$), but would be assigned to $V_4$ in (21-c) by the constraint profile.

The combination of subrankings yields the total ranking in (22). The trigger of reduplication, MAX-BR, needs to be high-ranked in order to trigger reduplication as the first operation. It is only outranked by RED=SYL in order to exclude reduplicants that are bigger than one syllable (and therefore have less violations of MAX-BR), and ¬FIN(F,$\omega$) in order to rule out final stress. Next is PARSESYL, which triggers the next operation, namely metrical parsing, which is regulated by the interaction of FTFORM, higher ranked ¬FIN(F,$\omega$) and lower-ranked ALLFTL.

(22) Ranking
¬FIN(F,$\omega$) » RED=SYL » MAX(PL)-BR » PARSESYL » REDFORM » FTFORM » RE-

DUCE » MAX » ALLFTL

In the next section I will go through the step-by-step derivations of two forms; one in which the reduplicant is exceptionally preserved despite being a potential target for vowel deleteion, and one form in which the base vowel is targeted by vowel deletion and deleted transparently.

### 4.3 Derivations

The first form to derive is (5-b) 'tkoxmamaxi', in which the reduplicant is odd-numbered and thus a potential target for vowel deletion, but it is preserved whatsoever. The input consists of the verb form without reduplication and an abstract RED morpheme.
In the first step, reduplication takes place. This is triggered by the high-ranked base-reduplicant faithfulness constraint MAXBR: no violations of MAXBR yield total reduplication, while four violations (for each segments of the stem) lead to no reduplication at all. The cover constraint REDFORM and the higher-ranked RED=SYL ensure the right shape and position of the reduplicant within the verb. Candidate (1a), in which reduplication has taken place, wins over candidate (1b), in which metrical parsing has been carried out, since it displays only two violations of MAXBR (for the two segments of the base that have not been copied), which remain throughout the derivation. Candidate (1d), in which the verbal stem is fully reduplicated and which therefore does not show any violation of MAXBR, is ruled out by the higher-ranked RED=SYL.

(23) Step 1 of *tkoxmamaxi*: Reduplication

| /RED, ti-ko-xuma-xi/ | | | ¬FIN(F,ω) | RED=SYL | MAX(PL)-BR | PARSESYL | REDFORM | FTFORM | REDUCE | IDENT | ALLFTL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1a. | | ti.ko.xu.ma.xi | | | ***!* | ***** | | | | | |
| 1b. | | (ti.kò)(xu.má)(xì) | | | ***!* | | | * | ** | | ** |
| 1c. | ☞ | ti.ko.xu.ma.**ma**.xi | | | ** | ****** | | | | | |
| 1d. | | ti.ko.xu.ma.**xu.ma**.xi | | *! | | ******* | | | | | |

(1c) is then submitted as the input for the second step, in which the material is parsed into metrical feet, which is induced by PARSESYL. The winning candidate (2b) transparently includes the reduplicant in the metrical structure, and bears main stress on the penultimate foot. PARSESYL also prevents the reduplicant from being extrametrical (cf. candidate 2d). Final stress as in (2c) is ruled out by the high-ranked ¬FIN(F,$\omega$).

(24) Step 2 of *tkoxmamaxi*: Metrical Parsing

At this point, only rhythmic vowel deletion remains to apply, triggered by REDUCE. Since REDUCE requires weak vowels to dominate no vocalic features, every unstressed vowel (that is, the first vowel of every binary foot) which is not reduced induces one violation of REDUCE. Candidate (3a), with all weak vowels fully specified, thus exibits three violations. The crucial candidates with respect to the opacity problem are (3b) and (3c). Crucially, candidate (3b) with a non-reduced reduplicant vowel wins over candidate (3c) with a reduced reduplicant since it exibits one violation less of MAXBR. This additional violation in (3c) is due to the fact that the reduplicant vowel bears place features in the base, but not in the reduplicant, which violates MAXBR according to

| /ti.ko.xu.ma.**ma**.xi/ | | ¬FIN(F,ω) | RED=SYL | MAX(PL)-BR | PARSESYL | REDFORM | FTFORM | REDUCE | IDENT | ALLFTL |
|---|---|---|---|---|---|---|---|---|---|---|
| 2a. | ti.ko.xu.ma.**ma**.xi | | | ** | *!***** | | | | | |
| 2b. ☞ | (ti.kò)(xu.má)(**ma**.xì) | | | ** | | | | *** | | ** |
| 2c. | (ti.kò)(xu.mà)(**ma**.xí) | *! | | ** | | | | *** | | ** |
| 2d. | (ti.kò)(xu.má)**ma**(xì) | | | ** | *! | | *! | *** | | ** |

the definition in (16-a). An additional reduction of stressed vowels, as in (3d), would aditionally violate the lower-ranked IDENT.

(25) Step 3 of *tkoxmamaxi*: Vowel Deletion

| /(ti.kò)(xu.má)(**ma**.xì)/ | | ¬FIN(F,ω) | RED=SYL | MAX(PL)-BR | PARSESYL | REDFORM | FTFORM | REDUCE | IDENT | ALLFTL |
|---|---|---|---|---|---|---|---|---|---|---|
| 3a. | (ti.kò)(xu.má)(**ma**.xì) | | | ** | | | | **!* | | ** |
| 3b. ☞ | (t ●.kò)(x●.má)(**ma**.xì) | | | ** | | | | * | ** | ** |
| 3c. | (t●.kò)(x●.má)(**m●**.xì) | | | ***! | | | | | *** | ** |
| 3c. | (t●.k●)(x●.m●)(**m●**.x●) | | | ***! | | | | | ****** | ** |

The derivation converges in the following step, since no further changes can be made to improve the constraint profile of (24):

(26) Step 4 of *tkoxmamaxi*: Convergence

| /(t ●.kò)(x●.má)(**ma**.xì)/ | | ¬FIN(F,ω) | RED=SYL | MAX(PLACE)-BR | PARSESYL | REDFORM | FTFORM | REDUCE | IDENT | ALLFTL |
|---|---|---|---|---|---|---|---|---|---|---|
| 4a. ☞ | (t ●.kò)(x●.má)(**ma**.xì) | | | ** | | | | * | ** | ** |
| 4b. | (t●.kò)(x●.má)(**m●**.xì) | | | ***! | | | | | *** | ** |

To sum up the derivation, the harmonic improvement tableau for 'tkoxumamaxi' is given below.

(27) Harmonic Improvement Tableau for *tkoxumamaxi*

| /(RED, tiko-xuma-xi/ | ¬FIN(F,ω) | RED=SYL | MAX(PLACE)-BR | PARSESYL | REDFORM | FTFORM | REDUCE | IDENT | ALLFTL |
|---|---|---|---|---|---|---|---|---|---|
| Step 1: Reduplication ti.ko.xu.ma.**ma**.xi | | | **** | ***** | | | | | |
| Step 2: Parsing (ti.kò)(xu.má)(**ma**.xì) | | | ** | | | | *** | | ** |
| Step 3: Vowel Deletion (t●.kò)(x●.má)(**ma**.xì) | | | ** | | | | * | ** | ** |
| Step 4: Convergence (t●.kò)(x●.má)(**ma**.xì) | | | ** | | | | * | ** | ** |

The constraint ranking MAX(PL)-BR > PARSESYL > REDUCE ensures the the order of operations as Reduplication > Metrical Parsing > Syncope. The reduplicated form is parsed into metrical feet in the second step, yielding an intermediate form to which vowel deletion can apply. Since MAXBR is ranked higher than REDUCE, it automatically protects the reduplicant from being deleted in the third step. Thus, the preservation of the reduplicant in a way follows from reduplication occuring as a very first step and the high-ranked MAXBR which is required for that. We have now accounted for the preservation of the reduplicant vowel, but not yet seen why the base vowel can be deleted transparently in case it is a target for vowel deletion. Let us look at a form like (5-a), where the base vowel is odd-numbered, whereas the reduplicant is even-numbered. In this case, the base vowel is not preserved, contrary to the reduplicant vowel in (5-b).
The first two steps of the derivation proceed as in the previous derivation above: in the first step reduplication takes place, triggered by MAXBR, followed by metrical parsing in the second step. The crucial third step, in which vowel deletion applies to the output of step 2, is illustrated below.

(28) Step 3 of *'psoppoxkonu'*: Vowel Deletion

| /(pi.sò)(po.**pò**)(xi.kó)(nù)/ | ¬FIN(F,ω) | RED=SYL | MAX(PL)-BR | PARSESYL | REDFORM | FTFORM | REDUCE | IDENT | ALLFTL |
|---|---|---|---|---|---|---|---|---|---|
| 3a. (pi.sò)(po.**pò**)(xi.kó)(nù) | | | ** | | | * | *!** | | *** |
| 3b. ☞ (p●.sò)(p●.**pò**)(x●.kó)(nù) | | | ** | | | * | | *** | *** |
| 3c. (p●.sò)(po.**pò**)(x●.kó)(nù) | | | ** | | | * | *! | ** | *** |

Here, it is the base vowel that is targeted by REDUCE since it it is a weak vowel. Crucially, the reduction of the base vowel does not induce a violation of MAXBR because MAXBR only applies in one direction, penalizing the deletion of material in the reduplicant which is present in the base, but not the other way round (Kager, 1999; McCarthy and Prince, 1995). (Protection of material in the base would require DEPBR (McCarthy and Prince, 1995). Therefore, (3b) wins over (3c) here because the preservation of the base vowel in (3c) induces a violation of REDUCE. After the deletion step, the derivation converges. The derivation is summarised in Tableau (29).

(29) Harmonic Improvement Tableau for *'psoppoxkonu'*

| /(RED, tiko-xuma-xi/ | | ¬FIN(F,ω) | RED=SYL | MAX(PL)-BR | PARSESYL | REDFORM | FTFORM | REDUCE | IDENT | ALLFTL |
|---|---|---|---|---|---|---|---|---|---|---|
| Step 1: Reduplication | pi.so.po.**po**.xi.ko.nu | | | **** | ******* | | | | | |
| Step 2: Parsing | (pi.sò)(po.**pò**)(xi.kó)(nù) | | | ** | | | * | *** | | *** |
| Step 3: Vowel Deletion | (p●.sò)(p●.**pò**)(x●.kó)(nù) | | | ** | | | | * | *** | *** |
| Step 4: Convergence | (p●.sò)(p●.**pò**)(x●.kó)(nù) | | | ** | | | | * | *** | *** |

# 5 Arguments against Serial Template Satisfaction

The standard model of reduplication in Harmonic Serialism is Serial Template Satisfaction, proposed by (McCarthy et al. (2012)). In STS, the reduplicant is a template of type X which can be filled by copying constituents of type X-1. Crucially, it disposes of faithfulness constraints of all kind, having the size of the copied material adjusted by the markedness constraint *COPY(x). The original motivation for the disposure of faithfulness constraints is the lack of a "direct input-output relation" (McCarthy et al., 2012) in Harmonic Serialism. Furthermore, STS is supposed to correctly predict typological gaps, that is, it can derive only the attested patterns of overapplication and rule out certain unattested patterns, which BR correspondence theory predicts.
A closer look at the reduplicative patterns that are dealt with in McCarthy et al. (2012) reveals that STS massively undergenerates. It is actually only able to normal application and overapplication. All of the patterns in (30) are actually attested, but most of them cannot be derived.

(30) Attested patterns and their accountability in STS

| Pattern | Solution in STS |
|---|---|
| Normal application | Process applies after copying |
| Overapplication | Process applies before copying |
| Back-Copying | (not possible) |
| Underapplication | (not possible) |
| Skipping Effects | (not possible) |

Just like in rule-based approaches, Overapplication is accounted for by ordering the phonological process before the copying process, whereas the process applying after copying yields a normal application pattern. Underapplication, however, cannot be accounted for in STS, as well as Back-Copying and Skipping effects. This section will deal with each of these phenomena, showing that all of them can be accounted for in a version of HS that includes faithfulness constraints.

## 5.1 Underapplication

'Regular' underapplication (as opposed to the special case of underapplication in MT) refers to the failure of a phonological rule to apply in reduplicated forms, despite the context being present. In Dakota, Ablaut applies to certain lexically-specified morphemes before other lexically specified morphemes (McCarthy and Prince, 1995). However, Ablaut fails to apply at the base-reduplicant juncture, as illustrated in (31).

(31) Dakota: Underapplication

| | | | |
|---|---|---|---|
| a. | ap$^{h}$á | ap$^{h}$é-ŝni | ap$^{h}$á-p$^{h}$á-ŝni |
| b. | háska | háske-ʔ | haská-haská-ʔ |

As pointed out in the previous section, underapplication is difficult to account for in all theories of reduplication. In parallel OT, according to Prince and Smolensky (1993), underapplication is a consequence of satsifying B-R identity while obeying special lexical conditions on RED. A constaint ℂ on these properties of RED is not ranked with respect to ID-BR, ruling out overapplication. For Tokyo Japanese, McCarthy and Prince (1995) use *[ŋ as a constraint ℂ, ruling out word-initial nasals.

(32) Skeletal Ranking for Underapplication (McCarthy & Prince, 1995: 6)
B-R Identity, ℂ » Phono-Constraint » I-O Faithfulness

Due to the lack of faithfulness constraints, STS cannot reproduce this analysis (cf. McCarthy et al. (2012)). In this way, STS is not much different from a serial rule-based model, where overapplication results from the process applying before copying, but underapplication is more difficult to account for. McCarthy et. al address the problem, claiming that "this seeming failure of STS is no liability, because the analysis is wrong." (McCarthy et al., 2012: 37). According to them, most cases of underapplication can be reanalysed, yiedling independent explanations for why the relevant process has failed to apply. For Tokyo Japanese, they reanalyze the reduplicated form as consisting of two prosodic words. In Akan, they attribute underapplication to the fact that the relevant process is not productive anymore, which is supported by the fact that loanwords do not undergo it. As for the Dakota data they put into question the lexical class membership of the reduplicant. Without giving any independent evidence, they conclude that "the reduplicative morpheme in Dakota is evidently not in the class of ablaut-undergoes, and no more needs to be said". (McCarthy et. al, 2012: 212) However, denying the existence of patterns of underapplication easily runs into its limits. As I have argued above, Mojeño Trinitario fits in none of these categories of reanalysis. The fact that the counting of the vowels does not restart after it has reached the reduplicant, but continues as if the reduplicant had been deleted transparently (even though it has not), is clear evidence for the whole verb being one prosodic word. Vowel deletion applies productively and transparently in all other contexts except reduplication. Thus, MT is a crucial example of a pattern that is attested, but cannot be derived by STS and can neither be reanalyzed in any way. This shows that contrary to what is claimed in McCarthy et al. (2012), underapplication does provide crucial support for BR correspondence over STS.
In HS with faithfulness constraints, there is no need for a constraint on special properties of the reduplicant, as in parallel OT, the ranking MAX-BR » ID-BR »ABLAUT derives underapplication in reduplicative contexts and transparent application in all other contexts, as (33) illustrates.

(33) Dakota: Underapplication

| /ap$^{h}$á-RED-ŝni/ | MAX-BR | ID-BR | ABLAUT | ID-IO(PLACE) |
|---|---|---|---|---|
| 1a. ap$^{h}$á-RED-ŝni | *!** | | | |
| 1b. ☞ ap$^{h}$á-ap$^{h}$á-ŝni | | | * | |
| 1c. ap$^{h}$é-RED-ŝni | *!** | | | * |
| 2a. ☞ ap$^{h}$á-ap$^{h}$á-ŝni | | | * | |
| 2b. ap$^{h}$á-ap$^{h}$é-ŝni | | *! | | * |

High-ranked MAX-BR requires reduplication as the first step; in the second step, the derivation converges. Rule application to either the reduplicant or the base is blocked by ID-BR. Overapplication is ruled out because it cannot be generated in one step by GEN, rather it has to be derived in two steps by first applying to one member of the base-reduplicant pair, which is ruled out by high-ranked ID-BR.

### 5.2 Skipping Effects

Contexts in which reduplicants do not correspond to a contiguous string of segments in the base ar referred to as *Skipping Effects* (McCarthy and Prince, 1995; McCarthy et al., 2012). Such an effect can be observed in Sanskrit, which shows prefixing CV-reduplication. When the onset of the reduplicated syllable is complex, only the first consonant of the onset cluster is copied and the second one is 'skipped', which leads to a non-contiguous string of reduplicant segments as in (34).

(34) Sanskrit: Skipping Effects

a. du-druv
b. pa-psa:
c. si-smi

In parallel OT, skipping effects are accounted for by having certain markedness constraints outranking CONTIGUITY$_{BR}$. In Sansrit, these markedness constraints are *COMPLEX-ONSET, which penalises complex onsets, thus ruling out **dru- druv*, and by the Margin hierarchy (Prince and Smolensky 1993/2004), which favors low-sonority onsets and thereby rules out **ru-druv*. Serial Template Satisfaction is by hypothesis limited to copying strings of Xs, which makes skipping effects difficult to account for. The solution McCarthy et al. (2012) propose is a post-copying deletion process: the more sonorous member of the onset cluster is deleted after copying a contiguious string of segments from the base to the reduplicant. Crucially, McCarthy et al. (2012) have to reintroduce faithfulness constraints at this point. In order to have deletion apply to the reduplicant instead of the base, they have to have MAX$_{Root}$ outrank MAX$_{affix}$. Having argued against faithfulness constraints on the base of supposedly unattested patterns from hypothetical languages, they now need to make use of faithfulness constraint in order to derive a pattern that is actually attested. This very clearly shows that STS massively undergenerates and that a basic Input-Output faithfulness relation is indispensable in reduplicative theory.

In Harmonic Serialism with faithfulness constraints, in contrast, skipping effects can easily be implemented as copying followed by deletion, as proposed by McCarthy et al. (2012). As for Sanskrit, it is sufficient to just slightly modify the ranking which is used in the parallel OT account by Prince and Smolensky (1993).

(35) Sanskrit: Skipping Effects

| /RED-druv/ | | | *COMPL-ONS | MAX-BR | *MAR/LIQ | *MAR/NAS | *MAR/FRIC | CONTIG-BR | ID-BR |
|---|---|---|---|---|---|---|---|---|---|
| 1a. | | RED-druv | * | *!** | * | | | | |
| 1b. | ☞ | dru-druv | * | | ** | | | | |
| 2a. | | dru-druv | *! | | ** | | | | |
| 2b. | ☞ | du-druv | | * | | | | * | |
| 2c. | | ru-druv | | * | *! | | | * | |
| 3a. | | dru-druv | *! | | ** | | | | |
| 3b. | ☞ | du-druv | | * | | | | * | |
| 3c. | | ru-druv | | * | *! | | | * | |

In the first step, reduplication is triggered by MAX-BR since both candidates equally violate *COMPL-ONS. This violation of the winning candidate (1b) is then eliminated in the second step by the deletion of the R in the onset. In the final step the derivation converges.

### 5.3 Overapplication and Back-Copying

Overapplication arises when a process that applies to one member of the reduplicant/base pair is duplicated in the other member without a context that would trigger the process to apply there. Effects on the reduplicant are copied to the base (overapplication) or effects on the base are copied to the reduplicant (back-copying). In Javanese, intervocalic *h*-deletion overapplies to the reduplicant; In Tagalog, assimilation overapplies to the base ('Back-Copying').

(36) Javanese: Overapplicaion in the reduplicant (McCarthy & Prince, 1995: 37)
- a. /arah/ → ara-e
- b. /bedah/ → beda-beda-e
- c. /dajoh/ → dajo-dajo-e

(37) Tagalog: Overapplication in the base (Back-Copying)
- a. /paN-pu:tul/ → pa**m**u:tul
- b. /paN-RED-pu:tul/ → pa**m**u**m**u:tul

Serial Template Satisfaction accounts for overapplication by having rule application preceding copying, similar to serial rule-based models of reduplication. Back-Copying, however, is neither accountable for in STS nor in parallel OT.
One problematic instance of overapplication are processes that apply at the reduplicant-base juncture. Neither parallel OT nor rule-based theories can account for these patterns since the overapplying process isn't applicable until reduplication has already occurred. Such cases from Malay and Tagalog are illustrated below.

(38) Malay: Overapplication at base-reduplicant-juncture
- a. /waŋi/ waŋĩ w̃ãŋĩ-w̃ãŋĩ
- b. /hemə/ hamə̃ h̃ãm̃ə̃-h̃ãm̃ə̃

Just as rule-based theories, STS has no way for accounting for those patterns because they cannot be captured by any ordering of operations. McCarthy et al. (2012) confront this problem by questioning the reliability of the Malay data, calling it "spurious and hence no counterexample to ordering theories of overapplication like STS" (McCarthy et al., 2012: 203).
In Harmonic Serialism with faithfulness constraints, overapplication at the base-reduplicant juncture is less problematic. The same ranking of PHONO-CONSTRAINT, MAXBR » ID-BR » ID-IO can derive both overapplication in the reduplicant as well as overapplication in the base (Back-Copying).

(39) Malay: Overapplication at base-reduplicant-juncture

| /RED-waŋi/ | | Nasal | MaxBR | RedForm | FtForm | ID-BR | ID-IO | AllFtL |
|---|---|---|---|---|---|---|---|---|
| 1a. | /waŋi/ | * | **!** | | | | | |
| 1b. | waŋĩ | | ***!* | | | | | |
| 1c. | ☞ waŋi-waŋi | ** | | | | | * | |
| 2a. | waŋi-waŋi | **! | | | | | * | |
| 2b. | ☞ waŋĩ-waŋĩ | * | | | | | ** | |
| 3a. | waŋĩ-waŋĩ | *! | | | | | ** | |
| 3b. | ☞ waŋĩ-w̃ãŋĩ | | | | | ** | *** | |
| 4a. | waŋĩ-w̃ãŋĩ | | | | | *!* | *** | |
| 4b. | ☞ w̃ãŋĩ-w̃ãŋĩ | | | | | | **** | |
| 5a. | waŋĩ-w̃ãŋĩ | | | | | *!* | *** | |
| 5b. | ☞ w̃ãŋĩ-w̃ãŋĩ | | | | | | **** | |

Reduplication occurs in the first step, creating two contexts for nasalisation of the final 'i', which is realised in the second step[4]. This, again, creates a new context for nazalisation in the third step. In the last step the constraint profile can be optimised by nazalisation of the first two segments, removing the two remaining violations of ID-BR. The constraint profile of candidate 4b only shows 5 violations of ID-IO and which cannot be further optimised, and the derivation converges. Whereas overapplication at the base-reduplicant juncture still remains problematic in other frameworks, in HS it simply follows from the step-wise architecture of the system: the Malay data can be analyzed as sequential nasalisation triggered by NASAL, where each operation creates the context for the next operation to apply, and final back-copying in order to satisfy ID-BR.

## 5.4 A Factorial Typology

In this section I have shown that HS with standard faithfulness constraints can account for a number of reduplicative patterns which are problematic for STS. The derivations discussed above give rise to the factorial typology in (40).

(40) Factorial Typology of reduplicative patterns in HS

| Ranking | Pattern |
|---|---|
| MaxBr » Phono-Constraint » ID-IO » ID-Br | Underapplication, MT Style |
| MaxBr, ID-Br » Phono-Constraint » ID-IO | Underapplication |
| MaxBr , Phono-Constraint »(Id-Io$_{RED}$ )» ID-Br » ID-IO | Overapplication |
| MaxBr , Phono-Constraint » ID-Br »ID-IO | Overappl. at Juncture |
| MaxBr , Phono-Constr. »(Id-Io$_{BASE}$ ID-Br )» ID-IO | Back-Copying |
| Phono-C$_1$ » MaxBr » Phono-C$_2$ » Contig-Br » Id-Br | Skipping Effects |

From the different rankings the following order of rule application arises for each of the patterns:

(41) Harmonic Serialism: Order of operations

[4] I summarise both nasalisation operations in one step for reasons of convenience; having both 'i'-segments nasalised sequentially would yield the same result.

| Pattern | Order of Operations |
|---|---|
| Overapplication | 1. Reduplication<br>2. Rule Application<br>3. Convergence |
| Back-Copying | 1. Reduplication<br>2. Rule-Application RED<br>3. Back-Copying to Base<br>4. Convergence |
| Overappl. B-RED-juncture | 1. Reduplication<br>2. Rule-Application BASE/RED<br>3. Rule Application at Juncture<br>4. Back-Copying<br>5. Convergence |
| Underapplication | 1. Reduplication<br>2. Convergence |
| Skipping Effects | 1. Reduplication<br>2. Deletion<br>3. Convergence |

Comparing parallel OT, STS and regular HS, it is striking that STS can derive the fewest attested patterns: it can only account for regular overapplication. Regular HS is the only theory which is able to derive all five patterns, including the special underapplication pattern in MT. The crucial argument for why HS should be preferred over parallel OT and Distributed Reduplication (DR) thus comes from Mojeño Trinitario, which can only be accounted for in HS.

(42) Comparison of frameworks[5]

| Pattern | parallel OT | STS | HS with faithfulness | DR |
|---|---|---|---|---|
| Underapplication | ✓ | ✗ | ✓ | (✓) |
| Underapplication MT | ✗ | ✗ | ✓ | ✗ |
| Overapplication | ✓ | ✓ | ✓ | ✓ |
| Overappl. RED-B-juncture | ✗ | ✗ | ✓ | ✓ |
| Back-Copying | ✓ | ✗ | ✓ | (✓) |
| Skipping Effects | ✓ | ✗ | ✓ | (✓) |

# 6 Conclusion

In this paper I have argued for a reduplicative theory in the framework of Harmonic Serialism with standard faithfulness constraints, and against the standard model of reduplication in HS, Serial Template Satisfaction. I have identified an opaque interaction of reduplication and rhythmic syncope in Mojeño Trinitario, yielding an exceptional pattern of underapplication which challenges all existing theories of reduplication. Based on this novel data I have argued for the re-integration of faithfulness constraints into the HS theory of reduplication by showing that the faithfulness constraint MAXBR plays a crucial role in MT reduplication: it triggers reduplication in the first step and protects the reduplicated material from deletion in the further steps of the derivation. Thus, the impossibility to delete the RED-vowel whereas the base vowel can be deleted transparently simply follows from the high-ranked MAXBR which is necessary to trigger reduplication in the first place.

The opacity in MT reduplication constitutes a problem for serial rule-based approaches to reduplication since the underapplication affects only the reduplicant but not the base. This pattern cannot be accounted for with geminate inalterability, which usually blocks rule application in forms with

[5]In order to derive the patterns marked with (✓), additional stipulative assumptions are needed.

underapplication in Distributed Reduplication (Frampton, 2009). It is also a challenge for parallel OT since it can only be accounted for in the full model without the Root-Affix Faithfulness Metaconstraint, having I-R-faithfulness outrank I-B-faithfulness, which in turn would give rise to a reversion of universal markedness properties of roots versus affixes.
Harmonic Serialism with standard faithfulness constraints can solve all those problems, whereas the standard model of reduplication in Harmonic Serialism, Serial Template Satisfaction proposed by McCarthy et al. (2012), cannot account for the opacity in MT reduplication since it lacks the crucial faithfulness relationship between base and reduplicant necessary to protect the RED-vowel from deletion. The underapplication of vowel deletion in MT reduplication is thus a crucial counterexample to Serial Template Satisfaction.
In section 5, I have extended my proposal to other attested patterns of reduplication, such as regular underapplication, overapplication, back-copying and skipping effects. I have shown that HS can straightforwardly account for all these patterns without the necessity of any pattern-specific constraints or assumptions. STS, in constrast, is only able to account for one pattern of reduplication (overapplication). McCarthy et al. (2012) base their argumentation for STS on its ability to exclude unattested patterns in hypothetical languages, but, as it turns out, it is not able to account most of the attested patterns and needs to put into question the reliablitiy of the data in those cases of failure. Based on only one attested pattern of reduplication McCarthy et al. (2012) can actually account for (overapplication), they argue for the disposure of faithfulness constraints in HS. This argumentation is, however, not consistent, since they have to make use of faithfulness constraints in order to account for skipping effects. Furthermore, recent work by Zukoff (2017) has shown that STS actually does predict some of the unattested phenomena it was supposed to be able to exclude, which is an even stronger argument for the re-integration of faithfulness constraint into the system of Harmonic Serialism. All in all, the case of MT has provided crucial evidence for the fact that (i) Harmonic Serialism should be preferred over parallel OT and rule-based models in reduplicative theory and (ii) faithfulness constraints need to be part of the architecture of Harmonic Serialism.

## References


Bowers, Dustin. 2015. A system for morphophonological learning and its implications for language change. Phd thesis, UCLA.

Frampton, John. 2009. *Distributed reduplication*. Cambridge, MA: MIT Press,.

Gill, Wayne. 1957. *Trinitario grammar*. San Lorenzo de Mojos: Misión Nuevas Tribus.

Hayes, Bruce. 1986. Inalterability in CV phonology. *Language* 62:321–351.

Kager, Rene. 1999. *Optimality theory*. Cambridge University Press.

Kager, René. 1997. Rhythmic vowel deletion in optimality theory. In *Derivations and constraints in phonology*, ed. I. Roca, 463–499. Oxford: Oxford University Press.

Kiparsky, Paul. 1998. Paradigm effects and opacity. Ms., Stanford University, Istanbul.

Kiparsky, Paul. 2000. Opacity and cyclicity. *The Linguistic Review* 17:351–367.

Marbán, Pedro. 1701. *Arte de la lengua moxa, con su vocabulario, y cathecismo*. Lima: Imprenta Real de Joseph de Contreras.

McCarthy, John, Wendell Kimper, and Kevin Mullin. 2012. Reduplication in harmonic serialism. *Morphology 22* 173–232.

McCarthy, John J. 2000. Harmonic serialism and parallelism. *Proceedings of the North East Linguistics Society* 40.

McCarthy, John J. 2008. The serial interaction of stress and syncope. *Natural Language and Linguistic Theory* 26:499–546.

McCarthy, John J. 2010. An introduction to harmonic serialism. *Language and Linguistics Compass* 4:1001–1018.

McCarthy, John J. 2016. The theory and practice of harmonic serialism. In *Harmonic grammar and harmonic serialism*, ed. John J. McCarthy and Joe Pater, 1–18.

McCarthy, John J., and Alan Prince. 1995. Faithfulness and reduplicative identity. In *Occasional papers in linguistics 18: Papers in optimality theory*, ed. Jill Beckman, Suzanne Urbanczyk, and Laura Walsh Dickey.

Prince, Alan, and Paul Smolensky. 1993. Optimality theory: Constraint interaction in generative grammar. *Computer Science Technical Reports* 664.

Rose, Françoise. 2014. When vowel deletion blurs reduplication in mojeno trinitario. In *Reduplication in indigenous languages of south america*, ed. Gale Goodwin Gómez and Hein van der Voort, 375–399.

Schein, Barry, and Donca Steriade. 1986. On geminates. *Linguistic Inquiry* 17:691–744.

Torres-Tamarit, Francesc. 2012. Syllabification and opacity in harmonic serialism. Doctoral Dissertation, Universitat Autònoma de Barcelona.

Zukoff, Sam. 2017. Actually, serial template satisfaction does predict medial coda skipping in reduplication. *Proceedings of the 2016 Annual Meeting on Phonology* .