Optionality and Markedness Suppression

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1 Introduction

Perhaps the most famous example of an optional phonological process comes from French, where schwa may be deleted in the context V#C___, among other places (Anderson 1982, Côté 2001, Dell 1973, Howard 1973, Selkirik 1978, Tranel 1994, among many others):

(1) a. *tu as* *<u>envie de te battre</u>* 'you feel like fighting'
ãvidətəbatʁ
ãvidtəbatʁ
ãvidətbatʁ

b. *envie de te le demander* 'feel like asking you'
ãvidətələdəmãde
ãvidtələdəmãde
ãvidətlədəmãde
ãvidətəldəmãde
ãvidətələdmãde
ãvidtəldəmãde
ãvidtələdmãde
ãvidətlədmãde

Because of consonant cluster prohibitions, certain logically possible deletion patters are unattested. As deletion is optional, it may apply or not to the various schwas in an utterance, yielding multiple phonetic forms for a single word or phrase.

This phenomenon has received much attention over several decades from researchers working in a variety of frameworks. Schwa deletion is particularly vexing for Optimality Theory (OT; Prince & Smolensky 1993[2004]) because the most common OT-based approaches cannot produce the full range of variation in this case. Theories of variation such as multiple grammars/variable rankings (Anttila 2006, 2007, Nagy & Reynolds 1997, Reynolds 1994) and stochastic rankings (Boersma & Hayes 2001) produce optionality by allowing multiple rankings, in this case both *Schwa ≫ Max and Max ≫ *Schwa, for example. The former ranking favors the maximum amount of deletion, and the latter prevents deletion altogether.

There is no way to rank the constraints such that forms with intermediate levels of deletion (e.g. *ãvidətələdmãde*) are favored—these candidates are collectively harmonically bounded (Riggle & Wilson 2005, Samek-Lodovici & Prince 1999, 2002) by the "extreme" candidates.

This paper proposes a solution to OT's collective harmonic bounding problem called Markedness Suppression (MS). Under MS, phonological optionality is grounded in optionality of violation mark assignment. The claim is that markedness constraints may be tagged with an operator ⊙, which grants Eval the freedom to refrain from assigning violation marks to candidates that would otherwise violate the constraint. That is, constraints tagged with ⊙ can be "suppressed."

For French, optionality results from tagging *Schwa with the ⊙ operator. This means that when Eval computes violations, it is permitted to refrain from recording violations of *Schwa for any candidate. For example, an evaluation of *envie de te le demander* may proceed as in (2), where each '○' marks a suppressed violation. For ease of exposition I include just three candidates from (1b). A fuller set of candidates is considered below.

(2)

/ãvidətələdəmãde/	⊙*Schwa	Max-V
a. ãvidətələdəmãde	**!**	
☞ b. ãvidtələdəmãde	*○○	*
c. ãvidətlədmãde	**!	**

By providing access to the harmonically bounded forms, MS achieves better empirical coverage than the approaches mentioned above. Other frameworks that do not suffer from the harmonic-bounding defect include optional rules (e.g. Labov 1972, Vaux 2008), local constraint evaluation (Riggle & Wilson 2005), and the rank-ordered model of Eval (Coetzee 2004, 2006). MS compares favorably to these theories: optional rules have difficulty accounting for the full typology of optionality, local constraint evaluation presents new difficulties in terms of its formal implementation, and the rank-ordered model of Eval cannot rule out implausible grammars without sacrificing its solution to the harmonic-bounding problem.

Optionality—and variation more broadly—is an extraordinarily common feature of phonological systems. Consequently, any satisfactory phonological theory must include a sound account of optionality. Indeed, Nevins & Vaux (2008) and Vaux (2008) use the harmonic-bounding defect to argue against the entire OT enterprise and in favor of a framework rooted in various kinds of optional rules that I will call RBP-O (for rule-based phonology with optionality). In this light, the significance of MS is that it endows OT with the ability to produce the full typology of optional processes and therefore shows that the perceived problem is not with OT itself, but with the specific resources various proposals make available to OT. MS even turns the tables on RBP-O by revealing drawbacks to optional rules. A further benefit of MS is that it allows a wide array of superficially distinct kinds of optionality to be subsumed under one mechanism.

The details of the proposal are fleshed out in §2, and it is tested against the full typology of optionality in §3. Objections to MS are addressed in §4. §5 argues that MS is superior to other optionality-producing systems in OT, and §6 compares MS to RBP-O. §7 addresses remaining issues, and §8 summarizes the results of the paper.

2 Markedness Suppression

2.1 French Schwa Deletion

The core of the proposal is this: Under Markedness Suppression, markedness constraints chosen on a language-particular basis can be tagged with the operator ⊙, which grants the Eval component of the grammar the freedom to ignore or eliminate any number of violations that this constraint would otherwise assign.

Markedness constraints in OT motivate processes. When the fully faithful candidate violates a sufficiently high-ranked markedness constraint, it loses to a less faithful form that avoids that violation. The input/output mapping therefore resembles a derivation in which some process (insertion, deletion, etc.) has applied. For example, in (3), *Schwa selects the candidate lacking the input schwa, just as if we had applied a rule such as /ə/ → ∅.

(3)

/…ə…/	*Schwa	Max
a. …ə…	*!	
☞ b. …∅…		*

In a rule-based framework, when application of the deletion rule is not obligatory, variation in the surface form results. MS is just the OT equivalent: if *Schwa doesn't always penalize schwas, deletion isn't always motivated. Suppressing *Schwa's violations is similar to refraining from applying the deletion rule:

(4)

/…ə…/	⊙*Schwa	Max
☞ a. …ə…	∘	
b. …∅…		*!

Suppressible constraints are marked with ⊙, and a violation mark that has been suppressed is noted by ∘. In (4), the faithful candidate's violation of ⊙*Schwa has been suppressed. Since this form is no longer penalized by ⊙*Schwa, deletion is unmotivated. As this example illustrates, mark suppression gives the upper hand to faithfulness. This means that MS invites variation in the direction of greater faithfulness—MS is the equivalent of failing to apply a rule.

When a violation mark is suppressed, the evaluation proceeds as if that mark had not been assigned in the first place. I assume that violations of ⊙-tagged constraints are randomly targeted for suppression. For any Tableau in which a suppressible constraint normally assigns n violations, there are 2^n possible evaluations, some of which yield identical results, either in the winner of the evaluation or ing the violation profiles of the candidates.

Riggle & Wilson (2005) object to an MS-style approach to optionality on the grounds that it opens the door to out-of-control derivations: nothing guarantees the survival of violation marks that rule out wildly deviant candidates. For example, we can't count on an optional Dep to block arbitrary amounts of epenthesis. But MS limits suppression to markedness constraints and therefore does not have this problem. Dep and other faithfulness constraints are ineligible for suppression and so will always rule out out-of-control unfaithfulness. The only new outputs that MS predicts are those that tend toward greater faithfulness; the input is an upper bound of sorts on the degree of permissible variation.

Of course, the standard way of "suppressing" a markedness constraint in OT is to rank it below faithfulness constraints. If Max outranks *Schwa, e.g., deletion is prevented. Consequently, some theories of optionality produce variation by permitting multiple constraint rankings in one language. These "reranking" theories, such as stochastic OT (Boersma & Hayes 2001) and multiple grammars/variable rankings (Anttila 1997, 2006, 2007, Kennedy 2008, Nagy & Reynolds 1997, Reynolds 1994, Ringen & Heinämäki 1999), might permit both *Schwa ≫ Max and Max ≫ *Schwa and thus produce optional deletion. But these theories do not generate the full range of variation. With only those two rankings available, we either get deletion across the board or no deletion at all:

(5)

/…ə…ə…/	*Schwa	Max
a. …ə…ə…	*!*	
b. …ə…∅…	*!	*
☞ c. …∅…∅…		**

/…ə…ə…/	Max	*Schwa
☞ a. …ə…ə…		**
b. …ə…∅…	*!	*
c. …∅…∅…	*!*	

That is, theories of optionality based solely on reranking cannot produce French-style optionality. MS, in contrast, can:

(6)

/…ə…ə…/	⊙*Schwa	Max
a. …ə…ə…	*!*	
☞ b. …ə…∅…	∘	*
c. …∅…∅…		**!

In a sense, MS allows *Schwa to be randomly selective in the schwas it chooses to penalize. Thus a candidate with less than complete deletion can win when Eval "ignores" enough of its *Schwa violations.

The Tableau in (6) illustrates another important point. Under MS, constraints are never "turned off." They assign violations as usual (as evidenced by candidate (a)'s violations), but Eval may remove some from consideration. This is important because a basic tenet of OT is the universality of constraints. In the strongest form of the claim, all constraints are active in all languages, though of course they are violable and may be crucially dominated.

Were MS simply a way of turning constraints off, it would result in Tableaux containing either the full of set of violation marks assigned by a constraint or none of those violation marks. MS is more nuanced than this. It permits a subset of a constraint's violation marks to appear, so the constraints must always be "on."

Let's apply MS to actual examples of schwa deletion in French. Recall that schwa is optionally deleted in contexts including V(#)C___:

(7) a. *tu as <u>envie de te battre</u>* 'you feel like fighting'
ãvidətəbatʁ
ãvidtəbatʁ
ãvidətbatʁ

b. *envie de te le demander* 'feel like asking you'
ãvidətələdəmãde
ãvidtələdəmãde
ãvidətlədəmãde
ãvidətəldəmãde
ãvidətələdmãde
ãvidtəldəmãde
ãvidtələdmãde
ãvidətlədmãde

This type of optionality is termed *iterative optionality* by Vaux (2003): the decision to delete a schwa is made separately (i.e. iteratively) for each schwa.

Phonotactic requirements block certain deletion patterns. For example **ãvidtldmãde*, with deletion of all four schwas, is impossible because of the illicit consonant cluster that is created. The precise conditions under which deletion is allowed, the principles behind these conditions, and even the grammaticality of specific deletion patterns, are complex and subtle issues that are the subject of a long strand of research. See, e.g., Côté (2001), Dell (1973), Noske (1996), Tranel (1994) for discussion of the issues and a variety of analytical approaches. Côté (2001) presents an especially detailed investigation of the factors that permit, block, and require schwa deletion. I am not directly concerned with these factors here. Although I will discuss below a context in which deletion is obligatory according to Côté (2001), for the moment I confine the discussion to the attested forms in (7).

In (7a), either of the two schwas may undergo deletion. They cannot both be deleted because of the phonotactic requirements just mentioned, which I represent with the cover constraint PHONOTACTICS.[1] With this constraint highly ranked, and with the ranking *SCHWA $\gg$ MAX, deletion of one schwa is optimal:

[1] Côté (2001) states that in addition to the variants in (7b), other seemingly phonotactically illegal possibilities are perfectly acceptable: *ãvidtlədəmãde* and *ãvidtlədmãde*. As the issue has consequences only for the content of PHONOTACTICS, I set it aside and assume that only the forms in (7b) are licit.

(8)

/ãvidətəbatʁ/	Phonotactics	*Schwa	Max
a. ãvidətəbatʁ		**!	
☞ b. ãvidtəbatʁ		*	*
c. ãvidtbatʁ	*!		**

I include here just one candidate with deletion of a single schwa. Deletion of just the other schwa is considered below.

To produce the form with no deletion, we must tag *Schwa as suppressible. Now the more faithful candidate wins when both of its violations of ⊙*Schwa are suppressed:

(9)

/ãvidətəbatʁ/	Phonotactics	⊙*Schwa	Max
☞ a. ãvidətəbatʁ		○○	
b. ãvidtəbatʁ		*!	*
c. ãvidtbatʁ	*!		**

This is not the only way for candidate (a) to emerge as optimal. There are two other possible patterns of suppression that produce this form:

(10) a.

/ãvidətəbatʁ/	Phonotactics	⊙*Schwa	Max
☞ a. ãvidətəbatʁ		○○	
b. ãvidtəbatʁ		○	*!
c. ãvidtbatʁ	*!		**

b.

/ãvidətəbatʁ/	Phonotactics	⊙*Schwa	Max
☞ a. ãvidətəbatʁ		*○	
b. ãvidtəbatʁ		*	*!
c. ãvidtbatʁ	*!		**

In both of these Tableaux, candidates (a) and (b) tie on *Schwa. In (10a), all the violation marks for *Schwa are suppressed, and in (10b), just one of candidate (a)'s violations is suppressed. The decision is passed on to Max in the standard OT fashion, and Max favors candidate (a).

Also, the Tableau in (8) is still a possible evaluation. It's the one in which no violation marks are suppressed at all.

So far we've seen how MS produces forms with no deletion or deletion of one schwa. It should be clear that *ãvidtbatʁ* can never win because it violates the highly ranked (and not suppressible) phonotactic constraints. But how do we choose between *ãvidtəbatʁ* and *ãvidətbatʁ*, each of which has deletion of one schwa? The decision can be made in two ways.

First, the violation mark for one form can be suppressed while the other is retained:

(11)

/ãvidətəbatʁ/	Phonotactics	⊙*Schwa	Max
a. ãvidətəbatʁ		*!*	
b. ãvidtəbatʁ		*!	*
☞ c. ãvidətbatʁ		○	*
d. ãvidtbatʁ	*!		**

Second, suppose the two candidates tie on the constraints considered so far:

(12)

/ãvidətəbatʁ/	Phonotactics	⊙*Schwa	Max
a. ãvidətəbatʁ		*!*	
☞ b. ãvidtəbatʁ		○	*
☞ c. ãvidətbatʁ		○	*
d. ãvidtbatʁ	*!		**

Tied evaluations are in fact one method that has been employed to produce optionality in OT (Hammond 1994, Odden 2008). If there is genuinely a tie, then the grammar is free to send either output to the next component of the grammar. But it has been noted (e.g. by Vaux (2003) and Riggle & Wilson (2005)) that a tie is highly improbable once the entire constraint set is considered. Eventually, a low-ranked constraint will favor one candidate over the other. Constraints on voicing in codas, schwas in heavy or open syllables, adjacent coronals, etc., could all possibly break the tie in (12). Violation mark suppression itself may yield a single output as in (11) and other Tableaux above, but if it does not, lower constraints can choose among the surviving candidates.

Compare this to the situation in reranking theories. Under the ranking *Schwa ≫ Max, the candidates with the maximal allowed deletion (in this case, one schwa) are optimal: adding *ãvidətbatʁ* to (9) results in a tie between that candidate and *ãvidtəbatʁ*. It may therefore seem that reranking theories can produce all three attested forms in this case. But this is not so. Just as the tie in (12) is probably broken by lower constraints, the tie between *ãvidətbatʁ* and *ãvidtəbatʁ* in a reranking analysis is probably broken by lower constraints. So one of these candidates is permanently unavailable (at least within the ranking needed for French, if not universally) to the grammar. This is a crucial advantage of MS: ties are not always broken in favor the same candidate.

It is, of course, possible to posit more than one set of rerankable constraints. Suppose Con1 favors *ãvidətbatʁ* and Con2 favors *ãvidtəbatʁ*. We can produce both of these outputs in a reranking theory by allowing reranking not just of *Schwa and Max, but also of Con1 and Con2. This approach is unappealing for two reasons. First, it inefficiently scatters the cause of optionality throughout the grammar. Second, it offers no explanation for the serendipitous presence of two interacting sets of rerankable constraints. It also predicts a language that lacks the rerankability of Con1 and Con2: the schwas in *de* and *te* would be deletable on their own, but when they cooccur, only the one in, say, *de* could be deleted, depending on the fixed ranking between Con1 and Con2. This seems unlikely.

The optionality in *envie de te battre* is rather simple. There are three possibilities, one with no deletion and two with the maximum of phonotactically permissible deletion. The variability in *envie de te le demander* (7b) is much greater. There are four schwas, and zero, one, or two of them may be deleted. Deleting consecutive schwas (e.g. **ãvidtlədəmãde*) is ruled out by phonotactic constraints, as is deletion of three or more schwas. (Again, see Côté (2001) for disagreement on this point.)

Here, to go along with maximal deletion and no deletion we also find forms with intermediate levels of deletion. This is the point on which MS truly sets itself apart from other theories of optionality in OT. Reranking theories cannot produce these intermediate forms. The candidates with maximal and zero deletion collectively harmonically bound them:

(13) a.

/ãvidətələdəmãde/	*Schwa	Max-V
a. ãvidətələdəmãde	***!*	
b. ãvidtələdəmãde	***!	*
☞ c. ãvidətlədmãde	**	**

b.

/ãvidətələdəmãde/	Max-V	*Schwa
☞ a. ãvidətələdəmãde		****
b. ãvidtələdəmãde	*!	***
c. ãvidətlədmãde	*!*	**

But the intermediate forms are potential outputs under MS. For example, in (14), two of candidate (b)'s violations are suppressed. Rather than violating *Schwa three times as it normally would, this candidate receives only one violation mark. It therefore performs better than candidates (a) and (c) on *Schwa, and phonotactic constraints rule out candidate (d).

(14)

/ãvidətələdəmãde/	Phonotactics	⊙*Schwa	Max
a. ãvidətələdəmãde		**!**	
☞ b. ãvidtələdəmãde		*∘∘	*
c. ãvidtəldəmãde		**!	**
d. ãvidtldəmãde	*!	*	***

Under MS, the range of available candidates is broadened to include forms in which a process (in this case deletion) applies in some available positions but not all. That is, MS allows OT to generate the full range of outputs in iterative optionality.

It should be obvious from the discussion so far that candidate (b) is not the only possible winner in the MS analysis. Candidates (a) and (c) can win under other suppression patterns. Considering a greater range of candidates, any of the possibilities in (7b) can win under the right pattern of suppression. By way of illustration, (15) shows one way to produce *ãvidətələdmãde*, with deletion of just the last schwa.

(15)

/ãvidətələdəmãde/	Phonotactics	⊙*Schwa	Max
a. ãvidətələdəmãde		***!*	
b. ãvidtələdəmãde		***!	*
c. ãvidətlədəmãde		***!	*
d. ãvidətəldəmãde		***!	*
☞ e. ãvidətələdmãde		**○	*
f. ãvidtəldəmãde		**	**!
g. ãvidtələdmãde		**	**!
h. ãvidətlədmãde		**	**!
i. ãvidtldəmãde	*!	*	***

With one of this candidate's violations suppressed, it now fares as well on *Schwa as the forms that delete two schwas. The decision passes to Max, which favors *ãvidətələdmãde*.

It would be tedious to show how all the possible outputs are produced, and illustrating all possible patterns of suppression would be even worse. It should be clear, though, that all eight possibilities are produced by the grammar while impossible patterns are ruled out. Non-suppressible constraints always eliminate forms with phonotactic problems, and depending on which violation marks assigned by *Schwa are suppressed, any of the remaining candidates can be optimal. In the event of a tie, lower constraints select one of the tied candidates.

A full analysis of French schwa deletion would take us too far from topic of this paper, but I wish to discuss one other aspect of the phenomenon to show how an account of optional deletion fits into the larger picture of schwa deletion. In contrast with the examples considered so far, schwa deletion is obligatory in hiatus; see (16). I follow Noske (1996) in the description that follows; see Côté (2001) for arguments that some of the deletion processes are really schwa insertion.

(16) a. *Prevocalic Deletion*

l'homme	/lə ɔm/	[lɔm]	*[ləɔm]	'the man, mankind'
l'ours	/lə uʀs/	[luʀs]	*[ləuʀs]	'the bear'

b. *Postvocalic Deletion*

entendue	/ãtãd+y+ə/	[ãtãdy]	*[ãtãdyə]	'heard' (fem.)
jolie	/ʒɔli+ə/	[ʒɔli]	*[ʒɔliə]	'pretty' (fem.)
risée	/ʀiz+e+ə/	[ʀize]	*[ʀizeə]	'laughed at' (fem.)

Clearly we cannot rely on a suppressible *Schwa to compel deletion in these cases. While *ləɔm, e.g., may be penalized on some evaluations, on others it will be optimal (☠ marks the incorrect winner):

(17)

/lə ɔm/	Phonotactics	⊙*Schwa	Max
☠ a. ləɔm		○	
(☞) b. lɔm			*!

If deletion is to be required in this case, we must call on another (non-suppressible) constraint. Since obligatory deletion seems to resolve hiatus, I'll adopt *Hiatus-ə (which militates against hiatus involving schwa) for this purpose. Adding this constraint to the ranking, *ləɔm is always ruled out:

(18)

/lə ɔm/	Phonotactics	*Hiatus-ə	⊙*Schwa	Max
a. ləɔm		*!	○	
☞ b. lɔm				*

It might seem undesirable to use multiple constraints to drive schwa deletion, but since one kind of deletion is optional and the other is obligatory, and the two deletion processes occur in distinct contexts, there is reason to believe we're dealing with separate (though related) phenomena. It is also possible to view *Hiatus-ə as one of the phonotactic constraints that circumscribes the (im)possible situations for deletion and retention of schwas.

Furthermore, in needing two constraints for schwa deletion, the MS analysis is in the same boat as other analyses. Vaux (2003) argues for the rule in (19) to account for (7b).

(19) ə→ ∅/V (#) C___, L→R, optional across #

To account for (7), the rule must be optional when the word boundary is present, but it is obligatorily within words (Dell 1973, Howard 1973, Noske 1996). This rule does not account for the deletion in (16), so another rule is needed. At the very least, one optional and one obligatory rule are required. Likewise, in a reranking analysis that sometimes permits Max ≫ *Schwa, an additional constraint such as *Hiatus-ə is necessary to account for (16).

In this section we've seen the core properties of Markedness Suppression. MS allows the violation marks assigned by designated markedness constraints to be removed from an evaluation, producing multiple outputs for a single input. Applying MS to optional French schwa deletion reveals three important properties of MS: (i) it provides access to attested but otherwise harmonically bounded forms; (ii) it allows apparent ties to be broken in more than one way, whereas relying solely on lower-ranking constraints would yield no variation; (iii) it produces variation only in the direction of greater faithfulness. Furthermore, this analysis can be couched within a fuller analysis of the behavior of schwa in the language.

I turn now to another example of iterative optionality for which MS provides an account, this time from the Kru language Vata.

2.2 Postlexical Harmony in Vata

In Vata (Kaye 1982a,b; see also Kiparsky 1985), [+ATR] optionally spreads from vowel to vowel leftward across a word boundary. The vowel inventory for this language is given in (20), and an example of postlexical spreading is shown in (21). The [+ATR] feature in the final word spreads to the last vowel of the preceding word. (21c) shows that only the last vowel of a word may be targeted.[2]

(20) a. *[+ATR] Vowels*

i	u
e	o
ʌ	

b. *[–ATR] Vowels*

ɪ	ω
ɛ	ɔ
a	

(21) a. ɔ̍ ní sa̍ká pì ‘he didn’t cook rice’
b. ɔ̍ ní sa̍kʌ́ pì
c. *ɔ̍ ní sʌ̍kʌ́ pì

In addition, “in a sequence of monosyllabic [–ATR] words the assimilation may propagate arbitrarily far to the left” (Kiparsky 1985:116). That is, one instance of postlexical spreading optionally triggers another instance, provided that each “step” crosses a word boundary:

(22) a. ɔ̍ ká zā pī ‘he will cook food’
b. ɔ̍ ká zʌ̄ pī
c. ɔ̍ kʌ́ zʌ̄ pī
d. o̍ kʌ́ zʌ̄ pī

Here, [+ATR] originates in the final word and spreads successively farther in each example. All examples are possible surface forms. Since each word is monosyllabic, each spreading step is legal in that it crosses a word boundary and targets a word-final vowel.

Vata’s postlexical spreading is an example of iterative optionality. In principle, the choice to spread at each locus in a string of monosyllabic words is independent of the choice made at other loci.

However, as in French schwa deletion, we don’t see true independence of application across loci. In French, deletion of one schwa is in principle independent of deletion of another schwa in the same form. But different deletion “events” can interact in that one can block another

[2] High vowels are subject to a further restrictions that is ignored here. They cannot undergo harmony if the triggering vowel is non-high: *ń nɔ̀ kpā*, **ń nù kpā* ‘I made a stool’ (Kaye 1982b:430).

if the occurrence of both would violate phonotactic requirements. Likewise, we only get the choice to target a vowel in Vata if other spreading instances or the lexical grammar provide an immediately following [+ATR] feature. That is, the independence of targets in both languages is restricted by specific factors.

Kaplan (2008) motivates postlexical spreading with a NONFINALITY constraint. See Kaplan for a full justification of the approach. That analysis suffers from the inability to prevent [+ATR] from spreading completely through a polysyllabic word to reach a preceding word (e.g. **ɔ̍ ní sʌ̍kʌ́ pì*), so I present an improved version here. I assume that the input for the postlexical constraint ranking reflects the output of Vata's lexical ATR harmony system, whereby all vowels in a word agree in that feature as described by Kaye (1982a,b). Postlexically, NONFINALITY-[–ATR] militates against placing [–ATR] features in a weak position, namely a word-final syllable.

(23) NONFINALITY-[–ATR]: no vowel in a word-final syllable may bear the feature [–ATR].

NONFINALITY-[–ATR] is violated three times by *ɔ̍ ká zā pī* (22a). When outranking MAX-[–ATR], this constraint motivates spreading [+ATR] throughout the construction:

(24)

/ɔ̍ ká zā pī/	NONFIN	MAX-[–ATR]
a. ɔ̍ ká zā pī	**!*	
b. ɔ̍ ká zʌ̄ pī	**!	*
c. ɔ̍ kʌ́ zʌ̄ pī	*!	**
☞ d. o̍ kʌ́ zʌ̄ pī		***

By tagging NONFINALITY as suppressible, the other candidates can become optimal. For example, the Tableau below shows one way to produce *ɔ̍ kʌ́ zʌ̄ pī*. DEP-[+ATR] ensures that only vowels adjacent to [+ATR] vowels harmonize—spreading (as opposed to insertion) of [+ATR] is the only way to satisfy NONFINALITY.

(25)

/ɔ̍ ká zā pī/	DEP-[+ATR]	⊙NONFIN	MAX-[–ATR]
a. ɔ̍ ká zā pī		**!*	
b. ɔ̍ ká zʌ̄ pī		**!	*
☞ c. ɔ̍ kʌ́ zʌ̄ pī		○	**
d. o̍ kʌ́ zʌ̄ pī			***!
e. o̍ ká zā pī	*!	**	*

I assume that spreading to non-adjacent vowels is blocked by the No Crossing Constraint (Goldsmith 1976), constraints on gapped structures (Akinlabi 1994, Archangeli & Pulleyblank 1994, Ito et al. 1995, Kirchner 1993), or other principles of locality (Ní Chiosáin & Padgett 1997).

Spreading [–ATR] is ruled out by Max-[+ATR]. As (26) shows, we can't rely on NonFinality to block [–ATR] spreading because NonFinality is suppressible.

(26)

/ɔ̍ ká zā pi̇̄/	Max-[+ATR]	Dep-[+ATR]	⊙NonFin	Max-[–ATR]
a. ɔ̍ ká zā pi̇̄			**!*	
b. ɔ̍ ká zʌ̄ pi̇̄			**!	*
c. ɔ̍ kʌ́ zʌ̄ pi̇̄			*!	**
☞ d. o̍ kʌ́ zʌ̄ pi̇̄			***	
e. o̍ ká zā pi̇̄		*!	○○	*
f. ɔ̍ ká zā pı̄	*!		○○○○	

Turning to the data in (21), the current ranking predicts **ɔ̍ ni̇́ sʌ̍kʌ́ pi̇̀* and **o̍ ni̇́ sʌ̍kʌ́ pi̇̀* to be possible outputs—see (27). The problem with these forms is that [+ATR] spreads through non-word-final vowels to alleviate NonFinality violations in preceding words. The faulty prediction has nothing to do with MS per se—it's a consequence of the ranking NonFinality ≫ Max-[–ATR], which incorrectly rewards non-myopic spreading (Wilson 2006).

(27)

/ɔ̍ ní sa̍ká pi̇̀/	Max-[+ATR]	Dep-[+ATR]	⊙NonFin	Max-[–ATR]
a. ɔ̍ ní sa̍ká pi̇̀			**!*	
b. ɔ̍ ní sa̍kʌ́ pi̇̀			**!	*
☠ c. ɔ̍ ni̇́ sʌ̍kʌ́ pi̇̀			○ or *!	***
☠ d. o̍ ni̇́ sʌ̍kʌ́ pi̇̀				****(!)

To capture the fact that only word-final vowels assimilate, I adopt an OCP constraint (Leben 1973) that militates against multiple [+ATR] vowels in a word:

(28) OCP-[+ATR]: Within a word, multiple vowels with a [+ATR] specification are prohibited.

As shown in (29), this constraint blocks spreading beyond a polysyllabic word's final vowel. But if it's ranked below Dep-[–ATR], it can't destroy harmonic words created by the lexical grammar—see (30).

(29)

/ɔ̍ ní sa̍ká pì/	Max-[+ATR]	Dep-[+ATR]	OCP	⊙NonFin	Max-[–ATR]
a. ɔ̍ ní sa̍ká pì				***!	
☞ b. ɔ̍ ní sa̍kʌ́ pì				**	*
c. ɔ̍ ní̍ sʌ̍kʌ́ pì			*!	○	***
d. o̍ ní̍ sʌ̍kʌ́ pì			*!		****

(30)

/nòvo̍yè/ ‘a bee’	Dep-[–ATR]	OCP-[+ATR]
☞ a. nòvo̍yè		*
b. nòvɔ̍yɛ̀	*!	

The high ranking of Dep-[–ATR] is further justified by the fact that [+ATR] vowels never become [–ATR] postlexically.

Finally, only regressive harmony is attested postlexically. Kaye (1982a,b) exemplifies this with *ń̍ nó kɔ̍̀* ‘I hear a man.’ This form cannot become **ń̍ nó kò̍*. To account for this, I adopt the Anchoring constraint in (31). Its effect is shown in (32).

(31) Anchor-R-[+ATR]: The segment at the right edge of a [+ATR] domain in the input must be at the right edge of a [+ATR] domain in the output.

(32)

/ń̍ nó kɔ̍̀/	Anchor-R-[+ATR]	NonFin
☞ a. ń̍ nó kɔ̍̀		*
b. ń̍ nó kò̍	*!	

As the preceding discussion makes clear, Vata’s postlexical harmony is subject to strict conditions. It is easy to assume that a theory in which violation marks can be tossed out at random would be incapable of preventing unattested harmony patterns. But MS is more constrained than this. The only constraint whose violations may be suppressed is NonFinality. The unattested assimilatory strategies are ruled out by high-ranking constraints, leaving only the legal possibilities for NonFinality to chose among.

For present purposes, *[–ATR] could replace NonFinality with similar results. These constraints differ in terms of the number of violation marks they assign to various candidates. For example, in (27), NonFinality assigns three violation marks to candidate (a), *ɔ̍ ní sa̍ká pì*, and two to candidate (b), *ɔ̍ ní sa̍kʌ́ pì*. *[–ATR] assigns an additional violation mark to each candidate. Thus the two constraints make different predictions about the frequency with which each candidate wins, as described below in §7.1. In the absence of frequency data for Vata, it is impossible to choose between the two analyses on these grounds.

As usual, reranking theories cannot produce the full range of possibilities. The ranking NonFinality ≫ Max-[-ATR] favors exhaustive spreading (*o̍ kʌ́ zʌ̄ pī*). The opposite ranking prohibits spreading (*ɔ́ ká zā pī*). No ranking of these constraints favors intermediate levels of spreading, and I know of no constraint that favors either *ɔ́ ká zʌ̄ pī* or *ɔ́ kʌ́ zʌ̄ pī* on principled, non-spurious grounds. (E.g., a constraint preventing spreading to mid vowels might favor *ɔ́ kʌ́ zʌ̄ pī*, but failure to spread to mid vowels is not characteristic of Vata's postlexical harmony.)

As in French schwa deletion, the optionality of postlexical harmony in Vata is too nuanced for an approach that allows multiple constraint rankings. Harmony can apply to varying degrees, yielding outputs that are harmonically bounded, so simply reranking constrains is insufficient. MS, however, produces these candidates by allowing suppression of the violation marks that render them harmonically bounded. The upshot is that MS provides better empirical coverage than reranking theories.

Furthermore, the success of MS shows that the existence—and even pervasiveness—of iterative optionality does not spell doom for OT as a whole. Vaux (2008) correctly notes that OT cannot produce iterative optionality under the frameworks he focuses on, which include primarily reranking theories. But, as he acknowledges, those aren't the only options. Once we abandon our reliance on the constraint ranking itself to produce optionality, more satisfactory solutions emerge. Rule-based theories do not have an advantage over OT in terms of iterative optionality; in fact, I argue below that MS grants OT the upper hand.

The next section applies MS to other varieties of optionality.

3 Other Kinds of Optionality

3.1 The Typology of Optionality

Nevins & Vaux (2008) identify three distinct types of optionality:

(33) *Typology of Optionality (Nevins & Vaux 2008:14, ex. 14)*

a. **all or nothing application:** if one target segment undergoes the process, then all of the target segments do; if one target segment doesn't undergo the process, then none of the target segments do.

b. **local application:** each target is evaluated independently of the others.

c. **locality-respecting application:** apply successively to each target, but if a given target does not undergo the rule, then cease scanning through the remainder of the relevant phonological domain for further targets.

An example of all-or-nothing optionality is Warao labial voicing (Howard 1973, Osborn 1966), where *p* optionally surfaces as *b*. But in a word with multiple *p*'s, if one voices, they must all voice. The data below are from Osborn (1966).

(34)	paro-parera	baro-barera	'weak'
	poto-poto	boto-boto	'soft'
	apaupute	abaubute	'he will put them'
	kapa-kapa	kaba-kaba	'kind of banana'
	hapisapa	habisaba	'other side'

I discuss this kind of optionality in §3.2. This is the only kind of optionality that reranking theories account for satisfactorily, yet MS also finds success here. We will also see reason to doubt the reality of all-or-nothing optionality altogether.

Type (33b) is iterative optionality, which was examined in the previous section.

Type (33c) is exemplified by Shimakonde vowel reduction (Liphola 2001, Odden 2008). Unstressed mid vowels to the left of the (penultimate) stressed syllable optionally reduce to *a*. But a vowel may be reduced only if every vowel to its left also reduces:

(35)
a. li-kolomoódi 'cough'
b. li-kalomoódi
c. li-kalamoódi
d. *li-kolamoódi

In procedural terms, vowel reduction starts at the left edge and moves rightward. If reduction does not apply to one vowel, it cannot apply to a subsequent vowel. Like iterative optionality, this kind of optionality is problematic for reranking theories, and for the same reason: When ranked over faithfulness, a constraint favoring reduction motivates nothing short of complete reduction. Under the opposite ranking, no reduction at all is optimal. There is no ranking that prefers reduction of some pretonic vowels but not others. I argue in §3.3 that locality-respecting optionality is just a special kind of iterative optionality.

Vaux (2003) identifies a fourth type of optionality, what he calls "Basic Optionality," whereby a process targets exactly one of the possible loci of application in a form. For example, in Dominican Spanish, *s* can be epenthesized in any syllable-final position (Bradley 2006, Núñez Cedeño 1988). Thus for *calamidad* 'calamity,' all the forms in (36) are possible. I address Basic Optionality in §3.4.[3]

(36)
calamidad
caslamidá
calasmidá
calamisdá
calamidás

As the following subsections show, MS affords analyses for the entirety of what I'll call the Nevins-Vaux typology. Viewed through the lens of MS, the various kinds of optionality appear remarkably similar—each is just a variant of iterative optionality.

[3]In Vaux (2008), a further development of Vaux (2003), the term "Basic Optionality" is not used, and the Dominican Spanish example is presented as akin to French schwa deletion. I believe it is worth distinguishing the cases, though, as Basic Optionality presents unique challenges.

3.2 All-or-Nothing Optionality

I am aware of just two examples of all-or-nothing optionality. One is from Bole and is discussed first because it is easily dismissed; Riggle & Wilson (2005) argue that that phenomenon is the product of general harmony constraints that rule out "intermediate" forms, not some property of the optionality process itself, and I pursue that argument. That leaves Warao labial voicing as the only remaining case of all-or-nothing optionality, and while it also submits to a harmonic analysis, its status is suspect.

3.2.1 Bole Sibilant Harmony

In Bole (Schuh 2002), the alveolar consonants *s*, *z* contrast with the palatal consonants *ʃ*, *dʒ*. However, many words exhibit free variation between these alveolars and their palatal counterparts. Also, *tʃ* alternates with *ʃ*. Schuh states that this variation is actually attested in a minority of words, and it is associated with no morphological or semantic regularity. Some examples are given in (37) (from the Fika dialect, though the variation is found more widely according to Schuh).

(37)	a.	*Variation among* s, ʃ, tʃ	
		sòndʒi ∼ ʃòndʒi ∼ tʃòndʒi	'pumpkin'
		sansala ∼ ʃanʃala ∼ tʃantʃala	'cattle egret'
		insóː ∼ inʃóː ∼ intʃóː	'now'
		tʃap ∼ ʃap	'all'
		mànsuwò ∼ mànʃuwò	'he grew old'
	b.	*Variation between* z, dʒ	
		zùːlù ∼ dʒùːlù	'cooked pumpkin'
		zàutu ∼ dʒàutu	'combing'
		gòzor ∼ gòdʒor	'throat'
		zâr ∼ dʒâr	'a stick of. . . '
		zìrɗuwòːyi ∼ dʒìrɗuwòːyi	'he tightened it'

To keep the discussion focused, I'll set aside the *ʃ∼tʃ* alternation. The free variation seen above is further restricted in that in a word containing multiple segments involved in these alternations, all such segments must be either palatal or alveolar:

(38)	ʃìnʃor	'dew'	**sìnʃor, *ʃìnsor*
	soːsò	'patch on clothes'	**soːʃò, *ʃoːsò*
	dʒàndʒa	'star'	**zàndʒa, *dʒànza*

As described by Riggle & Wilson (2005), the variation is one of anteriority. Assuming that alveolars (i.e. [+anterior]) are unmarked, the constraint *[–anterior] is motivated. Palatalization is not environmentally triggered in modern Bole—that is, it doesn't happen only before front vowels, e.g. This means palatalization must be motivated on more general grounds. But if [–anterior] is marked, what would encourage palatalization? I suggest that the answer lies in the coronal articulatory space. It has been argued (Crosswhite 2001, Flemming 2002, Padgett 2003) that phonological inventories tend to preferentially occupy maximally distinct, peripheral positions before using less distinct, more central positions. In terms of coronal consonants, we might take dentals and palatals to represent the periphery, with alveolars and retroflexes occupying the center of the consonant space. Thus a constraint encouraging peripheral segments—call it PERIPHERY—would favor *ʃ* over *s*.

As shown in (39), palatalized variants can be produced under the ranking ⊙*[–anterior] ≫ PERIPHERY. The palatal candidate wins when its violation of ⊙*[–anterior] is suppressed. Alternatively, the ranking ⊙PERIPHERY ≫ *[–anterior] could produce variation, with the alveolar candidate winning when its violation of PERIPHERY is suppressed.

(39)

/zù:lù/	⊙*[–ant]	PERIPHERY
a. zù:lù		*!
☞ b. dʒù:lù	○	

The all-or-nothing nature of the variation can be produced with a harmony constraint requiring all sibilants to match in anteriority. Such a constraint is defined in (40). When this constraint outranks ⊙*[–anterior], it weeds out all the disharmonic candidates before suppression could make them optimal. This is illustrated in (41).

(40) AGREE-[anterior]: all sibilants must have the same value for the feature [anterior].

(41)

/sansala/	AGREE-[ant]	⊙*[–ant]	PERIPHERY
☞ a. sansala			**
b. sanʃala	*!	○	*
c. ʃansala	*!	○	*
d. ʃanʃala		*!*	

According to Hansson (2001), the kind of harmony proposed here is the most common type of consonant harmony cross-linguistically. Although MS is designed to produce iterative optionality, when combined with well-motivated harmony constraints, it can also produced all-or-nothing optionality. In fact, from this point of view, all-or-nothing optionality is just a special kind of iterative optionality. As with French schwa deletion, high-ranking constraints rule out the illegal candidates in Bole. The difference between the two systems is that AGREE-[anterior] weeds out all the forms with intermediate levels of (de)palatalization, while the phonotactic constraints in French do not eliminate all the forms with intermediate levels of schwa deletion/retention.

A reranking analysis can account for both the *zù:lù* ∼ *dʒù:lù* alternation and the *sansala* ∼ *ʃanʃala* alternation. It can even do so without AGREE-[ant]: *[–ant] ≫ PERIPHERY favors *sansala*, and the opposite ranking favors *ʃanʃala*. This result holds even when rich-base inputs like /sanʃala/ are considered. This victory for reranking theories is quite limited though. The harmony constraint is unnecessary because the two rerankable constraints are markedness constraints. As we will see with Warao, in the usual case where one of the rerankable constraints is a faithfulness constraint, reranking theories require harmony constraints for all-or-nothing optionality, too.

Nonetheless, it appears that Bole's all-or-nothing optionality reflects a very common type of consonant harmony. It is more accurate to describe it as (iterative?) optionality within a harmonic system. With that state of affairs, it is not surprising that the alternation is coordinated across consonants.

3.2.2 Warao Labial Voicing

In Warao, /p/ optionally voices to [b], but within a word, if one /p/ voices, they all must:

(42)	paro-parera	baro-barera	'weak'
	poto-poto	boto-boto	'soft'
	apaupute	abaubute	'he will put them'
	kapa-kapa	kaba-kaba	'kind of banana'
	hapisapa	habisaba	'other side'

All but two of these examples are reduplicative, where coordination of voicing between copies is unremarkable. The claim of all-or-nothing optionality therefore rests on just two forms. Nonetheless, Osborn (1966:109–110) is very clear about the facts:

> In words like the one cited, with two or more occurrences of /p/, the allophones are consistently [b] or [p] for each utterance of the word. If the first occurrence of /p/ in the word is [b], the following occurrence(s) will be [b]. If the first occurrence is [p], the following occurrence(s) will be [p]. . . . For the vast majority of words, including those that are borrowed from Spanish (where /p/ = [p]), the [b] pronunciation predominates over [p] in Warao.

However, some important questions remain unanswered. In particular, it would be helpful to know whether the voicing pattern reflects variation across dialects or registers. The data above might simply show that where one dialect of Warao has /p/, another has /b/.

Assuming Osborn (1966) is correct, the difference between Warao's optionality and the optionality in French schwa deletion is that in the former, intermediate levels of voicing (e.g. **abaupute*) are impossible, while in the latter, intermediate levels of deletion are permitted. Since there is no need to produce these "mixed" forms in Warao, reranking theories have no problem accounting for the phenomenon. Candidates like **abaupute* are collectively harmonically bounded, and for once that is not a problem.

For purposes of illustration, I assume a constraint *[–voi, +lab] that motivates voicing. Reranking theories produce [abaubute] when *[–voi, +lab] outranks Ident(lab), and [apaupute] under the opposite ranking:

(43) a.

/apaupute/	*[–voi, +lab]	Ident(lab)
a. apaupute	*!*	
b. abaupute	*!	*
c. apaubute	*!	*
☞ d. abaubute		**

b.

/apaupute/	Ident(lab)	*[–voi, +lab]
☞ a. apaupute		*!*
b. abaupute	*!	*
c. apaubute	*!	*
d. abaubute	*!*	

This is an unobjectionable analysis if we're dealing with a dialectal or register difference: it amounts to the claim that the two dialects or registers have different grammars.

On the other hand, simply tagging *[–voi, +lab] as suppressible is insufficient. As (44) shows, this does not establish coordination of voicing.

(44)

/apaupute/	⊙*[–voi, +lab]	Ident(lab)
a. apaupute	*!*	
b. abaupute	*!	*
☠ c. apaubute	○	*
d. abaubute		**!

As with Bole, left to its own devices, MS does not yield all-or-nothing optionality. Perhaps the moral is that grammars provide two ways to produce optionality, reranking and MS. (Lee (2001) also argues for two methods of producing variation: multiple independent rankings for dialectal variation and freely rankable constraints for intra-speaker variation.) More satisfyingly, the harmony approach used for Bole can be adopted here. The constraint in (45) will rule out the illicit candidates.

(45) Agree(lab)-[voi]: Labial consonants must agree in voicing.

By ranking Agree(lab)-[voi] over ⊙*[–voi, +lab], only the correct forms are viable:

(46)

/apaupute/	Agree(lab)-[voi]	⊙*[−voi, +lab]	Ident(lab)
☞ a. apaupute		○○	
b. abaupute	*!	○	*
c. apaubute	*!	○	*
d. abaubute			*!*

While laryngeal harmony seems to be relatively rare (Hansson 2001), it is not unattested, so the crucial Agree(lab)-[voi] is motivated on independent grounds.

Kie Zuraw (p.c.) points out that even a reranking analysis of Warao requires a constraint like Agree(lab)-[voi] if we consider rich-base inputs. A form like /paba/ should be mapped to either [papa] or [baba], but under the ranking Ident(lab) ≫ *[−voi, +lab], this input emerges faithfully:

(47)

/paba/	Ident(lab)	*[−voi, +lab]
☠ a. paba		*
b. papa	*!	**
c. baba	*!	
d. bapa	*!*	*

The only way to rule out such disharmonic forms is by adopting a constraint like Agree(lab)-[voi]. So upon closer scrutiny, reranking theories do not have a clear advantage over MS with respect this variety of optionality.

As Riggle & Wilson (2005) note, convincing evidence for all-or-nothing optionality is lacking, both cross-linguistically and within Warao. This dearth is explained if all-or-nothing optionality requires both MS and harmony to operate on the same set of segments in one language. On such a view, there is no all-or-nothing optionality, just iterative optionality with harmonic restrictions. If this is in fact the correct line of reasoning, considerable doubt is cast upon reranking theories: the only kind of optionality they produce quite plausibly doesn't even exist! It is far too premature to close the book on the case, but at the very least we can say that all-or-nothing optionality should be more common if reranking is the primary means of producing optionality, or even if it is one of several such means.

3.3 Locality-Respecting Optionality

In Shimakonde, unstressed mid vowels to the left of the stressed syllable optionally reduce to *a* (Liphola 2001). But a vowel may be reduced only if every vowel to its left also reduces. The data from (35) are repeated in (48).

(48) a. li-kolomoódi 'cough'

b. li-kalomoódi
c. li-kalamoódi
d. *li-kolamoódi

It appears that vowel reduction starts at the left edge of the word and moves rightward. Reranking theories encounter the usual difficulty here: While the forms with no reduction and exhaustive reduction are easy to produce (see (49)), the intermediate forms with reduction of some but not all pretonic vowels are collectively harmonically bounded.

(49) a.

/li-kolomoódi/	Reduce	Ident
a. li-kolomoódi	*!*	
b. li-kalomoódi	*!	*
c. li-kolamoódi	*!	*
☞ d. li-kalamoódi		**

b.

/li-kolomoódi/	Ident	Reduce
☞ a. li-kolomoódi		**
b. li-kalomoódi	*!	*
c. li-kolamoódi	*!	*
d. li-kalamoódi	*!*	

The directional nature of Shimakonde's reduction is reminiscent of Vata's postlexical harmony. In fact, it would be plausible to categorize Vata's harmony as locality-respecting optionality rather than iterative optionality. This indeterminacy suggests that these two kinds of optionality are closely related, a position supported by the analysis below.

A similar example comes from Brazilian Portuguese, where pretonic mid vowels optionally reduce (this time by raising), but only if every vowel to their *right* also reduces (Nevins & Vaux 2008, citing personal communication with José Olímpio Magalhães):

(50) a. mexeríca 'tangerine'
b. mexiríca
c. mixiríca
d. *mixeríca

This time, *mexiríca* is collectively harmonically bounded by *mexeríca* and *mixiríca*.

Rule-based theories do not account for these reduction patterns so easily either. Referring to Brazilian Portuguese, Nevins & Vaux (2008:14) state:

> We can straightforwardly generate the forms in [(50)] by postulating an optional rule of pretonic vowel reduction that moves leftward beginning with the stressed

syllable. It may optionally apply successively to each potential target, but if it fails to apply once, the entire pass of application is voided.

This is unobjectionable as far as it goes, but I am unaware of any framework in which such a rule can be formalized. As we will see below, such rules do not seem to fit into the typology of rules generated by a theory with the parameters [±iterative] and [±optional], which is the RBP-O system Vaux (2008) argues for.

MS, on the other hand, can produce locality-respecting optionality using standard OT constraints. I illustrate the point with an analysis of Shimakonde's vowel reduction. Crosswhite (2001) uses the constraint License-Nonperipheral/Stress, defined in (51), to drive vowel reduction of the sort found in Shimakonde. I adopt it here.

(51) License-Nonperipheral/Stress: Nonperipheral vowels are licensed only in stressed positions.

With this constraint, mid vowels must become either high or low in unstressed positions. To produce lowering, I adopt the ranking Ident(high) ≫ Ident(low).

License-Nonperipheral/Stress is tagged as suppressible. The directionality facts follow from Align([+low],L,Stem,L), which requires the left edge of a [+low] domain (i.e. a string of [+low] segments) to be left-aligned with the stem.

(52)

/li-kolomoódi/	Align([+low],L,Stem,L)	Ident(high)	⊙License	Ident(low)
a. li-kolomoódi			*!*	
☞ b. li-kalomoódi			○	*
c. li-kalamoódi				**!
d. li-kolamoódi	*!		○	*
e. li-kulumoódi		*!*		

As (52) shows, only the attested candidates are viable outputs. Candidates (a) and (b) are ruled out by Alignment and Ident(high), respectively; only the first three candidates—the legal forms—can benefit from suppression of License-Nonperipheral/Stress. The Tableau above shows one way to produce the "intermediate" form unavailable to reranking theories.

Odden (2008) discusses an alternative analysis based on formal "reduction domains" ("r-d"; cf. Optimal Domains Theory (Cole & Kisseberth 1994)) at the left edge of the stem. Left-edge alignment is produced by Align(r-d,L,Stem,L)). Align(r-d,R,Stem,L) and Align(r-d,R,Stem,R) make conflicting demands about the placement of the reduction domain's right edge: the former wants this edge at the left edge of the stem (i.e. a small domain), and the latter wants this edge to be at the right edge of the stem (a large domain). Under a "mark pooling" theory of optionality, when these constraints are co-ranked, their marks are lumped together. A violation of one is equivalent to a violation of the other. As (53) shows, the candidates with domains starting at the left edge and extending various lengths to the right all tie. *MID$_{r\text{-}d}$ prohibits mid vowels in the reduction domain.

(53)

/li-kolomoódi/	AL(r-d,L,Stem,L)	*MID$_{r\text{-}d}$	AL(r-d,R,Stem,L)	AL(r-d,R,Stem,R)
☞ a. li-()kolomoódi				kolomoodi
☞ b. li-(ka)lomoódi			ka	lomoodi
☞ c. li-(kala)moódi			kala	moodi
d. li-ko(la)moódi	k!o		kola	moodi
e. li-(kolo)moódi		*!*	kolo	moodi

As Odden notes, there is little evidence for reduction domains. Even worse, as discussed in §5 below, relying on ties to produce optionality is a dangerous enterprise. Most likely there is a lower ranked constraint that will favor one of the tied winners over the others, so the tied evaluation in the Tableau above is quite fragile.

From the point of view of MS, locality-respecting optionality is just a variant of iterative optionality in which high-ranking constraints limit the range of possible outputs by eliminating candidates that don't display the appropriate directionality. As with iterative optionality in general, MS achieves better empirical coverage than reranking theories.

3.4 Basic Optionality

In Vaux's (2003) terminology, *Basic Optionality* describes a process that has multiple possible loci of application from which it may choose one. Such a situation arises in Dominican Spanish (Bradley 2006, Núñez Cedeño 1988), where [s] can be epenthesized in any coda position (subject to important phonotactic restrictions that need not concern us here).

(54) /abogado/ 'lawyer'
asbogado
abosgado
abogasdo
abogados

In a sense, basic optionality is a special case of iterative optionality in that the choice to apply a process at one locus is in principle independent of the choice made at other positions. The difference here is that the independence is unidirectional: when we determine that *s*-epenthesis, e.g., has not applied at one locus, we cannot deduce whether it has applied at another locus. We do not have full independence though since epenthesis at one position entails the lack of epenthesis at all other positions.

Epenthesis in Dominican Spanish is convincingly argued by the researchers cited above to be hypercorrection (see also Harris (2002)). This dialect, which has eliminated coda /s/ altogether, is stigmatized, and speakers attempt to compensate by reinserting these codas. Unfortunately, speakers are often unaware of which words have coda /s/ in more conservative dialects, so any rime that meets certain phonotactic and metrical conditions seems to be a possible epenthesis site. More examples are given in (55), with the conservative pronunciation and gloss on the first line, followed by possible epenthetic forms in Dominican Spanish.

(55) a. puedo 'I can'
puedos
puesdo

b. fucú 'bad luck'
fuscú
fucús

c. cada 'each'
cásda
cádas

d. abogado 'lawyer'
asbogado
abosgado
abogasdo
abogados

It appears that only one /s/ may be inserted in any word. Bradley (2006:24), citing personal communication with Rafael Núñez Cedeño, states this clearly. I am aware of just two counterexamples. One, from Núñez Cedeño (1988), is *mucháschos*, from *muchácho* 'boy.' This is clearly a typographical error, especially in light of Bradley's report on Núñez Cedeño's position on the issue. The other, from Harris (2002), is *hisposпóstamos* from *hipopótamo* 'hippopotamus.' It is labeled hypothetical by Bradley (2006:24).

Bradley (2006) presents an OT-based analysis of hypercorrection that predicts the one-/s/ limit. Since hypercorrecting speakers are aiming for a target in another dialect, Bradley proposes an Output-Output Faithfulness (Benua 1997) constraint to motivate epenthesis. He establishes a correspondence relationship between Dominican Spanish lexical items and the idealized words VsC and Vs# from conservative dialects. (See Bradley (2006) for a justification for using idealized words.) The constraint MaxOO-[s] requires the Dominican word to retain the /s/ from the idealized words. The definition of this constraint is given in (56); "radical style" refers to the /s/-deleting dialects.

(56) MaxOO-[s]: A preconsonantal or word-final [s] in the conservative style output has a correspondent in the radical style output.

Also relevant are Dep-IO, which militates against hypercorrective insertion, and $*s]_\sigma$, which motivates /s/-deletion in the first place. Below is a Tableau that illustrates the analysis (modified from Bradley's (38)).

(57)

/abogado/	MaxOO-[s]	Dep-IO	$*s]_\sigma$
a. abogado	*!		
☞ b. asbogado		*	*
☞ c. abosgado		*	*
☞ d. abogasdo		*	*
☞ e. abogados		*	*
f. asbosgado		**!	**

Candidate (a), with no epenthesis, violates MaxOO-[s] because no /s/ from the idealized words VsC and Vs# is preserved. The following four candidates contain exactly one coda /s/, satisfying MaxOO-[s] and violating Dep-IO and $*s]_\sigma$ once each. Multiple epenthesis, as in candidate (f), is ruled out because it incurs more violations of Dep and $*s]_\sigma$ without improving performance on MaxOO-[s].

Bradley relies on a variable ranking between MaxOO-[s] and Dep plus the tie shown in (57) to produce optionality. It is easy to translate this approach into an MS-based analysis. We need only allow just the ranking shown above and tag $*s]_\sigma$ as suppressible. Consequently, candidates (a) and (f) are still eliminated by MaxOO-[s] and Dep, respectively, and the tie can be broken either by suppression of $*s]_\sigma$ or by lower constraints.

But candidate (a) is a possible output in this dialect. Bradley produces it by allowing the ranking Dep-IO $\gg$ MaxOO-[s]; how can MS produce it? Researchers seem to agree that hypercorrection is a stylistic choice—an attempt to emulate a more prestigious dialect. Since dialects differ in part by their constraint ranking, hypercorrection can be viewed as the consequence of accessing a distinct ranking from the speaker's "default" Dominican Spanish grammar. So Bradley's variable-ranking approach can be recast in terms of separate grammars/dialects that are available to the speaker. This move does not reintroduce full-scale reranking theories into MS because it prescribes specific conditions under which multiple rankings are available, namely situations involving multiple dialects, registers, etc.—scenarios that independently call for multiple grammars. Within a dialect, MS remains the only source of optionality.

It's worth mentioning two other possibilities that do not rest on multiple grammars. First, the idealized words VsC and Vs# come from speakers' knowledge of the more conservative dialect. It seems likely that they're also aware that not all words in this dialect have a coda /s/. We can posit other idealized words, say VC and V#, that reflect this knowledge. When speakers choose one of these /s/-less words as the base for Output-Output Correspondence, epenthesis is unmotivated. The violation of MaxOO-[s] incurred by candidate (a) in (57) disappears, and that form wins.

Finally, we might simply allow the grammar to refrain from choosing a base, in which case MaxOO-[s] is effectively inert. This, too, is consistent with the stylistic nature of hypercorrection: when speakers choose to imitate the prestigious dialect, this choice is directly reflected in the selection of a base from that dialect and faithfulness to that base. When speakers do not make this choice, they select no base, so there's nothing to be faithful to.

Bradley aruges that the Output-Output Faithfulness approach has important advantages. It is compatible with OT analyses of the metrical and phonotactic restrictions that bear on epenthesis, it explains the one-/s/ limit, and it explains why /s/ specifically (and not some less marked consonant, like ʔ) is inserted: this is the consonant to which MaxOO-[s] demands faithfulness.

This completes the examination of the Nevins-Vaux typology. MS unites the entire typology under one umbrella. MS is chiefly designed to account for iterative optionality, and it represents a marked improvement over reranking theories in that regard. But the other kinds of optionality are within the theory's reach, too. In fact, we might view locality-respecting optionality and basic optionality as special cases of iterative optionality. To the extent that it exists, all-or-nothing optionality is also compatible with MS.

4 Objections to MS

To my knowledge, a framework like MS that produce variation through omission of violation marks has not previously been proposed. Other work has, however, pointed out the possibility of this approach and argued against it. I address those arguments here.

Riggle & Wilson (2005) argue that mark omission invites runaway evaluations. If violation marks can be freely discarded, there's nothing to stop us from declaring, say, Max to be optional and producing outputs with massive amounts of deletion. This would not be a good prediction: I know of no pattern of variation whereby a form of any length may be reduced to an output with an arbitrarily shorter length.

But Markedness Suppression does not carry this defect. By limiting suppression to markedness constraints, we avoid runaway outputs. MS effectively gives the upper hand to faithfulness, so it predicts only variation toward greater faithfulness. This is in fact what we see in the case studies above. Each example of optionality displays a continuum of outputs with forms that completely undergo some process at one end and those that do not undergo the process at the other end. Through suppression of markedness violations, those forms that obey the markedness constraint completely (i.e. those that undergo the process at all loci) lose their advantage over the more faithful candidates. Deviation from the input is compelled solely by markedness constraints, and MS merely alleviates the pressure those constraints exert. Viable outputs that disobey the suppressed markedness constraint may only do so in ways that show greater faithfulness to the input. Excess deletion, e.g., is still blocked by Max, which is ineligible for suppression. In this way, MS is comparable to an optional rule: when a rule fails to apply, the surface form more closely resembles the underlying form than it otherwise would, as if faithfulness had become more important.

Both Riggle & Wilson (2005) and Vaux (2008) (the latter citing Cheryl Zoll, p.c.) argue that an MS-style framework "undermines the spirit of the OT enterprise" (Vaux 2008:44). As Riggle & Wilson (2005:9) put it, "[t]he proposal also runs against the central tenet of OT that constraints are never 'turned off.'" To this objection there are two responses. First, as discussed in §2.1, MS does not turn constraints off and differs significantly from an approach that does. Second, if a theory precludes analyses of iterative optionality, then the theory must be changed. Standard OT and reranking theories are unsatisfactory in this regard, so some revision to the theory is necessary. Moreover, MS does not violate the central tenets of OT any more than reranking theories do in that the latter contradict OT's premise that constraint rankings are fixed within a language. If OT is to account for variation within a language, at least one principle of the standard theory must be relaxed (Akinlabi & Liberman 2000). It is inconsistent to give reranking theories a free pass for modifying one part of the theory while condemning MS for altering a different one.

Finally, Riggle & Wilson (2005:9) mention a perceived implementational confound:

> At the most basic level, it is hard to see exactly what the candidate set should be under this proposal. If *Gen* produces all candidates with all patterns of marks both present and omitted, then optimization will always select the candidates with the marks omitted—effectively rendering the optional constraint inert.

That is, under Riggle & Wilson's conception, the candidate set for *envie de te le demander* includes, for each unique output, $n + 1$ different instantiations of the candidate (where n is the maximum number of violation marks the candidate may receive for the suppressible constraint), each with a different number of violations. E.g., the candidate set includes the following, where asterisks mark violations of ⊙*Schwa:

(58) a. ãvidətələdəmãde, ****
ãvidətələdəmãde, ***
ãvidətələdəmãde, **
ãvidətələdəmãde, *
ãvidətələdəmãde, ∅
b. ãvidtəldəmãde, **
ãvidtəldəmãde, *
ãvidtəldəmãde, ∅

If this is the candidate set, only one output will ever emerge, namely *ãvidətələdəmãde* with zero violations: among all the candidates with zero violations of ⊙*Schwa, Max prefers this one. We've expanded the candidate set without producing variation.

This problem does not arise under MS. The range of possible violation patterns for one output form is not instantiated in a series of candidates in one Tableau. Rather, the range of possibilities arises across multiple Tableaux. Gen produces only *ãvidətələdəmãde* with four violations of *Schwa, *ãvidtələdəmãde* with three violations, etc., and Eval ignores any of these violation marks that it chooses. Thus *ãvidətələdəmãde* does not (always) harmonically bound the other candidates simply because Eval might treat it as having zero violations.

5 Other Approaches to Optionality in OT

In this section I discuss other OT-based frameworks for handling optionality and compare them to MS.

5.1 Reranking Theories

Most approaches to optionality in OT are reranking theories. These include Stochastic OT (Boersma & Hayes 2001), multiple grammars (Anttila 1997, 2006, 2007, Auger 2001, Kennedy 2008; Schütze 1997, under the name "tied constraints"), partially ordered grammars (Anttila 2007, Anttila & Cho 1998; Lee 2001, under the name "Reversible Ranking"), and floating constraints (Nagy & Reynolds 1997). See Anttila (2007) for an insightful comparison of the empirical differences among reranking theories.

All of these frameworks produce optionality by providing more than one ranking against which the candidate set is evaluated. One candidate may be optimal under one ranking, and another may be optimal under a different ranking.

In Stochastic OT, constraints are ranked on a numerical scale. On each evaluation some amount of noise is added to each candidate's ranking. If constraint A outranks constraint B in the pre-noisy rankings but the two constraints are sufficiently close together, this noise may end up reversing the ranking so that on a particular evaluation B may outrank A.

Under the multiple-grammars approach to variation, more than one fixed ranking is available, and on a particular evaluation any of these rankings may be chosen. Partially ordered grammars are very similar: the grammar is a partial ranking of constraints, and on each evaluation a complete order that is compatible with the partial order is chosen. For example, if the partial ranking is A $\gg$ B; A$\gg$ C, then either A $\gg$ B $\gg$ C or A $\gg$ C $\gg$ B may be chosen on an evaluation. Conceptually speaking, the biggest difference between multiple grammars and partially ordered grammars is that while the available rankings may be arbitrarily different under the former approach (at least in principle), the latter places inherent restrictions on how different the available complete rankings can be. Anttila (2007) investigates important empirical differences between these frameworks.

As proposed by Reynolds (1994) and Nagy & Reynolds (1997), floating constraints are constraints that may be inserted at any point in some span of a language's constraint ranking. If A is a floating constraint within the span B $\gg$ C $\gg$ D, then any of the rankings in (59) are available in the language.

(59)
a. A $\gg$ B $\gg$ C $\gg$ D
b. B $\gg$ A $\gg$ C $\gg$ D
c. B $\gg$ C $\gg$ A $\gg$ D
d. B $\gg$ C $\gg$ D $\gg$ A

Floating constraints are similar to partially ordered grammars. The rankings in (59) are reducible to the partial order B $\gg$ C $\gg$ D. For illustrative purposes, let's expand the constraint set to include two additional constraints: an undominated X and a constraint Y ranked below D. If the constraint A floats within the span B ≫ C ≫ D, we can capture this with the partial order X ≫ B ≫ C ≫ D ≫ Y; X ≫ A; A ≫ Y. Similarly, to translate the partial ranking A ≫ B; A≫ C from above into a floating-constraint configuration, we need only posit A ≫ B and allow C to float in the span of the ranking defined by B alone.

One floating-constraint configuration that cannot be modeled using partial orderings is a situation in which two constraints float as a block with respect to other constraints. For example, if A ≫ B is fixed and {C, D} float with respect to A, then only C, D ≫ A ≫ B and A ≫ C, D ≫ B are possible rankings in the grammar. That is, either both C and D outrank A, or they both rank below A. This cannot be reduced to the partial order A, C, D ≫ B because this would also permit the ranking C ≫ A ≫ D ≫ B. Whether the power to enforce "floating blocks" is necessary is an open question; Reynolds (1994) presents one analysis that crucially relies on this device, but reanalysis in other terms may be possible.

All of these reranking frameworks have been used to model, often with impressive accuracy, data concerning the frequency with which possible variants are attested in corpora or experimental elicitations. However, as has been noted many times above, these theories cannot produce iterative optionality. For any two constraints A and B, they allow at most A ≫ B and B ≫ A. Thus either a process will apply exhaustively or not all. As iterative optionality seems to be extremely common, this is a significant handicap.

As I argued above, MS is superior to reranking theories in this regard. As shown in §7.1, MS also makes predictions about the relative frequency of each variant. In fact, reranking theories seem to have no empirical advantage over MS, except possibly in the accuracy of the frequency predictions (which have not yet been fully investigated for MS).

5.2 Tied Winners and Tied Constraints

Some researchers have relied on ties of one kind or another to produce multiple outputs. Hammond (1994) and Odden (2008) argue that multiple winners can be produced if the constraint set underdetermines the outcome of an evaluation. That is, if no constraint distinguishes two candidates, they can both emerge as optimal under the right ranking. Such a situation was discussed in §2.1.

Another approach considered by Odden (2008) uses tied constraints to produce multiple winners. Riggle & Wilson (2005) term this "mark pooling." The idea is that if two constraints are tied, a violation of one is as bad as (or is no worse than) a violation of the other. To take French schwa deletion as an example, if *Schwa and Max-V are tied, then the three candidates in (60) are equally optimal.

(60)

/ãvidətələdəmãde/	*Schwa	Max-V
☞ a. ãvidətələdəmãde	****	
☞ b. ãvidtələdəmãde	***	*
☞ c. ãvidətlədmãde	**	**

Relying on ties to produce variation is a dangerous enterprise. As Lee (2001), Vaux (2003), and Riggle & Wilson (2005) note, it is highly unlikely that no constraint will distinguish two candidates. At the very least, a *Structure constraint militating against syllables (Prince & Smolensky 1993[2004], Zoll 1993, 1998) will favor candidate (a) in (60).

Baković & Keer (2001) point out a particularly unlikely prediction of tied-winner approaches like that of Hammond (1994). In that framework, optionality arises because the constraint set cannot distinguish two candidates—the two forms have exactly the same violation profiles. This means that the candidates are equally harmonic under all rankings, and if a process is optional in one language, it should be optional in all languages. This is clearly not the case.

While ties are possible under MS (see §2.1), it is assumed that lower-ranked constraints break the tie. MS itself can also break erstwhile ties, as §2.1 shows.

5.3 Local Constraint Evaluation

Riggle & Wilson's (2005) Local Constraint Evaluation (LCE) is one of the few frameworks that produces variation in OT. Under LCE, each constraint is decomposed into freely rankable position-specific constraints. When two "parent" constraints are unranked in a language, this indeterminacy can be resolved separately for each position in the form. Thus for French schwa deletion we can have *Schwa ≫ Max for one vowel and Max ≫ *Schwa for another vowel. This means the intermediate forms that are unavailable in reranking theories can be produced. The analysis is illustrated in (61).

(61)

/ãvidə$_1$tə$_2$lə$_3$də$_4$mãde/	*[ə]@1	Max@1	Max@2	*[ə]@2	Max@3	*[ə]@3	Max@4	*[ə]@4
a. ãvidtə$_2$ldə$_4$mãde		*		*	*!			*
☞ b. ãvidtə$_2$lə$_3$də$_4$mãde		*		*		*		*
c. ãvidə$_1$tə$_2$ldə$_4$mãd	*!			*	*			*
d. ãvidə$_1$tə$_2$lə$_3$də$_4$mãde	*!			*		*		*

Since *Schwa and Max are not crucially ranked in the grammar at large, the position-specific versions of these constraints can be interleaved. For each position except position 1 in this Tableau, Max outranks *Schwa so deletion is banned at positions 2, 3, and 4. But with *Schwa@1 ≫ Max@1, deletion of the first schwa is required.

Furthermore, LCE distinguishes forms that delete equal numbers of schwas. This is evident from a comparison of candidates (b) and (c) from (61). Both forms have deletion of just one schwa, but the position-specific constraints evaluate them differently because the candidates do not show deletion of the same schwa. So LCE provides an analysis of iterative optionality, and it resolves the problem of dealing with otherwise tied candidates.

Riggle & Wilson (2005) are careful to point out that certain details in the formal implementation of LCE are not fully clear. For some constraints like *Schwa, determining the locus of violation is trivial: *SCHWA@i is violated if a candidate contains a schwa with the index i. But other constraints, like *N$\c{C}$ (Pater 1999), refer to multiple segments. For these constraints it is not clear how to determine which segments (one? both?) their position-specific versions are concerned with.

Epenthesis is also problematic. Although Riggle & Wilson provisionally suggest a way to assign indices to epenthetic segments, they note that the issues are not simple. It may or may not be necessary for epenthetic segments at different positions in different candidates to receive separate indices, and whatever index an epenthetic segment is assigned, it is crucial to maintain consistent indexing of material that is common to all candidates. For example, consider the hypothetical candidates *trab* and *tərab*, where the schwa in the second candidate is epenthetic. If these candidates are assigned indices to produce $t_1r_2a_3b_4$ and $t_1ə_2r_3a_4b_5$, a position-specific constraint like *VOICEDSTOP@4 will not provide an adequate comparison of the two candidates.

The status of position-specific constraints invites more questions. Are they always present in the grammar, or are they projected as needed in each evaluation? If the latter, by what mechanism does projection occur? If the former, how many such constraints are available, and does this put an upper bound on the length of phonological representations? Can each position-specific constraint be ranked independently of its sisters, aside from resolving unspecified rankings between parent constraints? E.g., is the ranking *SCHWA@4 $\gg$ MAX@1...MAX@n $\gg$ *SCHWA@1... available to a grammar, so that schwas may appear anywhere in the language except as the fourth segment in a word?

It is also not clear whether LCE makes useful frequency predictions. To take (61) as an example, the ranking shown there is no more or less likely than any other permutation of the *SCHWA and MAX constraints. Since each permutation selects a single winner by essentially specifying which schwas must be deleted, all deletion patterns are equally likely. While that may correspond to the actual frequency patterns in this particular example,[4] there are other patterns of optionality, such as Anttila's (1997) Finnish data, in which the variants are not equally probable.

MS, in contrast, has none of these uncertainties. The only new mechanism is Eval's ability to ignore violation marks for certain constraints. MS does not entail the massive expansion of the constraint set that LCE requires. Also, although LCE is presented as an alternative to reranking theories, it is itself a reranking theory. Multiple outputs are produced by allowing different rankings among the position-specific constraints. LCE adds more machinery to reranking theories, while MS aims to replace reranking mechanisms altogether. MS also makes more nuanced frequency predictions, as we will see below.

5.4 Rank-Ordered Model of Eval

Coetzee (2004, 2006) develops a model of variation called the rank-ordered model of Eval (ROE) that, like MS, provides multiple output forms in a single constraint ranking. The idea is that rather than merely selecting the optimal candidate, an OT grammar "imposes

[4]To my knowledge the relevant data have not been collected.

a harmonic rank-ordering on the full candidate set" (Coetzee 2006:338). All candidates are available as outputs (with an important caveat), but more harmonic candidates are more likely outputs. To restrict the range of variation, Coetzee adopts a "cut-off line" that divides the constraint ranking into two parts. Constraints ranked above the cut-off line function as normal OT constraints and eliminate candidates from consideration as usual. Only candidates that survive to the cut-off line are eligible variants.

To illustrate, an ROE analysis of French schwa deletion might proceed as follows. The ranking PHONOTACTICS ≫ *SCHWA ≫ MAX from above can be used. The cut-off line is placed between PHONOTACTICS and ≫ *SCHWA (indicated with a jagged line between the those columns below): candidates that violate PHONOTACTICS are still ruled out categorically, but candidates that violate *SCHWA are possible variants even though they're not the most harmonic forms. A Tableau with representative candidates is given in (62).

(62)

/ɑ̃vidətələdəmɑ̃de/	PHONOTACTICS	*SCHWA	MAX
☞ a. ɑ̃vidətələdəmɑ̃de		****	
☞ b. ɑ̃vidətəldəmɑ̃de		***	*
☞ c. ɑ̃vidətlədmɑ̃de		**	**
d. ɑ̃vidtldəmɑ̃de	*!	*	***

Like MS and LCE, ROE produces harmonically bounded yet viable candidates. It even makes relative (though not absolute) frequency predictions: the more harmonic variants are proposed to be more common. However, ROE has no adequate solution to the runaway unfaithfulness problem. As Coetzee (2006) notes, if faithfulness constraints appear below the cut-off line, candidates that violate these constraints arbitrarily many times cannot be ruled out if they survive to the cut-off line. He provides the following hypothetical example:

(63)

/pikat/	NOCODA	MAX	DEP
a. pi.kat	*!		
☞ b. pi.ka		*	
☞ c. pi.ka.ti			*
☞ d. pi.ka.ti.ti			***
☞ e. etc.			*****

In response, Coetzee turns to Riggle's (2004) model of Gen, which includes only non-harmonically bounded candidates. Since the problematic forms in (63) are harmonically bounded, Riggle's theory removes (or more accurately, never introduces) these candidates, and runaway unfaithfulness is ruled out. Excluding harmonically bounded candidates also has the benefit of rendering the candidate set finite (Samek-Lodovici & Prince 1999).

The problem is that an adequate theory of variation must include harmonically bounded candidates. Some of the possible (and attested) outputs in (62) are harmonically bounded, yet the finite Gen would bar them from consideration. ROE, then, is faced with a dilemma: include harmonically bounded candidates and invite runaway unfaithfulness, or solve the runaway unfaithfulness problem and fail to account for the full range of facts.

5.5 Richness of the Base

A final approach to optionality comes from Baković & Keer's (2001) analysis of the optionality of complementizers and *wh*-phrases in embedded clauses in English and Norwegian. For example, *that* is optional in declarative complement clauses (Baković & Keer 2001, ex. 1):

(64) a. I think [**that** the coat doesn't fit him].
b. I think [the coat doesn't fit him].

Baković & Keer argue that this optionality is derived from the presence of multiple inputs. If an input contains the complementizer (formally, [+COMP]), faithfulness constraints ensure that it is preserved in the output. If the complementizer is absent from the input (i.e. [–COMP]), that again is preserved by faithfulness. In other contexts where the complementizer is obligatory (e.g. in complements with subject extraction—see (65) below, from Baković & Keer (2001), ex. 3), higher ranking markedness constraints neutralize the two inputs to an output containing the complementizer.

(65) a. The coat [**that** *t* doesn't fit him] might fit me.
b. *The coat [*t* doesn't fit him] might fit me.

Whatever the merits of this analysis, it does not carry over to phonological optionality. It would require that in French, every word that contains a schwa that's deletable in at least one context has two lexical entries, one with a schwa and one without. In fact, a word with multiple deletable schwas must have as many lexical entries as schwa-deletion patterns it may exhibit. In Vata, every word with a [–ATR] final vowel must have an alternative lexical entry with a [+ATR] final vowel. These scenarios are clearly highly implausible.

6 MS versus Optional Rule Application

In RBP-O, rules are associated with the parameters [±optional] and [±iterative] (Vaux 2008), and permutations of these parameters yield rules that operate in different ways. Vaux (2003, 2008) and Nevins & Vaux (2008) argue for analyses of many of the above phenomena grounded in a framework of this sort (see also Labov (1972)). While RBP-O seems to straightforwardly account for the range of optional processes, it encounters significant difficulties.

Iterative optionality such as French schwa deletion is accounted for via a deletion rule marked as [+optional, +iterative]. This rule moves successively from locus to locus, and at each locus the decision to apply the rule or not is made. Consequently, deletion of each schwa is independent of deletion of other schwas.

All-or-nothing optionality is produced by [+optional, –iterative] rules. There are two problems with this. First, given Vaux's description of how [+iterative] rules apply (summarized in the previous paragraph), the parameter [–iterative] would seem to produce a rule that can only apply once in a form, not one that potentially applies at all possible loci. Second, this designation seems to leave no room for basic optionality. Dominican Spanish requires an optional rule (hence [+optional]) that can apply at most once (hence [–iterative]). But if the settings [+optional, –iterative] produce all-or-nothing optionality, the Dominican Spanish rule should produce exactly *abogado* or **asbosgasdos* rather than the forms in (54).

Two different optionality parameters are needed. A global parameter, when set to [+globally optional], allows variation in terms of whether the rule can apply at all. A local parameter, when set to [+locally optional], allows the choice to be made at each locus. The combination [+globally optional, –locally optional] produces all-or-nothing variation (if we choose to apply the rule, we have no choice but to apply it at all loci), and [+locally optional, –iterative] produces basic optionality (for each locus, we can choose whether or not to apply the rule, but it can only be applied once). Of course, this discussion assumes that all-or-nothing optionality is attested. If it is not, the combination [+optional, –iterative] can be redefined as needed to describe Dominican Spanish-style optionality, leaving all-or-nothing optionality unproducible.

Finally, locality-respecting optionality does not fall within the typology predicted by the parameters. The remaining unassigned parameter combinations all involve [–optional], which we clearly do want for an optional process. As discussed in §3.3, Nevins & Vaux (2008:14) propose a special kind of rule that applies sequentially to produce locality-respecting optionality, and at any point we can choose to stop applying the rule. Once that decision is made, we can't apply the rule again. This is a sound strategy, but RBP-O provides no formalization for such a rule. The strategy also has the undesirable effect of treating locality-respecting optionality as very different from other kinds of optionality, an unattractive position compared to the close kinship between locality-respecting optionality and iterative optionality that MS reveals.

Furthermore, producing the full range of optional processes relies crucially on an iterativity parameter, which Kaplan (2008) argues to be an unsound theoretical construct on the grounds that no process requires the specification [–iterative].

Nagy & Reynolds (1997) point out that OT has an advantage over rule-based approaches to optionality in that OT automatically predicts different frequencies for each variant, but in rule-based phonology, different frequencies must be stipulated:

> [N]ot only do the various rankings of the constraints account for each of the forms that surface and prohibit those forms that never surface, but also the relative number of occurrences of each surface form is correlated with the number of rankings that would produce each form. This is an improvement over Labovian rules (1972:93–101), in which the frequency of application of the rule. . . must be be stipulated and is based directly on the frequency count in the sample. (p. 38)

Nagy & Reynolds mean to defend reranking theories, but their point holds for MS, too.

In sum, to produce the full typology of optionality, RBP-O seems to require two parameters (one of which is undesirable on independent grounds) and possibly a third, plus additional unidentified theoretical machinery specifically designed for locality-respecting optionality. It is therefore not preferable to Markedness Suppression, which requires only the suppressibility operator to produce the full range of facts. The typological landscape is more uniform under MS: in contrast with the three or four irreconcilable kinds of optionality that rule-based phonology gives us, MS reveals a single brand of optionality that interacts with other constraints in the usual OT fashion to yield the variety we see.

7 Remaining Issues

This section addresses aspects of Markedness Suppression whose elaboration must await future research.

An important question concerns the range of constraints eligible for suppression. The reasons for limiting suppression to markedness constraints were discussed above, but many constraints, such as Alignment constraints, are not easily categorized. Tagalog [–complete] reduplication displays variable placement of the reduplicant (Rackowski 1999):

(66) /ma-ʔ-pa-bili/
ability-TM-cause-buy
'be able to have (someone) buy'

a. ***maa**maʔipabili
b. ??ma**ʔii**ʔipabili
c. maʔi**paa**pabili
d. maʔipa**bii**bili

An obvious approach to these data involves a suppressible Alignment constraint that penalizes forms whose reduplicants aren't adjacent to the root. But if an alternative analysis is available, we can ask whether Alignment constraints are indeed eligible for suppression. Similarly, it may turn out that suppressing certain markedness constraints yields unattested patterns. In this case, we may want to restrict the set of suppressible constraints to some (hopefully principled) proper subset of markedness constraints.

Sometimes variation is detected only in a subpart of a language's grammar. For example, Carstairs-McCarthy (2008) argues that in German, weak masculine nouns are lexically specified for permission to violate NounSg≠Pl, a constraint requiring singular nouns to be distinct from their plural counterparts. Tagging NounSg≠Pl as suppressible would predict that all nouns, not just weak masculine nouns, may violate NounSg≠Pl. Exploring ways of restricting optionality is one way to compare competing variation-producing frameworks.

Markedness Suppression makes an important prediction regarding differences between intra-speaker and interdialectal variation. Only through MS can otherwise harmonically bounded candidates with intermediate levels of process application become available. But crucially, MS does not allow such forms to be produced to the exclusion of the "harmonic bounders." Since no ranking produces only one of these intermediate forms and none of its harmonic bounders, there should be no language in which just the harmonically bounded form is attested. E.g., we should find no French′ in which exactly one schwa is always deleted in a phrase like *envie de te le demander*. To put it differently, MS predicts an implicational hierarchy: if a language allows one intermediate form, it should also, in principle, allow at least one of its harmonic bounders. Determining whether this prediction is borne out is an important test for MS.

MS also imposes certain ranking requirements. Because only markedness constraints are eligible for suppression, when the variants violate the relevant faithfulness constraint to different degrees, the ranking ⊙Markedness ≫ Faithfulness is required. The opposite ranking won't produce any variation because the faithfulness constraint will select a winner before suppression comes into play. Furthermore, the suppressible constraint can never be counted on to rule out any candidate: if that candidate's violations are suppressed, it might become optimal. For example, ⊙*SCHWA won't always rule out **ãvidətələdəmãde***ə**, with retention of all schwas and epenthesis of an extra one, even though this form normally incurs more violations of *SCHWA than the attested forms. Some other constraint (DEP or *HIATUS-ə, e.g.) must be called on instead, and this constraint must outrank ⊙*SCHWA to ensure that the epenthetic candidate never wins via suppression.

Finally, MS makes predictions about the relative frequencies by which each of a range of variants should be attested. This has become an important testing ground for theories of variation, and the topic deserves its own section, immediately below.

7.1 Frequency Predictions

Anttila (1997, 2007) and Anttila & Cho (1998) use the Partial Orders Theory to model the frequencies with which variants are attested.[5] The idea is that within the set of complete rankings allowed by a partial grammar, some variants win more often than others, and those variants are predicted to occur more frequently (in a corpus count, say) than the variants that win less commonly. As an illustration, Anttila (2007) examines vowel coalescence in Finnish: "Vowel Coalescence applies to a sequence of unstressed short vowels, both derived and nonderived, where the second vowel is [+low]" (526). His examples are in (67) (his (13)).

(67)	a.	/suome-a/	→ śuomea ∼ śuomee	'Finnish (partitive)'
	b.	/ruotsi-a/	→ ŕuotsia ∼ ŕuotsii	'Swedish (partitive)'

Coalescence involving mid vowels is more common than coalescence involving high vowels. To account for this, Anttila posits the ranking *EA ≫ *IA, where each constraint bans the obvious vowel sequences. The faithfulness constraint that discourages coalescence is not ranked with respect to these constraints, so on any particular evaluation, if coalescence of *ia* is permitted, so is coalescence of *ea*, though the reverse is not true:

[5]The use of partial rankings to predict frequencies is said to go back to Kiparsky (1993), which I have not seen. Anttila (2006) uses the slightly different Multiple Grammars Theory to similar effect.

(68)

	Coalesce ea?	*Coalesce ia?*
FAITH ≫ *EA ≫ *IA	No	No
*EA ≫ FAITH ≫ *IA	Yes	No
*EA ≫ *IA ≫ FAITH	Yes	Yes

Coalescence of *ea* is produced by two of the three rankings, so it is predicted to occur with a frequency of 2/3. But *ia* coalesces under just one of the rankings, so its predicted occurrence is 1/3.

Markedness Suppression makes similar predictions. Consider the violation profiles of the candidates in (69).

(69)

	$\odot C_1$	C_2
a. A	**	*
b. B	*	

The only way for A to win is for it to lose both of its violation marks for C_1 while B retains its lone violation mark for that constraint. Assuming each violation mark has a 50% chance of being suppressed, the likelihood that candidate A has both of its marks suppressed is .25. The probability that candidate B retains its violation mark is .5. The probability that both events occur is the product of these probabilities, or .125. This means that candidate A wins in one eighth of the evaluations. Candidate B wins the rest of the time.

Unfortunately, I am aware of no frequency data relevant to any of the MS analyses above, and an MS-based analysis of Anttila's Finnish facts has not been worked out, so verification of MS's frequency predictions must await future work. Investigating this aspect of MS can shed light on the properties of suppression itself: Is it correct to assume a 50% suppression rate? Do violation marks interact with each other in that if one violation mark for a candidate is suppressed, it is more (or less) likely that another mark for that candidate will be suppressed?

8 Conclusion

Variation is pervasive in human language, and an adequate theory of phonology must account for the range of attested phonological variation. This paper aims to further that enterprise by proposing a new framework that gives rise to variation. In this framework, optionality results from variation in the degree to which certain constraints penalize a range of candidates. Markedness Suppression is an advancement beyond existing theories of variation in OT in that it generates iterative optionality with a minimum of new machinery. It is also superior to rule-based approaches to optionality in that it unites the typology of optionality under one umbrella and is capable of modeling each variant's frequency of attestation.

It was argued here that MS produces the full Nevins-Vaux typology of optionality. This is an improvement over virtually all other OT frameworks, which are limited to all-or-nothing optionality. In order to produce the full range of facts, rule-based theories need a variety of parameters plus a specific (and so far unformalized, to my knowledge) kind of rule. MS achieves the same breadth of coverage with only the suppressibility operator. Some aspects of this typology require further investigation, such as the existence of all-or-nothing optionality.

While MS is intended to do much of the work that reranking theories have done in the past, this does not mean that multiple grammars are never appropriate analytical tools. To control multiple dialects is to have access to multiple grammars, after all. Optionality that is best understood as an interdialectal phenomenon is therefore amenable to analysis as multiple grammars. For example, /s/-epenthesis in Dominican Spanish has been argued to reflect speakers' attempts to access a more prestigious dialect, so the analysis presented here (based on Bradley's (2006) full-fledged variable-ranking analysis) rested partially on multiple grammars. In cases such as this one, optionality is really crosslinguistic variation.

Vaux (2008) argues that classic OT is incompatible with certain very common kinds of optionality. MS is intended to resolve this impasse by providing grammars a more nuanced way of permitting variation than simply reranking constraints. It is hoped, in fact, that MS can completely replace reranking in analyses of (non-interedialectal) optionality. OT has proved to be a powerful tool for investigating variation, and much of the work cited in this paper places variation in a central position by using it as an arbiter between competing analyses. MS provides a more complete formal picture of variation and therefore invites further detailed investigations of this very basic aspect of linguistic systems.

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