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From MPARSE *to* CONTROL: *deriving ungrammaticality**

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1 Introduction

A major insight of Optimality Theory (Prince & Smolensky 1993) is that grammatical constraints are ranked and violable. These ranked constraints evaluate an infinite set of candidate output forms, of which the optimal one is the actual output. The winning candidate is a compromise between the potentially conflicting demands that grammatical constraints impose. A question that the OT literature has only rarely addressed is how ungrammaticality arises if constraints are violable and violation does not entail ungrammaticality.

In this paper, we point to some shortcomings of the only existing proposal to deal with ungrammaticality in OT, the special constraint MPARSE (Prince & Smolensky 1993). We propose a restructuring of the architecture of the OT constraint system that overcomes these shortcomings. We show that one of the great strengths of OT, that of separating well-formedness from the repair strategies to arrive at well-formed structures, is a weakness in dealing with absolute ungrammaticality. MPARSE forces us to consider what repairs might have been employed to fix up an ill-formed string. However, as we show in several cases, absolute ungrammaticality should be considered separately from the issue of possible repairs. Ungrammaticality results when the optimal form a grammar can produce still fails to satisfy a constraint governing un-

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grammaticality. MPARSE, as a component of EVAL, requires us to evaluate multiple candidates, hence multiple repairs, simultaneously. We demonstrate that existence of a repair shown by particular alternations in a language (for example to avoid impermissible coda clusters) does not mean that the same repair will be available as a measure of last recourse to save an otherwise ungrammatical form (for example, to augment a subminimal form).

We propose to add a non-optimising constraint component called CONTROL, which contains only those inviolable constraints that cause ungrammaticality rather than repair. If the winning candidate from EVAL, the usual ranked and violable constraint component, satisfies all the constraints in CONTROL, it is a grammatical output. If it violates a constraint in CONTROL, no grammatical output is possible. This approach is empirically superior to MPARSE, and it also makes clearer a crucial distinction between two kinds of inviolable constraints that has not enjoyed much explicit attention in the literature. Inviolable constraints in EVAL outrank all potentially conflicting constraints and cause repairs or block otherwise general alternations. Inviolable constraints in CONTROL cause ungrammaticality, never repair.[1]

2 MPARSE

Prince & Smolensky (1993) propose that the candidate output set includes a special candidate with no phonetic realisation, called the Null Parse. The Null Parse by stipulation satisfies all well-formedness and faithfulness constraints. By definition, the Null Parse violates only the special constraint MPARSE, which no other candidate violates. Ranking a phonological constraint C above MPARSE is equivalent to declaring C inviolable: any candidate that violates C is worse than the Null Parse. In (1), the Null Parse emerges as the winning candidate because all other candidates violate constraint C, which outranks MPARSE.

(1) C ≫ MPARSE: *ungrammaticality preferred over violation of C*

	Constraint C	MPARSE
Cand A	*!	
☞ Null Parse		*

[1] Two new developments in OT might possibly have a bearing on the success or failure of MPARSE. The first of these is McCarthy's (1998) Sympathy Theory. The second is Sprouse's (1997) Enriched Input Theory. Both of these models are in the early stages of development. There are no published references as yet for either. Furthermore, McCarthy (1999) is a revision of Sympathy Theory designed to reduce its currently excessive formal power. Since the proper form of these theories is as yet unclear, we refrain from discussing them here. To the best of our knowledge, however, our CONTROL proposal is fully compatible with both.

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In §3, we illustrate the use of MPARSE by summarising Raffelsiefen's (1996) analysis of morphological gaps in English *-ise* suffixation.

3 English *-ise* formation

Raffelsiefen (1996) claims that the English verbalising suffix *-ise* attaches productively to nouns and adjectives with non-final stress, but not to nouns or adjectives with final stress.

(2)

Non-final stress		*Final stress*	
rándom	rándomìse	corrúpt	*corruptise
vápour	vápourìse	obscéne	*obscene-ise
átom	átomìse	secúre	*secure-ise

Raffelsiefen notes that a number of forms do not obey this generalisation. We are aware of three types of counterexamples, the first two mentioned also by Raffelsiefen (data from Webster's *3rd New International Dictionary*):

(3) a. *Final-stressed polysyllabic stems taking* -ise *with stress shift*
Japán Jápanìse

b. *Final-stressed polysyllabic stems taking* -ise *with stress clash*
machíne machínìse

c. *Monosyllabic stems taking* -ise (*necessarily with stress clash*)
Sérb Sérbìse

Raffelsiefen claims that the categories in (a) and (b) need not be accounted for by the grammar as they are clearly exceptional (in her terminology, they are actual but not potential words). Based on speaker reactions and the sporadic productivity of the patterns in (a) and (b), we tend to agree with this assessment. On the other hand, category (c), which Raffelsiefen does not mention, seems to be productive and readily accepted by native speakers. We were able to find the following examples in Brown (1963): *Serbise*, *Grecise*, *Francise*, *Turkise*, *zincise*, *mythise*, *dockise*, *coalise*, *stylise*, *filmise*, *tourise*, *sensise*, *chlorise*.

The complications just mentioned make it less than perfectly clear that *-ise* suffixation represents a valid case of absolute ungrammaticality. Nevertheless, we present Raffelsiefen's analysis in order to demonstate a typical use of MPARSE in dealing with ungrammaticality. We also sketch an analysis of the same facts in our proposed CONTROL framework in §5, and show that a CONTROL analysis handles the forms in (3), where the existing MPARSE analysis fails. In §4, we present several other cases of ungrammaticality that we find even more compelling than the English example.

With these caveats, we now turn to Raffelsiefen's analysis of gaps in *-ise* suffixation. Raffelsiefen argues that ungrammaticality in the case of

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final-stressed stems results from an irresolvable conflict between two inviolable constraints, *CLASH and IDENT.

(4) a. *CLASH
Two adjacent stressed syllables are prohibited.

b. IDENT
The stem of the derived word must be identical to the base (no stress shift).

*CLASH and IDENT both outrank MPARSE. Any candidate that violates either *CLASH or IDENT is worse than the Null Parse. Since it is impossible to simultaneously satisfy both *CLASH and IDENT for an input form with final stress, the Null Parse emerges as the winning candidate.[2]

(5) *No grammatical output for final-stressed stem*

/kərápt-ájz/	IDENT	*CLASH	MPARSE
kórəptàjz	*!		
kəráptàjz		*!	
☞ Null Parse			*

When the input stem has non-final stress, however, it is possible to satisfy both *CLASH and IDENT. A grammatical *-ise* form exists for such a stem.

(6) *Grammatical output for non-final-stressed stem*

/rændəm-ajz/	IDENT	*CLASH	MPARSE
☞ rændəmàjz			
rəndówmàjz	*!	*	
Null Parse			*!

We have seen that Prince & Smolensky's MPARSE approach handles ungrammaticality by ranking the special constraint MPARSE below other constraints. When violation of one of those higher-ranked constraints is unavoidable, the MPARSE-violating Null Parse emerges as the winning candidate.

While MPARSE works for some cases of ungrammaticality, we show in §4 below that it is unable to handle other cases. We present data from Turkish, Tagalog and Tiene where an MPARSE account predicts a grammatical output where there is in fact none. Finally, we return in §5 to English *-ise* suffixation, and demonstrate that Raffelsiefen's MPARSE account of English *-ise* suffixation, summarised above, fails to handle the grammatical form *Serbise* and other *-ise* derivations from monosyllabic

[2] Raffelsiefen actually gives a phonological representation to the Null Parse, which is identical to the phonological input form, with unattached affixes, and allows it to violate well-formedness and faithfulness constraints. In Raffelsiefen's approach, MPARSE prohibits unattached affixes. Since this difference in interpretation does not affect our arguments, we continue to assume Prince & Smolensky's approach here and in the rest of this paper.

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bases.[3] We show that a CONTROL analysis allows *Serbise* to surface, while still correctly ruling out polysyllabic ungrammatical forms with stress clash.

4 Challenges to MPARSE

Ranking a constraint C above MPARSE means that no grammatical output can violate C. The Null Parse will win over any candidate that violates C, as it violates only MPARSE, which is ranked lower than C.

In this section, we show that there are cases of ungrammaticality in which the ungrammatical candidate could be repaired by violating a constraint independently known to be violable in other, grammatical forms in the language. If constraint C is violable, it has to be ranked below MPARSE. Then, MPARSE cannot force ungrammaticality since violation of MPARSE by the Null Parse is more serious than violation of C by another, non-null candidate. The Null Parse therefore cannot be the winning candidate.

4.1 Turkish

Our first challenge to MPARSE comes from Istanbul Turkish, where subminimal forms are not repaired by epenthesis, even though epenthesis applies for other (syllable structure) reasons in certain grammatical forms.

4.1.1 *Minimal size condition.* As Itô & Hankamer (1989) and Inkelas & Orgun (1995) observe, some Turkish speakers impose a disyllabic minimal size constraint on suffixed forms.

(7)

Root	*Suffixed form* ($\sigma\sigma$ min)
sol^{j} 'musical note G'	sol^{j}-ym 'my G'
do[4] 'C'	*do-m 'my C'

Ungrammatical monosyllabic forms are not augmented by epenthesis, as shown in (8), where epenthetic segments are indicated in boldface:

(8) *Repair by epenthesis is not possible*

a. *do**ju**m
b. *do**u**m
c. ***i**dom
d. *dom**u**

The failure of epenthesis to augment subminimal forms implies that constraints barring epenthesis must outrank MPARSE, allowing the Null Parse to win. The relevant grammatical constraints are DEP, which disallows epenthesis of segments, and LEX≈PR and FTFORM, which together require each form to contain a disyllabic foot.

(9) a. DEP
Do not insert segments (McCarthy & Prince 1995).

[3] We thank the anonymous reviewer who brought this form to our attention.

[4] Inkelas & Orgun report that some speakers have a long vowel in this form, while others have a short vowel. We use the short-vowel variety in this paper, though our analysis extends without modification to the long-vowel microdialect.

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b. LEX≈PR, FTFORM
Every word must contain a disyllabic foot (Prince & Smolensky 1993).

Since violating one of these constraints in order to create a grammatical output form is not possible, they must all outrank MPARSE (10).

(10) DEP, LEX≈PR, FTFORM ≫ MPARSE

Tableau (11) shows how this ranking accounts for the failure of epenthesis to repair subminimal forms. All epenthetic candidates violate a constraint ranked above MPARSE, as does the subminimal candidate. The Null Parse is the winning candidate:

(11) *No grammatical output*

/do-m/	DEP	LEX≈PR, FTFORM	MPARSE
dom		*!	
doum	*!		
dojum	*!*		
idom	*!		
domu	*!		
☞ Null Parse			*

While this analysis accounts for the current set of data, it suffers from a crucial flaw: the ranking of DEP above MPARSE implies that epenthesis is never possible. However, epenthesis is in fact allowed to avoid vowel hiatus or illicit coda clusters in suffixed forms (12). The form in (b) is especially relevant, since it contains the same possessive suffix as the ungrammatical subminimal form in (7). This shows that epenthesis is possible in forms containing that suffix, making it even more puzzling that the forms in (7) are not augmented by epenthesis:

(12) a. /araba+a/ → arabaja 'car-DAT'
b. /it+m/ → itim 'my dog'

If MPARSE is to allow epenthesis, it must outrank DEP. Under this ranking, the candidate with epenthesis is the winner.

(13) *Different ranking required*

/it-m/	MPARSE	DEP
☞ itim		*
Null Parse	*!	

The fact that epenthesis is used to avoid illicit coda clusters and vowel hiatus, but never to augment subminimal forms, results in a ranking paradox. The analysis in (13) requires that MPARSE outrank DEP, whereas (11) requires that DEP outrank MPARSE. An MPARSE account must either overgenerate, allowing epenthesis to augment subminimal forms, or undergenerate, disallowing epenthesis into clusters.

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In the following section, we propose a solution to this dilemma by removing the constraint causing ungrammaticality from the component where potential repairs are evaluated.

4.1.2 *Solution*: CONTROL. When there is no grammatical output, speakers often have judgements about what the output would have been if a grammatical output were possible. This suggests that the phonological input–output mapping does generate an output form, which independent constraints rule out. Our proposal takes this intuition as a starting point in developing an empirically superior alternative to MPARSE. Specifically, we propose that the ranked constraint component EVAL always produces a winning non-null candidate, an optimal form with respect to the given constraint ranking. In order to deal with ungrammaticality, we introduce a new inviolable constraint component, CONTROL. Winning candidates from EVAL must satisfy all constraints in CONTROL in order to be grammatical output forms.[5] This proposal is based on the important but not immediately obvious observation that natural language grammars contain two different types of inviolable constraints. The first type of these is more commonly discussed in the OT literature – constraints that force violation of lower-ranked constraints but are never violated themselves. The Turkish syllable structure constraint causing epenthesis in (13) is an example of such an inviolable constraint. The second type of inviolable constraint, which has not received as much attention in the literature, causes ungrammaticality but never repair. Placing both types of constraints in EVAL leads to ranking paradoxes, as in §4.1.1 above. Placing the second, ungrammaticality-causing type of inviolable constraint into the new CONTROL component avoids these paradoxes. In order to be grammatical, an output must satisfy the two conditions in (14):

(14) *Conditions required for all grammatical outputs*

The output must:

a. be the optimal candidate chosen by EVAL;
b. satisfy all constraints in CONTROL.

The resolution to the Turkish constraint-ranking dilemma is in (15). Disyllabic minimality is inviolable. This can result if it is in EVAL and it outranks all conflicting constraints, or if it is in CONTROL, where all constraints are inviolable. High-ranking constraints in EVAL force violation of lower-ranked conflicting constraints. The minimal size condition never forces augmentation of subminimal forms or any other kind of repair. Therefore, minimality constraints belong in CONTROL, not EVAL. In (14) the winning candidate of EVAL is *dom*, which violates no constraints in EVAL. However, this winning candidate fails to satisfy the

[5] CONTROL superficially resembles Halle's (1973) notion of the Filter in that a portion of the grammar overgenerates and another component filters out ungrammatical forms, but the formal mechanism is quite different. CONTROL is more restricted in its use, and, unlike Halle's Filter, cannot alter the phonological, morphosyntactic or semantic properties of its inputs.

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minimality conditions in CONTROL and is therefore ungrammatical, as indicated by the scissors symbol.

(15)

	/do-m/	*V.V	DEP
a. EVAL	☞ dom		
	doum	*!	*
	dojum		*!*
		LEX≈PR,FTFORM	
b. CONTROL	✂ dom	*!	

The winning candidate from EVAL is submitted to CONTROL strictly for grammaticality judgements. Unlike EVAL, CONTROL evaluates a single form, and therefore does not choose between candidates. It can only declare the single winning candidate from EVAL grammatical or ungrammatical. Therefore, no repair is possible to satisfy constraints in CONTROL. If the winning candidate from EVAL violates a constraint in CONTROL, ungrammaticality results.

The MPARSE account was confounded by the fact that epenthesis is possible in Turkish even though it is not used to augment subminimal forms. Our solution is not subject to this difficulty. By ranking CODACOND above DEP in EVAL, for example, we can account for the fact that epenthesis applies in order to avoid illicit coda clusters (16):

(16)

	/it-m/	CODACOND	DEP
a. EVAL	☞ itim		*
	itimi		*!*
	itm	*!	
		LEX≈PR,FTFORM	
b. CONTROL	✓ itim		

This example illustrates the important difference between two types of inviolable constraints that our proposal captures. CODACOND is never violated in Turkish. It is always obeyed, even at the expense of violating lower-ranking faithfulness constraints in EVAL. The prosodic minimality condition is also never violated, but forms that violate it are never repaired. Instead, no grammatical output is possible. We account for this by placing the minimal size constraints in CONTROL rather than EVAL. CODACOND, on the other hand, must be in EVAL, since it demonstrably interacts with other constraints in EVAL.

One final question that remains is the restriction of the minimal size condition to morphologically derived forms. Cross-linguistically, non-derived forms are not always immune from prosodic minimality, as Inkelas & Orgun (1995) show for a different, bimoraic size condition in Turkish, Mester (1994) for Latin and McCarthy & Prince (1993) for Axininca Campa. Turkish disyllabic minimality, however, is restricted to derived forms, as is Japanese bimoraic minimality (Itô 1990). For the

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purposes of this paper, we assume simply that the constraints LEX≈PR and FTFORM apply in Turkish specifically to derived stems (this is similar to Itô's treatment of Japanese minimality). Monosyllabic roots may thus satisfy LEX≈PR by surfacing with a degenerate foot.[6]

4.1.3 *Constraining* GEN*: a failed attempt to save* MPARSE. Inviolable constraints have sometimes been suggested to be a part of GEN, the component of an OT grammar that generates the set of candidate output forms. For example, McCarthy & Prince (1995) propose placing their 'm-scope p-scope concordance condition' in GEN. Although proposals to constrain GEN have usually been intended to capture cross-linguistic universals, it is also worth considering whether constraining GEN might resolve the Turkish ranking paradox without requiring the use of CONTROL. Suppose one were to prohibit GEN from creating derived output candidates of less than two syllables. While this move successfully removes the subminimal candidates, it incorrectly predicts that the epenthetic candidate in (16) will win over the Null Parse. MPARSE must still outrank DEP since Turkish does use epenthesis in order to prevent CODACOND violations. Consequently, the candidate that violates only DEP is preferred over the Null Parse.

(17)

/do-m/	MPARSE	DEP
☞ doum		*
Null Parse	*!	

We cannot constrain GEN to prevent it from performing epenthesis, which, as we have already seen, is possible in Turkish. Constraining GEN, therefore, cannot be the right approach to ungrammaticality.

4.1.4 *Another failed attempt to save* GEN*: constraint conjunction.* In this section, we consider another possible, but equally flawed, attempt to save MPARSE. This method consists of using constraint conjunction, a mechanism proposed by Smolensky (1995) to deal with different phenomena and further developed in Itô & Mester (1996).

The main idea behind constraint conjunction is the following. When two constraints, C and D, are conjoined, the conjoined constraint [C|D] is violated only when C and D are both violated. By ranking [C|D] above C and D, one can derive so-called gang effects, where violation of either C or D is allowed, but violation of both is not possible. Constraint conjunction might help with the MPARSE ranking paradox by allowing C and D to be ranked below MPARSE while ranking [C|D] above MPARSE. In Turkish, for example, DEP could be ranked below MPARSE, as required by grammatical outputs containing epenthesis. If the conjunction of DEP with another constraint outranks MPARSE, we could perhaps rule out the ungrammatical ***doum*** without ruling out the grammatical ***itim***.

[6] Inkelas & Orgun (1995) and Orgun (1996) have proposed a more elaborate approach to the immunity of underived forms to prosodic minimality in Turkish, involving cophonologies. Our CONTROL analysis is also consistent with cophonologies.

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We start by reconsidering Turkish minimality with an eye towards which constraints may be conjoined in order to salvage the MPARSE account. To this end, we consider again the ungrammatical epenthetic candidates in (8) (the subminimal form ***do-m*** is not considered, since ruling that form out poses no challenge to MPARSE). Of these candidates, we may rule out ***idom*** (8c) and ***domu*** (8d) by observing that initial and final epenthesis are never found in Turkish morphophonemic epenthesis.[7] Morphologically sensitive alignment constraints (McCarthy & Prince 1993) ranked above MPARSE could presumably account for the absence of epenthesis at a word edge.

The remaining two candidates both violate two constraints: ***dojum*** (8a) has both vowel and consonant epenthesis, and ***doum*** (8b) has vowel epenthesis and vowel hiatus. Let us first examine ***dojum***, with vowel and consonant epenthesis. We might try to rule this form out by using separate DEP constraints for vowels and consonants. Individually, these constraints are both ranked below MPARSE. Their conjunction, which is violated when vowel and consonant epenthesis both apply, is ranked above MPARSE. The tableaux in (18) show how this accounts for epenthesis into clusters and failure of epenthesis to save subminimal forms.

(18) a. *Epenthesis breaks up impermissible coda clusters*

/it-m/	MPARSE	CODACOND	DEP-V	DEP-C
itm		*!		
☞ itim			*	
Null Parse	*!			

b. *Epenthesis breaks up vowel hiatus*

/araba-a/	MPARSE	*V.V	DEP-V	DEP-C
araba.a		*!		
☞ arabaja				*
Null Parse	*!			

c. *No epenthesis to augment subminimal forms*

/do-m/	FTBIN	LEX≈PR	[DEP-V|DEP-C]	MPARSE
dom	*!			
dojum			*!	
☞ Null Parse				*

As we have seen, an MPARSE account with constraint conjunction can successfully rule out a candidate that has both vowel and consonant epenthesis. Epenthesis into clusters involves a single consonant or a single

[7] Some borrowings have adopted initial epenthesis: *istim* 'steam', *uskur* 'screw'. However, since initial epenthesis is never found in demonstrably synchronic alternations, these forms may safely be considered historical relics with the once epenthetic vowel now part of their underlying representation.

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vowel, but never both. We have taken advantage of this fact in formulating an account based on constraint conjunction. Our constraint ranking allows candidates with either vowel or consonant epenthesis, but not both.

We now turn to a more serious challenge, namely the fact that a single epenthetic vowel would have been enough to bring the total size of the subminimal ***dom* to two syllables. The relevant candidate is ***doum***, with vowel epenthesis and vowel hiatus. The obvious way to proceed for an MPARSE account is to conjoin DEP-V and *V.V and rank the conjoined constraint above MPARSE. Note that *V.V itself has to be ranked below MPARSE, since vowel hiatus is allowed in forms such as *sa.at* 'hour', *du.a:* 'prayer' and *solu-.a* 'breath-DAT'. This ranking accounts for the data seen so far, as shown in the tableau in (19):[8]

(19)

a. /saat/	LEX≈PR, FTFORM	[*V.VV|DEP-V]	MPARSE	MAX-V	*V.V	DEP-V
☞ sa.at					*	
sat				*!		
Null Parse			*!			
b. */do-m/						
dom	*!					
doum		*!		*	*	*
☞ Null Parse			*			
c. /it-m/						
☞ itim						*
Null Parse			*!			

The forms *sa.at* and ***doum*** both violate *V.V. However, ***doum*** also crucially violates DEP-V. This violation alone is not fatal, however, as *itim*, which also violates DEP-V, is grammatical. Of these three forms, ***doum*** is the only one that violates both *V.V and DEP-V. None of the grammatical forms violates this precise combination of constraints. The constraint conjunction account is based on this observation. The conjoined constraint [*V.V | DEP-V] is violated just in case its component constraints are both violated. In general, a constraint conjunction solution to MPARSE paradoxes will be possible in the event that there is a unique combination of constraints that ungrammatical forms violate, but no grammatical form violates. This combination of constraints can be conjoined into one constraint and ranked above MPARSE.

This general solution to MPARSE paradoxes will not work, however, if some grammatical form also violates both of the conjoined constraints. In fact, there are grammatical forms in Turkish that violate both *V.V and DEP-V. These forms arise out of the opaque interaction between vowel epenthesis into coda clusters (which we have already seen in forms like

[8] We assume that a morpheme contiguity constraint prevents glide epenthesis from breaking vowel hiatus in *saat*.

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itim) and intervocalic velar deletion. We show some examples of velar deletion (Zimmer & Abbott 1978, Sezer 1981, Inkelas & Orgun 1995) in (20):

(20)	jatak	'bed'	jata.a	'bed-DAT'
			jata.ɯm	'bed-1SGPOSS'
	salak	'stupid'	sala.ɯm	'stupid-1SG'
	doruk	'peak'	doru.un	'peak-2SG POSS'

The interaction between vowel epenthesis and velar deletion is opaque, of the type that would be characterised as counterbleeding in theories with rule ordering. Note that the dual DEP/*V.V violations take place in the possessive suffixation cophonology.

In these forms, epenthesis applies even though the surface representation does not meet its environment. In a rule-ordering account of this phenomenon, epenthesis would precede velar deletion (21):

(21)	*underlying*	dorukn
	$\emptyset \rightarrow V / C __ C\#$	dorukun[9]
	$k \rightarrow \emptyset / V __ V$	doruun
	surface	doruun

Opaque rule interactions pose a challenge to Optimality Theory, which, in its pure form, claims that surface forms result from the interaction between faithfulness and well-formedness constraints. In the velar deletion example, we have what appears to be a gratuitous faithfulness violation. Solutions to this problem have been proposed by McCarthy (1998) and by Sprouse (1997), who develops an analysis of Turkish velar deletion. The mechanism is quite involved, however, and we therefore refer the reader to those references.

For our purposes, it suffices to compare the constraints that *doruun* (input /doruk-n/ 'peak-2SG POSS') violates with those that the ungrammatical form **doun* (input /do-n/ 'C-2SG POSS') violates:

(22)	do.ru.un	*do.un
DEP-V	*	*
*V.V	*	*
MAX-C	*	✓

Notice that the ungrammatical form **doun* violates a subset of the constraints that the grammatical form *doruun* violates. This in itself is not a problem for OT, since candidate outputs only need to fare better with respect to other candidates for the same input. However, this situation does pose a fatal challenge to the MPARSE–constraint conjunction approach: for MPARSE to work there must be a combination of constraints

[9] For convenience, we ignore vowel harmony, which determines the quality of the epenthetic vowel. In addition, rule environments for epenthesis and velar deletion are simplified. See Inkelas & Orgun (1995) for the most up-to-date discussion of the exact set of circumstances in which velar deletion applies.

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that only ungrammatical forms violate. In this case, such a combination of constraints does not seem to exist.

We conclude that constraint conjunction is not a viable alternative to CONTROL.

4.1.5 *Another failed attempt to save* MPARSE*: cophonologies.* Our demonstrations of the failure of MPARSE all depend on showing that attempted MPARSE analyses run into constraint-ranking paradoxes. If a mechanism were available that would allow the use of different constraint rankings in different components of the grammar, it is conceivable that these ranking paradoxes would disappear. One such mechanism, that of cophonologies, has been proposed and elaborated by Orgun (1996) and Inkelas (1998).

According to the cophonology proposal, each grammatical construction is associated with a specific constraint ranking, called its cophonology. The output of each grammatical construction is determined from its input by using the cophonology of that construction. Thus, for example, we may say that the root cophonology of Turkish has FTFORM at a relatively low-ranking position, allowing bare roots to surface with a monosyllabic foot. On the other hand, the possessive suffixation cophonology would have a high-ranking FTFORM constraint (above MPARSE or in CONTROL, depending on the framework assumed), preventing monosyllabic possessed forms from surfacing.[10]

If it turned out that the ranking paradoxes that MPARSE encounters come from different cophonologies, one could save the MPARSE approach by positing different constraint rankings for those cophonologies. Unfortunately, however, all the constraints involved in the Turkish ranking paradox are violated in the same cophonology, namely the possessive suffixation cophonology. Vowel epenthesis applies in forms containing the possessive suffix (18). Vowel hiatus is also possible in possessed forms (21). In fact, in the forms in (21), both vowel epenthesis and vowel hiatus are found. Since ungrammaticality due to subminimality can be avoided by combining vowel epenthesis with vowel hiatus, both of which are found in the possessive suffixation cophonology, the MPARSE ranking paradox cannot be resolved by recourse to cophonologies.

4.2 Tagalog *-um-* infixation

Infixation of the verbal marker *-um-* in Tagalog poses another challenge to an MPARSE analysis. Following McCarthy & Prince's (1993) analysis of Tagalog infixation, we treat *-um-* as basically prefixing, aligning to the left

[10] One reviewer raises the following questions: is it a coincidence that *all* suffixation cophonologies have the disyllabic minimal size condition? Could it have just as well been the case that some affixes had this requirement and others did not? The answer appears to be that not every single-consonant suffix, hence not every derived form, has this minimality condition. The imperfective affix has the allomorph *-(i)r* (subject to vowel harmony) following polysyllabic roots, and *-er* (again subject to vowel harmony) after monosyllabic roots. However, two CV verb roots irregularly take the *-r* allomorph, resulting in monosyllabic derived forms: *je-r* 'eat-IMPF' and *de-r* 'say-IMPF'.

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edge of the word. It infixes into consonant-initial roots in order to yield superior syllable structure (that is, to avoid codas). In (23) *-um-* prefixes to a vowel-initial stem and infixes when the stem begins with a consonant or consonant cluster.

(23) abot um-abot 'to reach for'
sulat s-um-ulat 'to write'
gradwet gr-um-adwet 'to graduate' (French 1988)

Following McCarthy & Prince, we use the alignment and well-formedness constraints in (24) in our analysis of *-um-* prefixation and infixation.

(24) a. ALIGN(*um*-L, Word-L)
The morpheme *-um-* is located at the left edge; is a prefix.
(This is EDGEMOST in McCarthy & Prince and Prince & Smolensky.)

b. NOCODA
Syllables are open.

Although our analysis of *-um-* infixation is in the same spirit as McCarthy & Prince's, we will amend it slightly to deal with additional facts that we have elicited from several Tagalog consultants. For some speakers, NOCODA cannot be the constraint that drives infixation, as in McCarthy & Prince (1993). For these speakers, infixation of *-um-* into CC-initial stems does not necessarily yield the smallest possible number of NOCODA violations. Instead, *-um-* infixation improves syllable structure by avoiding onsetless syllables whenever possible. Thus, *-um-* may infix after the first consonant in a CC-initial stem (25):

(25) gradwet grumadwet ~ gumradwet 'to graduate'
plantsa plumantsa ~ pumlantsa 'to iron'
preno pumreno ~ prumeno 'to brake'

Following Anttila (1995), we assume that variation results from crucial non-ranking of constraints. In Tagalog, we claim that NOCODA and ALIGN are not crucially ranked. In (26), *-um-* attaches to the CC-initial stem *plantsa*. If NOCODA is favoured over ALIGN, *plumantsa* emerges as the winner. If ALIGN is favoured over NOCODA, however, ONSET forces infixation by only one segment, and *pumlantsa* is the winner.

(26) ONSET ≫ NOCODA, ALIGN: *variable infixation*

/um+plantsa/	ONSET	NOCODA	ALIGN
☞ pumlantsa		**	*p*
☞ plumlantsa		*	*pl*
umplantsa	*!	**	

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In an MPARSE analysis, MPARSE must outrank ONSET, ALIGN and NOCODA, as each of these three constraints is violated in some grammatical form, e.g. *umabot* violates ONSET and NOCODA; *sumulat* and *pumlantsa* violate ALIGN and NOCODA.

(27) MPARSE ⩾ ONSET, NOCODA, ALIGN: *prefixation*

/um+abot/	MPARSE	ONSET	NOCODA	ALIGN
☞ umabot		*	*	
Null Parse	*!			
abumot		*	*	*a!b*

Having established that MPARSE outranks ALIGN, we now present cases of ungrammaticality that could have been prevented by additional alignment violations. These cases show that MPARSE is not a viable option for dealing with ungrammaticality in Tagalog infixation: ALIGN is known to be violable (even multiply violable, as in *gr-um-adwet*) in Tagalog. Given that, it must be ranked below MPARSE. As such, ALIGN cannot cause ungrammaticality.

The relevant restriction is that *-um-* cannot attach to *w-* or *m-* initial stems, a fact that we attribute to an OCP-related constraint. OCP violations are not avoided by violating ALIGN, as would be expected in an MPARSE analysis since MPARSE must outrank ALIGN; instead, they result in ungrammaticality. The fact that ALIGN is not violated to avoid ungrammaticality implies that it must outrank MPARSE. We therefore encounter a ranking paradox.

As with the Turkish case, the constraint enforcing ungrammaticality cannot apply to the grammar as a whole. Although [wum] sequences appear not to exist in Tagalog, [mum] appears in a small number of words: *mumo* 'particles of cooked rice falling off the plate during a meal', *mumoʔ* 'ghost', *mumugin* 'gargle'. The last form yields a derived *mum* sequence through reduplication: *mumumugin* 'will gargle'. It is clear, however, that *-um-* affixation does not allow these sequences. Three pieces of evidence illustrate the ungrammaticality of *-um-* with [m]- and [w]- initial stems:

(i) Distribution: *-um-* never occurs with native words beginning with /m/ or /w/: 'It may be noted that *-um-* does not occur with bases beginning with /m/ or /w/.' (Schachter & Otanes 1972: 292).

For example, *-um-* attaches to noun and adjective stems, yielding the verbal meaning 'to become' (28a). It fails, however, to attach to stems beginning with [m]- (28b):

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(28) a. pagod 'tired' pumagod 'to fatigue, weary'
saja 'happiness' sumaja 'to become happy'
b. mahal 'expensive' *mumahal 'to become expensive'
mura 'cheap' *mumura 'to become cheap'

(ii) Variable infixation of *-um-* is not possible with /Cw/-initial stems borrowed from English:[11]

(29) swiŋ sumwiŋ ~ *swumiŋ 'to swing'
swer sumwer ~ *swumer 'to swear'
swalow sumwalow ~ *swumalow 'to swallow'

(iii) [m]-initial loans cannot take *-um-*:[12]

(30) a. -um- *infixation possible for loans*
keri →kumeri 'to carry'
fejl →fumejl 'to fail'
pejnt →pumejnt 'to paint'
bejk →bumejk 'to bake'
b. *No* -um- *infixation for* [m]- *or* [w]- *initial loans*
meri →*mumeri 'to marry'
mejl →*mumejl 'to mail'
wejl →*wumejl 'to wail'
walow →*wumalow 'to wallow'
mejk →*mumejk 'to make'

In the next section, we show that MPARSE cannot deal with these facts, while CONTROL can.

4.2.1 *Failure of* MPARSE. Tagalog could have avoided OCP violations by hyperinfixation of *-um-* into the stem, but this never occurs, a fact that an MPARSE analysis cannot easily capture. The constraint in (33) applies in a morphologically restricted environment – one containing *-um-*. As we have shown, the *-um-* construction is blocked with *w-* and *m-* initial stems, though [um] can follow [m] in a small number of other forms. As a result, we specify that (31) applies specifically to the *-um-* construction.[13]

[11] /Cm/-initial stems do not allow *-um-* at all: *smajl* 'smile'→**summajl*, **smumajl*. The first is not possible since there are no double-*m* sequences in Tagalog, and the second is out because of the special restriction on *-um-*.

[12] It should be noted that *-um-* is not the only verb marker in Tagalog and, for lexically idiosyncratic reasons, does not combine with all native stems. Our consultants did not always agree whether *-um-* was the appropriate marker for a particular borrowed stem. Accordingly, we expect the judgements in (30a) to vary from speaker to speaker. However, all our consultants consistently agreed that any given [m]- or [w]- initial stem could not take *-um-*. Therefore we do not expect the judgements in (30b) to vary from speaker to speaker.

[13] The morphological restriction on (31) could be stated more broadly to apply to all derived forms containing an affix with lexically specified segmental content, as the

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(31) OCP-*um*

mum, ***wum***: sonorant labials are not allowed in consecutive onsets. (See Raffelsiefen 1996 for a similar constraint in English.)

This OCP constraint must outrank MPARSE in order to cause ungrammaticality, but this ranking alone is not sufficient to derive ungrammaticality. In order for MPARSE to cause ungrammaticality, it must be outranked by at least two constraints that potentially conflict with each other. When satisfying one of those constraints that outrank MPARSE entails violating another, the Null Parse will emerge as the winner. In Tagalog, it is obvious that the relevant constraint that conflicts with OCP is ALIGN, for violating ALIGN would have been a way to satisfy OCP. Accounting for ungrammaticality therefore requires ranking both OCP and ALIGN above MPARSE. Yet, MPARSE must outrank ALIGN since alignment violations are tolerated in *-um-* infixation. This ranking incorrectly predicts that further alignment violations should be allowed in order to prevent OCP violations.

(32) MPARSE *cannot rule out ungrammatical candidate with hyperinfixation*

/um+RED+meri/	OCP	MPARSE	ONSET	NOCODA	ALIGN
mumeri	*!				*m*
ummeri			*!	*	
merumi					*mer*
Null Parse		*!			

Implementing a kind of window restriction on where infixation is allowed might save the MPARSE analysis. The non-existence of hyperinfixed outputs could be accounted for if ALIGN were supplemented with a constraint limiting *-um-* to the first syllable. While such a constraint would save the MPARSE analysis, it clearly is not in the spirit of the alignment approach to infixation. According to McCarthy & Prince (1993), the location of infixes is not to be stipulated as in Prosodic Circumscription (McCarthy & Prince 1986), but rather emerges from the interaction of alignment and well-formedness constraints.

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only exceptions to the restrictions on [wum] and [mum] are monomorphemic or involve reduplication. If the morphological breadth of (31) is to be expanded, however, the phonological environment must be restricted to one where a labial vowel is present between the consecutive sonorant labial onsets. This additional restriction is necessary since [mV$_{[-\text{md}]}$m] can be derived, e.g. /maN-bili/ → [mamili] 'to go shopping'. Since no other affix supplies the appropriate phonological context to determine whether the morphological or phonological context is crucial, both kinds of restriction are possible. We choose the narrow morphological restriction since some form of morphological restriction is necessary regardless of how restrictive the phonological environment is.

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We have seen that an MPARSE analysis of Tagalog *-um-* infixation encounters a fatal ranking paradox. In the following section, we illustrate that a principled solution using CONTROL is readily available.

4.2.2 *Solution using* CONTROL. Since OCP-*um* causes ungrammaticality rather than repair, it must be in CONTROL, not EVAL. The correct result follows, as shown in (33):

(33)

	/um+RED+meri/	ONSET	NOCODA	ALIGN
a. EVAL	☞ mumeri			*m*
	ummeri	*!	*	
	merumi		*!	*mer*
		OCP-*um*		
b. CONTROL	✂ mumeri	*!		

The CONTROL account succeeds where MPARSE fails, thanks to the proper separation of optimising inviolable constraints that cause repair from non-optimising constraints that do not.

Notice also that Tagalog poses yet another problem for a constraint conjunction account. One might try to conjoin alignment with itself to rule out multiple violations (hyperinfixation). However, in *gr-um-adwet*, two segments (*gr*) violate alignment. Conjoining alignment with itself to rule out multiple violations is therefore not an option. One would need to resort to a triple conjunction: two alignment violations are allowed, but three or more are not. Such an approach not only goes against the basic assumption that natural language grammars do not count, but it also misses the point entirely: the point is that hyperinfixation is not an option in Tagalog. A counting (multiple-conjunction) approach suggests that one could just as easily have a language in which infixation by up to 47 segments is allowed, but not by 48 or more segments. This clearly cannot be the right approach.

4.3 Tiene

Our next example comes from Tiene. This example is perhaps not as watertight on its own as the Turkish and Tagalog cases. Nonetheless, we feel that it is quite compelling as part of a general cross-linguistic pattern of morphological gaps that lend themselves more readily to a CONTROL than an MPARSE analysis. Like the Turkish and Tagalog examples, our Tiene analysis yields a significant insight into the failure of MPARSE. In a rule-based account, environments, targets and repairs are bundled into a single package. Thus, one does not expect a rule to apply outside its intended environment. Prince & Smolensky and McCarthy & Prince point out that this packaging prevents rule-based accounts from capturing

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interesting generalisations, as within and across languages the same target may be reached by various paths, depending on the input form. Optimality Theory provides a more satisfactory approach, by decoupling well-formedness targets from the operations that allow a language to reach them. The actual way in which the well-formedness targets are reached (or fail to be reached) emerges from the interaction of grammatical well-formedness and faithfulness constraints. While the separation of environments and targets from specific repairs is a strength of OT in general, it is a weakness when it comes to absolute ungrammaticality.

Tiene has a number of restrictions on the syllabic and segmental shape of verb stems (Hyman & Inkelas 1998). Hyman & Inkelas list the following conditions on bases. (BASE is the traditional term in the Bantu literature for the constituent including a verb root and derivational affixes, but excluding the inflectional final vowel morpheme):

(34) a. STEMSIZE
The base may not contain more than two syllables.

b. STEMSHAPE 1: *prosodic shape*
The base may not contain a heavy syllable followed by a light syllable (*CVVCV).[14]

c. STEMSHAPE 2: *nasality*
In $C_1VC_2VC_3$ bases, C_2 and C_3 agree in nasality.

d. STEMSHAPE 3: *place of articulation*
In $C_1VC_2VC_3$ bases, C_2 is coronal. C_3 is either labial or velar.

The constraint on nasality is not relevant to our purposes here, and we will not dwell further on it. Tiene treats the constraints on stem size and stem shape in (34) differently. The STEMSIZE constraint is never violated. Potential violations by oversize bases result in ungrammaticality, never repair by deletion of excess phonological material. The STEMSHAPE constraints, however, do on occasion lead to repair. In other cases, they are violated under pressure from a higher-ranking base–reduplicant identity constraint. As it turns out, MPARSE is unable to deal with these facts.

We begin by illustrating STEMSHAPE 3 (place of articulation) in action, as described by Hyman & Inkelas. When a suffix with a labial or velar consonant attaches to a coronal-final root, simple suffixation results (35). We do not show the final vowel morpheme, since it is not relevant to our purposes.

(35) ból- 'break'	ból-ek- 'be broken'	< Proto-Bantu *-ek-
kót- 'tie'	kót-ek- 'be untied'	< Proto-Bantu *-uk-

[14] We are aware that this looks suspiciously like a foot-structure constraint, specifically one against an anti-iamb. However, as we are not aware of any independent Tiene facts that argue for foot structure, we refrain from assigning a specific interpretaion to this constraint.

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When a suffix with a coronal consonant attaches to a labial- or velar-final root, infixation results:

(36) lók- 'vomit ló-se-k- 'cause to vomit' < Proto-Bantu *-es-
jók- 'hear' jó-le-k- 'listen to' < Proto-Bantu *-ed-

The question of what would happen if a suffix with a labial or velar consonant were to attach to a labial- or velar-final root is not fully resolved. It turns out all such suffixes have an allomorph with a coronal consonant, and this allomorph is always used on labial- or velar-final roots. As expected, this allomorph is an infix.

Finally, when a suffix with a coronal consonant attached to a coronal-final root, 'imbrication' (Bastin 1983), that is, fusion, results.

(37) *Imbrication*

mat- 'go away' maas- 'make go away' < Proto-Bantu *-es-
koŋ- 'nibble' kooŋ- 'nibble for' < Proto-Bantu *-ed-

In order to understand the imbrication data in (37), we need to determine the underlying forms of the causative (Proto-Bantu *-*es*-) and applicative (Proto-Bantu *-*ed*-) suffixes. Examination of the data in (36) suggests the forms -*se*- and -*le*-, respectively. Following Hyman & Inkelas, however, we assume that these affixes underlyingly have empty vocalic slots, as the vowel qualities are fully predictable from vowel harmony. Thus, the underlying forms of the affixes are -*s*V- and -*l*V-. The imbrication phenomenon in (38) then involves deletion of the affix or root coronal and fusion of the affix and root vowels:

(38) mat + sV → maas-
koŋ + lV → kooŋ-

We are not concerned with determining which consonant deletes and which one stays behind. Hyman & Inkelas show that this is determined according to markedness, such that the relatively unmarked consonant deletes. What does matter to us is that the StemShape constraint must outrank Max-IO (no deletion) since deletion repairs StemShape violations (from now on, we use StemShape as a cover term for the three constraints in (34b–d)). In an MParse account, MParse must outrank Max-IO as well. Otherwise, ungrammaticality would have been preferred over deletion.

(39) StemShape *forces deletion*

/mat+sV/	MParse	StemShape	Max-IO
masat-		*!	
☞ maas-			*
Null Parse	*!		

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With the ranking MPARSE ⩾ MAX-IO in mind, we turn to STEMSHAPE 1 (prosodic shape), described in (34b). The observation that bases may not be CVVCVC is not just a static generalisation in the Tiene lexicon. It is actively enforced on appropriate inputs. Again, full details do not concern us; we refer the interested reader to Hyman & Inkelas. We provide one relevant example here, taken from Hyman & Inkelas. When the reversive affix (Proto-Bantu **-od-*, Tiene *-lV-*) is added to a CVVC root such as *sook* 'put in', the root vowel is shortened in order to satisfy STEMSHAPE:

(40) sook + lV → solek- (*soolek-)

This implies that STEMSHAPE outranks MAX-IO(μ), a constraint against vowel shortening.

The STEMSIZE constraint, unlike the STEMSHAPE constraints, occasionally leads to ungrammaticality in Tiene. This happens in the definitive construction, which consists in reduplicating the final VC of the stem. When the definitive construction applies to a CVC root, reduplication applies.

(41)

jɔb-	'bathe'	jɔb-ɔb-	'bathe thoroughly'
mat-	'go away'	mat-at-	'go away once and for all'
jak-	'believe'	jak-ak-	'believe once and for all'
lɔŋ-	'load'	lɔŋ-ɔŋ-	'load once and for all'

One problem that arises in the definitive construction is that the output form does not obey the otherwise general STEMSHAPE constraint, which requires C_2 to be coronal and C_3 to be labial or velar. Ranking base–reduplicant identity above STEMSHAPE handles this easily. In (42), the losing candidate **maat* is constructed according to the expected output based on the examples in (41), where STEMSHAPE forces deletion.

(42) STEMSHAPE *violation in reduplication*

/mat+RED/	IDENT-BR	STEMSHAPE
☞ mat-at-		*
ma-at-	*t!	
mat-ak-	*k!	

While reduplicated forms may violate STEMSHAPE, STEMSIZE is never violated in Tiene. For a CVCV stem, there is no possible morphologically expressed definitive form. A periphrastic form adding *nkó mɔ́to* to the verb conjugated in the neutral aspect must be used instead (Ellington 1977: 93).

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(43) *No grammatical output for* CVCVCV+RED

Base		*Reduplicated form*	
		STEMSIZE *violation*	*deletion*
kótob-	'chase'	*kótob-ob-	*kób-ob- *kót-ob- *kót-ot-
vútek-	'come back'	*vútek-ek-	*vek-ek-
binem-	'sleep'	*binem-em-	*bem-em-
panam-	'frighten'	*panam-am-	*pam-am-

For a CVCVC input, reduplication would result in a CVCVCV form, violating STEMSIZE. One question that arises is why Tiene does not resort to deletion in order to bring the reduplicated form down to the required CVCVC or CVVC shape.

In (39), we established that MPARSE must outrank MAX-IO(seg), since deletion is available to repair STEMSHAPE violations. In (40) we saw that vowel shortening is also possible in order to avoid STEMSHAPE violations. Thus, MPARSE must outrank MAX-IO(μ) as well. In addition, from (42), we know that base–reduplicant identity outranks STEMSHAPE. When we combine these partial rankings, we get the following full ranking:

(44) STEMSIZE ≫ MPARSE, IDENT-BR ≫ STEMSHAPE ≫ MAX-IO(seg), MAX-IO(μ)

In order to be maximally generous to the MPARSE approach, we assume that IDENT-BR outranks MPARSE. This way, we can rule out such candidates as **kótob*, **vútek*, etc. MAX-BR is also included for completeness, though it is necessarily ranked below MPARSE, as even CVC roots don't undergo total reduplication (41). We now have the fixed ranking in (45):

(45) STEMSIZE, IDENT-BR ≫ MPARSE ≫ MAX-BR ≫ STEMSHAPE ≫ MAX-IO(seg), MAX-IO(μ)

Unfortunately, this ranking still predicts a grammatical reduplicated output for a CVCVC input:

(46) MPARSE *incorrectly predicts a grammatical output for* CVCVCV+RED

/kótob+RED/	STEMSIZE, IDENT-BR	MPARSE	MAX-BR	STEMSHAPE	MAX-IO(seg), MAX-IO(μ)
kótob-ob	*!		***	?	
☞ kób-ob			*	*	**
kót-ob	*!		*		**
kót-ot			*	*	**
Null Parse		*!			

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The candidates *kób-ob* and *kót-ot* fare equally well in this tableau. We can assume that Hyman & Inkelas' constraint that favours deletion of unmarked consonants and retention of marked consonants (39) selects *kób-ob* as the winning candidate.[15] Unfortunately (independently of this assumption), this is the wrong result: in reality, there is no grammatical output. The Null Parse should be the winner. The only way to make this happen is to rank constraints against deletion and vowel shortening above MPARSE. However, we have seen that these constraints are violable; they are violated in order to satisfy STEMSHAPE (39) and STEMSIZE (40). True, we could conjoin them and rank the conjunction above MPARSE. Nevertheless, we have seen that constraint conjunction is not a viable solution for MPARSE-related ranking paradoxes in general (§4.1.4).

The constraint responsible for ungrammaticality in Tiene is STEMSIZE, which restricts bases to a maximum size of two syllables. The fact that deletion cannot salvage STEMSIZE violations implies that, in an MPARSE account, MAX-IO(seg) or MAX-IO(μ) outranks MPARSE. However, this incorrectly rules out deletion in the causative forms in (38). This is an irresolvable ranking paradox.

CONTROL circumvents this problem entirely. STEMSIZE is in CONTROL; therefore, nothing motivates deletion in the definitive aspect forms in (43). The winning candidate from EVAL contains four syllables. It violates the STEMSIZE constraint in CONTROL and is therefore ungrammatical.

(47)

	/mat+RED/	MAX-IO	RED=σ
a. EVAL	☞ mat-at		
	maat	*!	
	/panam+RED/	MAX-IO	RED=σ
b. EVAL	☞ panam-am		
	paam-am	*!	
		STEMSIZE	
c. CONTROL	✓ mat-at		
	✂ panam-am	*!	

Thus, the constraint causing ungrammaticality, STEMSIZE, does not cause deletion, and it is unfortunate that an MPARSE analysis forces us to consider this potential repair.

[15] An anonymous reviewer raises the question of how a full-reduplication candidate such as *kót-kot* would fare. However, as in most Bantu languages, syllables are always open in Tiene (the stem-final consonant is a surface onset since the final vowel morpheme is always present; if the base is to be evaluated grammatically on its own, one may assume the final consonant to be extrametrical). Thus, such a candidate would be ruled out by inviolable syllable structure constraints.

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5 A CONTROL analysis of English *-ise* suffixation

In this section, we present an analysis of morphological gaps in English *-ise* suffixation. As mentioned in §3, there are certain irregularities in the data that may cast doubt on the status of this case as an example of morphological gaps. Nonetheless, we find convincing Raffelsiefen's assertion that counterexamples to her generalisation regarding stress are idiosyncratic exceptions and that there is a general grammatical pattern that should be accounted for. In (48), we repeat English facts from (2).

(48)

Non-final stress		*Final stress*	
rándom	rándomìse	corrúpt	*corruptise
vápour	vápourìse	obscéne	*obscene-ise
átom	átomìse	secúre	*secure-ise

At first sight, it would appear that the constraint responsible for ruling out *-ise* forms derived from final-stressed stems should be *CLASH, as in Raffelsiefen's analysis. However, there is a problem with this move: the MPARSE analysis given by Raffelsiefen incorrectly rules out the attachment of *-ise* to monosyllabic stems, as in *Serbise*. This constitutes another serious challenge to MPARSE that CONTROL handles readily.

For an MPARSE account to work, at least two inviolable constraints must outrank MPARSE. When these two constraints come into conflict, ungrammaticality results. If only one constraint outranks MPARSE, a lower-ranking constraint can be violated instead of MPARSE and ungrammaticality does not result. There are two problems with this kind of account. First, the requirement that there be at least two inviolable constraints in order for ungrammaticality to result does not correspond to a genuine insight about the nature of ungrammaticality. It is purely an artefact of the MPARSE theory. Secondly, on the empirical side, ungrammaticality in English *-ise* suffixation demonstrably results from a single inviolable constraint, not two, as we now show.

In her anaysis of *-ise* suffixation, Raffelsiefen ranks *CLASH and IDENT above MPARSE. We have seen that *CLASH *is* violated in *Serbise*. This leaves IDENT as the only inviolable constraint. While MPARSE cannot derive ungrammaticality from a single inviolable constraint, a liability we address in §6, CONTROL can. Naturally, we relegate IDENT to CONTROL, though in a modified form (HEAD-ID in (49)) in order to deal with loss (or shift) of secondary stress as in *álphabèt*, *álphabetìse*.

(49) a. *CLASH
Two adjacent stressed syllables are prohibited.

b. HEAD-MAX
The head syllable of each input morpheme must correspond to a stressed syllable in the output (that is, no deletion of the main stress of a morpheme).

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c. HEAD-ID
The location of the head syllable of the output should be the same as the location of the head syllable of the input (adapted from Alderete 1999's NO-FLOP-PROM; no main stress shift).

In our analysis the winning candidate from EVAL avoids stress clash whenever possible. When *-ise* attaches to polysyllabic stems, primary stress shifts away from the suffix, and secondary stress may disappear altogether. The constraint HEAD-MAX ensures that the primary stress of the stem or the stress of the suffix *-ise* is not deleted. This constraint ensures that the output contains a stressed syllable corresponding to the head syllable of each morpheme. This correspondence does not ensure that the stressed syllable necessarily be linked to the same segments in input and output; it merely requires that some stressed syllable be present. In other words, this constraint allows primary stress shift but not deletion, so an input with two input stresses like [kərʌ́pt-ájz] also contains two output stresses. When HEAD-MAX is ranked above *CLASH, disyllabic stems shift stress from the second to the first syllable to avoid clash, whereas monosyllabic stems do not have another syllable to shift stress to (50a). The winning candidates from EVAL in (50a), therefore, are [kórəptàjz], which avoids clash, and [sə́ɹbàjz], which does not. Applying HEAD-ID (49c), which penalises stress shift, to these candidates in CONTROL eliminates the stress-shifting form [kórəptàjz] while allowing [sə́ɹbàjz] to pass. It should be obvious that HEAD-ID refers to the input–output relationship and does not compare the winner of EVAL to the candidate in CONTROL. Such a comparison would be meaningless since the winner of EVAL and the candidate in CONTROL are the same entity. In addition, HEAD-ID must be specific to this morphological construction, as shift of primary stress is tolerated elsewhere, e.g. *propóse*, *pròposítion*. Although this morphological specificity is not directly addressed in Raffelsiefen's MPARSE analysis, a similar construction-specific restriction must hold for it too.

(50)

	/kərʌ́pt-ájz/	HEAD-MAX	*CLASH
a. EVAL	☞ kórəptàjz		
	kərʌ́ptàjz		*!
	/sə́ɹb-ájz/	HEAD-MAX	*CLASH
b. EVAL	☞ sə́ɹbàjz		
	sə́ɹbájz	*!	
		HEAD-ID	
c. CONTROL	✂ kórəptàjz	*!	
	✓ sə́ɹbàjz		

We have seen that MPARSE fails to deal with English *-ise* suffixation because there is only one inviolable constraint in this construction.

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MPARSE needs at least two inviolable, conflicting constraints to derive ungrammaticality, a point we explore more closely in the next section. CONTROL is not subject to this counterintuitive restriction and deals successfully with *-ise* suffixation.

6 CONTROL and the spirit of Optimality Theory

We have argued for a revision of the basic model assumed in Optimality Theory. In the original Prince & Smolensky model, there is one constraint component, EVAL, which evaluates an infinite set of candidate forms. The candidate that fares best is the winner. Crucially, there is always a winner. If ungrammaticality is the desired result, a special candidate called the Null Parse must be the winning candidate.

In our model, being the best candidate with respect to EVAL is not sufficient. A candidate also needs to satisfy independent inviolable constraints in CONTROL. Otherwise, there is literally no output.

(51) *Ungrammaticality in two conceptions of OT*

	MPARSE model	CONTROL model
grammatical output	input → [EVAL] → output	input → [EVAL / CONTROL] → output
no grammatical output	input → [EVAL] → Null Parse	input → [EVAL / CONTROL] → no output

The CONTROL model of ungrammaticality is more direct than the MPARSE model: we do not assume an abstract entity, the Null Parse, that satisfies all faithfulness constraints purely by stipulation. Rather, we propose a direct model that views ungrammaticality as the non-existence of any output.

Like any proposal for a broad architectural revision, our proposal must be approached with caution. In particular, we must ask ourselves whether this move is within the spirit of OT, or whether it amounts to a complete reworking of the OT model.

Before addressing this question, let us point out that whether or not our proposal amounts to a major change in the OT model, we submit that it must be accepted, since we have amply demonstrated the empirical need for it in this paper.

We claim that our proposal, in addition to being empirically necessary, is in fact more in line with our understanding of the spirit of OT, and EVAL in particular, than MPARSE is. Consider first EVAL in a pure OT system,

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in which all constraints are ranked and violable in principle. In such a system, the only constraints that will be inviolable in practice are those that outrank all potentially conflicting constraints. As optimisation is the goal of EVAL, constraint ranking is never vacuous except in cases of non-interaction.

Now consider a system that includes MPARSE. In such a system, the grammatical constraints can be conceptually divided into two classes: those ranked above MPARSE, and those ranked below. The constraints above MPARSE are inviolable in principle, since the Null Parse is better than any candidate that violates one of those constraints. The constraints below MPARSE, on the other hand, behave exactly like the constraints of a pure OT system. They are all violable in principle.

(52) inviolable constraints ≫ MPARSE ≫ violable constraints

The distinction between these two groups of constraints (those above MPARSE and those below MPARSE) is a subtle one since inviolability appears to fall out of constraint rankings. A constraint is inviolable if and only if it outranks all conflicting constraints. It would appear that this fact covers constraints ranked above MPARSE in the same manner as those ranked below MPARSE. However, the inviolability of constraints ranked above MPARSE arises from the combination of constraint ranking and the ad hoc property of the Null Parse that it violates no constraint besides MPARSE, including, oddly enough, faithfulness constraints. To see the force of this distinction, consider the fact that in a pure EVAL system all potentially interacting constraints should interact with one another. Yet, constraints ranked above MPARSE can never interact with each other. If a given candidate violates one constaint above MPARSE, violation of any other constraint ranked above MPARSE is irrelevant. Therefore, constraint ranking is meaningless within the block of constraints ranked above MPARSE. Since violation of any of these constraints results in ungrammaticality, we cannot rank one constraint in this group higher than another to force violation of the lower-ranked one. In fact, this group of constraints behaves exactly as inviolable constraints did in pre-OT phonological theories: any grammatical output must satisfy all of these constraints. If violation cannot be avoided, ungrammaticality results.

Below MPARSE, the constraints in EVAL behave as one would expect them to behave: no output form ever violates the highest-ranking constraints below MPARSE. Within this block of constraints, constraint ranking is always non-vacuous. Thus, using MPARSE together with the Null Parse is nothing but a stipulation that a number of grammatical constraints are inviolable. As we have said, it does not make any sense to talk about the relative ranking of the inviolable constraints. Therefore, using MPARSE results in a hybrid system, with unranked, inviolable constraints as well as ranked, violable constraints pooled together in EVAL. We take EVAL to be the core component for optimising outputs through the interaction of constraints, and the inclusion of non-interacting con-

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straints that do not optimise outputs in this component strikes us as incongruous.

In addition to noting that the inviolable constraints cannot be ranked, it is worth noting that the separation of inviolable from violable constraints is not as clear-cut in the MPARSE model as it is in the CONTROL model. Again, the ad hoc property of the Null Parse that it violates only MPARSE and no other constraint muddies the waters. Violations of well-formedness constraints and MPARSE are always in complementary distribution, by definition. A candidate violating a well-formedness constraint cannot violate MPARSE, nor can a candidate that violates MPARSE violate a well-formedness constraint. Therefore, MPARSE always interacts with any well-formedness constraint, that is, their relative rankings are potentially meaningful. Yet ranking a well-formedness constraint above MPARSE is vacuous unless a relevant faithfulness constraint also outranks MPARSE. Raffelsiefen's MPARSE analysis of English *-ise* suffixation fails to extend to monosyllabic roots because of this requirement, as shown in §5. Consider also two hypothetical languages similar to Axininca Campa (McCarthy & Prince 1993), in which a highly ranked minimal size condition (MIN) causes subminimal roots to be augmented. In the first, MPARSE is top-ranked (53a). In the second, MIN outranks MPARSE (53b). In both, MPARSE outranks FAITH:

(53)

a. /ba/	MPARSE	MIN	FAITH
ba		*!	
☞ bata			**
Null Parse	*!		

b. /ba/	MIN	MPARSE	FAITH
ba	*!		
☞ bata			**
Null Parse		*!	

The ranking of MPARSE with respect to MIN is necessarily vacuous in (53) because FAITH is ranked below MPARSE, and the same winning candidate is selected in each tableau. The relative rankings of MPARSE and MIN is relevant only when FAITH also outranks MPARSE (54):

(54) MIN, FAITH ≫ MPARSE

/a/	MIN	FAITH	MPARSE
a	*!		
ata		*!*	
☞ Null Parse			*

The fact that the relative ranking of MIN and MPARSE is vacuous when FAITH is ranked below MPARSE does not raise any new empirical difficulties for the MPARSE model. However, we raise the point because the

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MPARSE model partially obscures the observation that is the central theme of this paper: constraints that cause ungrammaticality are phonologically inert. They do not trigger phonological repair. The CONTROL model captures this observation directly by placing these constraints in a component that has no repair mechanism and no constraint interaction. In the MPARSE model, it would seem at first that placing a constraint above MPARSE is the analogue to placing a constraint in CONTROL. However, this is only partially true since ranking well-formedness alone above MPARSE is insufficient to trigger ungrammaticality. It is also necessary to include above MPARSE any faithfulness constraints that would be violated in an apparent repair of the well-formedness violation.

Let us now turn to the CONTROL model. Like the MPARSE model, the CONTROL model stipulates that a number of grammatical constraints are inviolable in principle. Those constraints are in CONTROL, and act as a filter dwelling outside of the pure OT system. EVAL in this model is pure OT: constraint ranking is always non-vacuous, and inviolability results only from domination of all competing constraints.

Thus, while the CONTROL model also stipulates that there are separate blocks of inviolable-in-principle (causing ungrammaticality) and inviolable-in-practice constraints (top-ranking in EVAL, causing repair), it implements the idea more directly than the MPARSE approach. Constraints that are inviolable in principle are not in the ranked-and-violable constraint component EVAL, but rather in the separate CONTROL component. Every constraint in EVAL is violable in principle (though not necessarily in practice, in the case of top-ranking constraints).

Besides confusing the issue of inviolable-in-principle and inviolable-in-practice constraints, the Null Parse proposal gives rise to empirical problems. Ranking a constraint above MPARSE does make it inviolable. However, such a constraint may still incorrectly force violation of a constraint ranked below MPARSE, as was shown in §§4.1–4.3. The main advantage of the CONTROL approach is its successful handling of the lack of interaction between ungrammaticality-causing constraints with the regular input–output mapping of the grammar.

We conclude that our approach is superior to MPARSE in conceptual as well as empirical terms. The main conceptual advantage is that it makes a clear distinction between the inviolable, non-interacting constraints in CONTROL and the violable (subject to domination), interacting ones in EVAL, a distinction that the MPARSE approach uses implicitly, albeit unsuccessfully.

7 Learning and the nature of CONTROL

Separating constraints into two groups raises a learnability question: how does the learner decide which constraints reside in CONTROL and which ones in EVAL? In this section, we present a simple yet effective approach to this issue.

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A learning algorithm must include: (i) an initial state; (ii) steps for reaching the target grammar from the initial state. We assume that at the initial state all constraints are in EVAL, and that the learner ranks these constraints according to Tesar's (1995) learning algorithm. Of course, with this arrangement any conceivable input gives rise to a grammatical output since MPARSE is absent from EVAL. In order to handle ungrammaticality, it is necessary to provide the learning algorithm with the means to create constraints in CONTROL. Our mechanism is based on Regier's (1992) proposal of WEAK NEGATIVE EVIDENCE. In his work on the acquisition of the semantics of spatial prepositions, Regier suggests that positive evidence for a form constitutes weak negative evidence for alternative forms. For example, suppose that the learning algorithm is presented with a picture showing a ball on a table and the sentence 'the ball is *on* the table'. This constitutes positive evidence that the preposition 'on' is appropriate in this context. According to Regier, it is also weak negative evidence that other prepositions such as 'under' or 'through' could not be used to describe the same situation. Of course, positive evidence is much stronger than weak negative evidence. Thus, if the learner also is presented with 'the ball is *atop* the table' to describe the same picture, the positive evidence provided is sufficient for the learning algorithm to determine that 'atop' is appropriate to the same situation, despite the weak negative evidence for 'atop' provided by 'the ball is *on* the table'.

The ranking of constraints with respect to each other in EVAL proceeds as described by Tesar's (1995) algorithm of constraint demotion. In order for constraints to be recategorised to CONTROL, however, the learning algorithm has to compare what grammatical outputs are allowed with unviolated constraints in EVAL *vs.* CONTROL. If placing an unviolated constraint C in CONTROL results in either (a) no grammatical output where a grammatical output is known to exist or (b) a grammatical output that is different from the known output, this constitutes positive evidence that C belongs in EVAL. In the absence of such positive evidence, unviolated constraints may be moved from EVAL to CONTROL, based on weak negative evidence. Consider, for example, the case of Tagalog, where the affixes *-um-* and *mag-* have similar functions, and they are usually in complementary distribution with respect to which roots they attach to. Each form that the learner encounters that contains *mag-* constitutes negative evidence that *-um-* could not have been used instead. Once a learner encounters a number of *w-* and *m-* initial forms containing *mag-* (or possibly with another verb marker or in a periphrastic construction), considerable weak negative evidence has accumulated that *-um-* cannot be used on such forms. In addition, each occurrence of *-um-* with bases that begin with something other than *-w-* or *m-* provides weak evidence for *-um-* attaching to *w-* or *m-* initial roots. Based on this weak negative evidence, the learner may posit that the constraint OCP-*um* belongs in CONTROL. Since moving OCP-*um* to CONTROL does not rule out any actual

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grammatical forms or predict different surface forms that the ones actually observed, the move is successful.

We can speculate on the consequences that this kind of learning algorithm has for how strongly speakers feel about whether morphological gaps are part of the grammatical system or are accidental. The Turkish and Tagalog examples serve as counterpoints. The Tagalog speakers we surveyed have strong opinions about whether *-um-* can attach to *w-* or *m-* initial roots; in fact, most find the idea comical. The strength and uniformity of their judgements lead us to believe that the weak evidence for *-um-* in these contexts is overwhelming. Indeed, the evidence is very consistent. Not only is *-um-* absent in this context (and *mag-* present), but in addition the number of lexical items that contain the sequence *mum* or *wum* is very small. We have found only three headwords in English's (1986) comprehensive dictionary of Tagalog that begin with these sequences. Also, few derived *mum* and *wum* sequences exist, and they are formed only by reduplication, never by an affix with lexically specified segmental content. As a result, there is almost no positive evidence for *mum* or *wum* at all in the language, and no positive evidence for sequences derived from separate lexically specified affixes.

The Turkish speakers' grammaticality judgements, while strong, are not as uniform as those of the Tagalog speakers. Of twelve speakers surveyed by Inkelas & Orgun (1995), five speakers belonged to the group with the disyllabic minimality condition and seven did not. As these two groups of speakers have no other discernable differences in their grammars, it is clear that speakers who have the disyllabic minimal size constraint in CONTROL have not arrived at it through positive evidence. Rather, they must have formulated it through weak negative evidence, noticing that all morphologically derived words they encounter are polysyllabic, and concluding that this is a grammatical requirement.

8 Conclusion

We have considered the treatment of ungrammaticality in OT and shown that MPARSE, Prince & Smolensky's (1993) proposal, is unable to account for the full range of data. We have proposed an alternative mechanism for ruling out ungrammatical forms. By assigning constraints that cause ungrammaticality to the separate, non-optimising constraint component CONTROL, we ensure that those constraints will not cause repair, thereby avoiding the spurious prediction of ungrammatical outputs.

In the three languages we have discussed, Turkish, Tagalog and Tiene, MPARSE fails to rule out some ungrammatical forms. In particular, it fails when the following conditions obtain:

(i) a constraint C_1 is independently known to be violable in some grammatical output forms;

(ii) a different constraint C_2 is never violated;

(iii) violation of C_2 can be avoided by violating C_1.

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When these conditions hold, MPARSE predicts the existence of a grammatical output that violates C_1 and satisfies C_2. However, we have shown that there are cases in Turkish, Tagalog and Tiene in which precisely these conditions obtain, yet there is no grammatical output.

MPARSE incorrectly predicts ungrammatical outputs because it fails to distinguish two types of inviolable constraints: those that cause ungrammaticality and those that cause repair. Our proposal offers a principled distinction between these two types of inviolable constraints. Those that cause ungrammaticality are in CONTROL. Those that cause repair or block alternations are in EVAL, and outrank all conflicting constraints.

The specific constraints that we have argued belong in CONTROL all refer to morphological information, a fact that we handle with morpheme-specific constraints, though we admit the possibility of analyses using cophonologies. Turkish does not augment subminimal forms, even though its grammar allows epenthesis to satisfy syllable structure constraints. The minimal size constraint applies only to morphologically derived forms. Tagalog does not resort to hyperinfixation in order to prevent unwanted *m-um-* and *w-um-* sequences, even though regular infixation allows multiple alignment violations in stems with initial onset clusters. The OCP constraint responsible for ungrammaticality refers specifically to the morpheme *-um-*. In Tiene, deletion is not possible to avoid violations of STEMSIZE, even though deletion *is* available to avoid violations of STEM SHAPE. The constraint in CONTROL, STEMSIZE, refers to a morphologically defined string, the verb stem. We believe it is perfectly natural for these ungrammaticality-causing constraints to be idiosyncratic, applying only when specific morphemes or other morphologically defined units are involved. The constraints we have proposed for CONTROL are quite similar to subcategorisation constraints, but we believe they are better expressed as a kind of output filter rather than an input filter, as subcategorisation constraints would be. It would be possible to state that Tagalog *-um-* subcategorises for stems that do not begin with sonorant labials. However, such brute-force restrictions miss the important point that these restrictions exist because of the ill-formed output structures they would produce. It is this ill-formedness of output structures that the CONTROL solution captures naturally and directly. In any event, a subcategorisation account of Turkish possessives requires a disjunctive statement of subcategorisation: the possessive construction requires either a disyllabic stem or a consonant-final stem. This disjunction is unsatisfying since the reasons for the division are already provided by the grammar – addition of the possessive suffix to a consonant-final stem triggers vowel epenthesis, hence a second syllable is automatic. Finally, Latin (Mester 1994) and Axininca Campa (McCarthy & Prince 1993) do not distinguish derived from non-derived minimality. Consequently, minimality in these languages must be implemented as an output filter rather than an input filter. The CONTROL approach uses a single mechanism to account for the morphologically specific (e.g. Turkish prosodic minimality) and language-wide (e.g. Axininca Campa prosodic minimality) ungrammaticality effects.

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