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*On targeted constraints and cluster simplification**

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In his article 'Consonant cluster neutralisation and targeted constraints', Wilson (2001) proposes a far-reaching revision of Optimality Theory to accommodate targeted constraints, which compare candidates differing only in certain specific ways. Targeted constraints, it is argued, can explain why cluster-simplification processes affect the first member of a cluster but never the more marked member of a cluster. In this remark, I show that this argument encounters difficulties once it has been embedded in a fuller picture of constraint interaction. Some general properties of the targeted-constraints model are also discussed.

1 Introduction

The article 'Consonant cluster neutralisation and targeted constraints' (Wilson 2001; hereafter TC) addresses the following empirical generalisation (hereafter FCD):

(1) *Inventory-restricted first consonant deletion* (from Wilson 2001: 167)
Let α and β be any two consonants in the segmental inventory of language L. If L resolves intervocalic $\alpha\beta$ and $\beta\alpha$ clusters by deletion, then it does so by consistently deleting the *first* member of the cluster (i.e. /V$\alpha\beta$V/→[VβV] and /V$\beta\alpha$V/→[VαV]).

Apparently, no known cluster-simplification process ignores the order of the consonants and instead singles out the more marked consonant for deletion. For example, no language neutralises both /kabta/ and /katba/ to [kata], deleting the voiced obstruent because it is more marked – unless *b* deletes everywhere, thereby removing it entirely from the language's inventory. Here, I will follow TC in assuming that FCD is an empirically correct generalisation.

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This is an important observation, and by putting it on the agenda of phonological theory, TC makes a significant contribution (for more on this point, see §5 below). Moreover, TC makes a persuasive case that the FCD generalisation does not follow from Optimality Theory as originally conceived (Prince & Smolensky 1993), even with various enhancements like positional faithfulness (Beckman 1997, 1998, Casali 1996 and many others). Instead, TC offers an interesting, far-reaching revision of OT's fundamentals, with the goal of explaining FCD. The principal proposal is that (some) markedness constraints are TARGETED, in the sense that they can only compare candidates that are very similar to one another. For example, Prince & Smolensky's original NoCoda constraint says that both [ka.ba] and [ka.ta] are more harmonic than [kat.ba], but its targeted replacement, as we will see, says only that [kaba] is more harmonic than [katba], taking no position on [kata]'s harmony relative to the other two candidates.

In this remark, I will show that TC does not ultimately succeed in its goal of explaining FCD. Specifically, I will show that the explanation has problems once it is embedded in a fuller system of constraint interaction. I also address some suggested modifications of the analysis intended to remedy this problem; this discussion leads to a more general understanding of what the targeted-constraints model can and cannot do.

2 The original argument

A classic OT constraint is a function from a set of candidates to a stratified partial order of those candidates (Samek-Lodovici & Prince 1999). In a stratified partial order, every element belongs to some stratum. The strata are ordered with respect to one another, but elements within a stratum are not ordered among themselves. Thus, the members of a stratum share all order relations. For example, ranking people by their year of birth yields a stratified partial order like $[\![\{\text{Joe}_{1953}, \text{Mary}_{1953}\} > \text{Sam}_{1960} > \{\text{Harry}_{1968}, \text{Anne}_{1968}\}]\!]$. No order is imposed on, say, Joe and Mary; they are said to be NON-COMPARABLE under this ranking procedure.[1]

The original NoCoda constraint takes the candidate set {kat.ba, ka.ba, ka.ta} and assigns to it the order $[\![\{\text{ka.ba, ka.ta}\} \succ \text{kat.ba}]\!]$ – the top stratum includes the candidates receiving the fewest violation marks (here, zero), then one more than that in the next stratum and so on. This is a stratified partial order, because it satisfies the defining conditions: every candidate belongs to exactly one stratum; the strata are ordered with respect to one another; candidates within a stratum are non-comparable by NoCoda; and candidates within a stratum share all order relations.

[1] For typographic simplicity, I omit the braces surrounding singleton sets. I use double brackets around orderings, except that the outermost brackets are omitted in tableaux. The vertical bar indicates non-comparability.

A targeted constraint puts candidates into a partial order, which is not necessarily stratified. In a partial order, two elements can be non-comparable with one another yet not share order relations. For example, ranking only the men in a mixed-gender group by their year of birth yields a partial order in which the men are stratified and the women are non-comparable with the men and with each other: $[\![[\![\text{Joe}_{1953} > \text{Sam}_{1960} > \text{Harry}_{1968}]\!] \mid \{\text{Mary}_{1953}, \text{Anne}_{1968}\}]\!]$. Because every woman W_i is non-comparable with every man M_j, and W_i does not share M_j's order relations, this is not a stratified partial order. A less obvious example: ranking each gender separately yields two stratified partial orders which are non-comparable with one another: $[\![[\![\text{Joe}_{1953} > \text{Sam}_{1960} > \text{Harry}_{1968}]\!] \mid [\![\text{Mary}_{1953} > \text{Anne}_{1968}]\!]]\!]$.

Like the year-of-birth-by-gender example, the definition of a targeted constraint includes a statement of which candidates can be compared by that constraint. Here is the targeted constraint NoWeakConsonant, as defined in TC. (For clarity, targeted constraints will be indicated with a preposed 'T'.)

(2) T-NoWeakConsonant (T-NoWkC; Wilson 2001: 160)

Let x be any candidate and α be any consonant in x that is not released by a vowel. If candidate y is exactly like x except that α has been removed, then y is more harmonic than x (i.e. $y \succ x$).

This targeted constraint imposes the non-stratified partial order $[\![[\![\text{kaba} \succ \text{katba}]\!] \mid \text{kata}]\!]$ on the candidate set. In this order, [kaba] is more harmonic than [katba], but [kata] is non-comparable with the other two candidates; that is, this particular constraint says nothing about how [kata] fares relative to [kaba] and [katba]. The candidate [kata] is non-comparable with the others because it does not meet the antecedent condition of T-NoWkC: [kata] is not 'exactly like' [katba] or [kaba] except for the removal of an unreleased consonant, because *b* is released into a vowel.

Ranked above the faithfulness constraint Max(C), targeted T-NoWkC can compel deletion of the first consonant in a cluster, but not the second, as shown in tableau (3).

(3) T-NoWkC $\gg$ Max(C)

/katba/	T-NoWkC	Max(C)
☞ a. kaba		(katba $\succ$ kaba)
b. katba	kaba $\succ$ katba !	
c. kata		katba $\succ$ kata !
cumulative	$[\![\text{kaba} \succ \text{katba}]\!] \mid \text{kata}$	kaba $\succ$ katba $\succ$ kata

In this modification of the familiar OT violation tableau, the violation marks are replaced by constraint-enforced orderings that go against the candidate in that row. For instance, the cell indicating [katba]'s performance on T-NoWkC contains the expression 'kaba $\succ$ katba!', which means that this constraint orders [kaba] above [katba], with fatal consequences

for the latter. The bottom row contains the cumulative ordering of candidates by all constraints applied as ranked. Each constraint adds its ranking of candidates to the accumulating picture, so long as they do not contradict orderings already established by higher-ranking constraints. In MAX(C)'s evaluation of [kaba], the parenthesised expression '(katba ≻ kaba)' indicates that this order of candidates has been overridden by a higher-ranked constraint.

Targeted constraints are an important part of TC's explanation for FCD. The other part of the explanation involves the relationship between cluster simplification and segmental markedness. According to the FCD generalisation, there can be no language that simplifies /katba/ to [kata], deleting the more marked *b* – just as long as *b* is in the inventory of the language as a whole. That codicil is necessary because TC does not rule out the possibility of a /katba/→[kata] mapping if *b* deletes everywhere. As we will see in §3, this argument goes through only with a highly restricted constraint set. It does not generalise when a more realistic set of constraints is considered.

Here is how the argument is presented in TC. If *b* is present in the inventory, every markedness constraint that *b* violates must be ranked below MAX(C). For instance, *b* violates untargeted NOVOICEDOBSTRUENT (NOVCDOBS), defined as *[−son, +voice]. Therefore, if *b* is in the inventory, faithfulness constraints like MAX(C) and IDENT[voice] must dominate NOVCDOBS. Furthermore, if the language also has cluster simplification, we know from (3) that T-NOWKC dominates MAX(C). So, in a language that has *b*'s in the inventory, the constraints must be ranked as T-NOWKC ≫ MAX(C) ≫ NOVCDOBS. This puts NOVCDOBS so low in the ranking that it cannot affect the outcome of cluster simplification. Tableau (4) certifies this result; the tableau also includes top-ranked IDENT[voice] for completeness.[2]

(4) IDENT[voice] ≫ T-NOWKC ≫ MAX(C) ≫ NOVCDOBS

/katba/	ID[vce]	T-NOWKC	MAX(C)	NOVCDOBS
☞ a. kaba			(katba ≻ kaba)	(kata ≻ kaba) (kapa ≻ kaba)
b. katba		kaba ≻ katba !		(kata ≻ katba) (kapa ≻ katba)
c. kata			katba ≻ kata !	
d. kapa	{kaba, katba, kata} ≻ kapa !		(katba ≻ kapa)	
cumulative	{kaba, katba, kata} ≻ kapa	⟦⟦kaba ≻ katba⟧ | kata⟧ ≻ kapa	kaba ≻ katba ≻ kata ≻ kapa	*no change*

[2] Following TC, I show all constraint rankings as total orders, even when certain details of the ranking cannot be determined. For example, IDENT[voice] and T-NOWKC could be transposed in (4) and the result would be the same.

Tableau (4) shows that this candidate set has been fully ordered by the time that NoVcdObs gets its hands on it. NoVcdObs is therefore unable to favour deletion of the marked consonant *b*. In other words, if *b* is in the inventory, NoVcdObs is ranked so low that it cannot cause the cluster in /katba/ to be simplified by deleting the more marked consonant *b*. So this ranking conforms in its predictions with FCD.

It is possible to force the deletion of *b* from /katba/ by ranking No VcdObs above Max(C), as shown in tableau (5). But now we have a language where *b* is entirely absent from the inventory, because *b* deletes everywhere by virtue of the ranking NoVcdObs ≫ Max(C). So this ranking also conforms in its predictions with FCD – vacuously, because *b* isn't in the inventory, so the antecedent condition of FCD isn't met.

(5) Ident[voice] ≫ NoVcdObs ≫ T-NoWkC ≫ Max(C)

/katba/	Id[vce]	NoVcdObs	T-NoWkC	Max(C)
a. kaba		kata ≻ kaba ! (kapa ≻ kaba)		(katba ≻ kaba)
b. katba		kata ≻ katba ! (kapa ≻ katba)	kaba ≻ katba	
☞ c. kata				(katba ≻ kata)
d. kapa	{kaba, katba, kata} ≻ kapa !			(katba ≻ kapa)
cumulative	{kaba, katba, kata} ≻ kapa	kata ≻ {kaba, katba} ≻ kapa	kata ≻ kaba ≻ katba ≻ kapa	*no change*

Together, tableaux (4) and (5) show that non-contextual markedness constraints like NoVcdObs cannot influence the outcome of cluster simplification unless they are ranked above Max(C). But once NoVcdObs is ranked above Max(C), it eliminates all voiced obstruents from the inventory as a whole. Here is how the argument is summarised in TC:

> If consonants α and β are both in the segmental inventory of a language, then intervocalic clusters that contain them can be resolved by consistently deleting the first consonant, but *not* by consistently deleting the more marked consonant. In other words, the existence of the more marked consonant β in the segmental inventory forces the non-contextual markedness constraint $*\beta$ to be ranked so low that it cannot affect the decision about which consonant deletes (Wilson 2001: 170).

The inference that β's presence in the inventory entails crucial low rank of $*\beta$ – e.g. if *b* is in the inventory, then NoVcdObs must be ranked below Max(C) – is the crux of TC's argument. This inference will be scrutinised in the next section.

3 The effect of inventory emergence

TC (pp. 166–170) establishes that FCD follows from a 'basic' factorial typology containing only the constraints T-NoWkC, Max, Ident and a

single untargeted, non-contextual markedness constraint (*PL(lab,dor) in TC; NoVcdObs here). The factorial typology is basic or limited in the sense that it is obtained by permuting only this manageably small set of constraints. This is a sound method for studying the consequences of some proposal in OT, but only as a first approximation. Ultimately, it is necessary to ask how the proposal fits into a fuller picture of the universal constraint set Con.

OT is highly interactive, so there is a constant danger of seemingly solid results evaporating when additional constraints are considered (see McCarthy 2002: 112–117 for an example). Imagine we are given a set of candidates and a limited set of constraints. Following Samek-Lodovici & Prince (1999), we can determine which candidates are WINNERS in the sense that they can win under some permutation of the given constraints. The other candidates are LOSERS in relation to that limited constraint set – they cannot win under any permutation. Now suppose that the limited constraint set is expanded by the addition of other constraints, while holding the candidate set constant. The erstwhile winners are still winners: they will win under those ranking permutations that put the original constraints at the top. But it is illegitimate to conclude that the erstwhile losers are all still losers. One of the newly added constraints could crucially favour an original loser, making it into a winner when that constraint is top-ranked.[3]

Generalising the results of TC beyond its basic factorial typology presents the same difficulty. TC seeks to explain why the mappings /kaba/ →[kaba] and /katba/→[kata] cannot co-exist in a language, and TC shows that this follows from a limited set of constraints. But a larger – and more realistic – constraint set can affect this argument by promoting a loser to winner status. Specifically, as we will see, certain other constraints can protect the *b* in the /kaba/→[kaba] mapping without influencing deletion of *b* in the /katba/→[kata] mapping. In that case, FCD no longer follows from the theory: the language has β's in the inventory but simplifies both /$\alpha\beta$/ and /$\beta\alpha$/ by deleting β.

Within TC's limited constraint set, the ranking NoVcdObs ≫ Max(C) is sufficient to ensure that voiced obstruents are absent from the inventory of the language. But when additional constraints are considered, this ranking is clearly insufficient to impose that inventory restriction. As Prince & Smolensky (1993: 176) and Kirchner (1997) aptly put it, inventories are 'emergent' from the grammar. OT is highly interactive, and so a simple *β ≫ Max(C) ranking intended to eliminate the segment β from the inventory can be affected by diverse constraints ranked higher than *β. More generally, no M ≫ F ranking is assurance that M is active over all relevant inputs; markedness or faithfulness constraints dominating M can render it inactive in specific circumstances. Because this is such a basic property of OT, there is and can be no easy generalisation from TC's basic typology to a more realistic Con.

[3] Thanks to Alan Prince for suggesting this formulation.

Many and varied are the constraints, real and imaginable, that can deactivate NoVcdObs in specific circumstances, despite the ranking NoVcd Obs ≫ Max(C). Faithfulness to segments in the lexical root (McCarthy & Prince 1995) is one possibility, and in fact TC (pp. 173–175) actually exploits this possibility to good effect. Other positional faithfulness constraints also come to mind, though it seems clear that a goal of the TC programme is the elimination of positional faithfulness.

Markedness constraints, too, can override NoVcdObs, with problematic results. The constraint Onset is a straightforward example. If Onset outranks NoVcdObs, then the force of the ranking NoVcdObs ≫ Max(C) is not felt in the /kaba/→[kaba] mapping, as demonstrated by (6).[4]

(6) Onset ≫ Ident[voice] ≫ NoVcdObs ≫ T-NoWkC ≫ Max(C)

/kaba/	Onset	Id[vce]	NoVcdObs	T-NoWkC	Max(C)
☞ a. kaba			(ka.a ≻ kaba) (kapa ≻ kaba)		
b. ka.a	{kaba, kapa} ≻ ka.a !				(kaba ≻ ka.a) (kapa ≻ ka.a)
c. kapa		kaba ≻ kapa ! (ka.a ≻ kapa)			
cumulative	{kaba, kapa} ≻ ka.a	kaba ≻ kapa ≻ ka.a	*no change*	*no change*	*no change*

In (6), /b/ survives into the surface inventory, despite the ranking No VcdObs ≫ Max(C). But the same ranking will force *b* to delete in clusters if there is a voiceless obstruent adjoining it, as in (7).

(7) *Same ranking*

/katba/	Onset	Id[vce]	NoVcdObs	T-NoWkC	Max(C)
a. kaba			kata ≻ kaba ! (kapa ≻ kaba)		(katba ≻ kaba)
b. katba			kata ≻ katba ! (kapa ≻ katba)	kaba ≻ katba	
☞ c. kata					(katba ≻ kata)
d. kapa		{kaba, katba, kata} ≻ kapa !			(katba ≻ kapa)
cumulative	*no change*	{kaba, katba, kata} ≻ kapa	kata ≻ {katba, kaba} ≻ kapa	kata ≻ kaba ≻ katba ≻ kapa	*no change*

Tableau (7) is identical to (5) except for the addition of Onset, which has no effect on the outcome in this case. Therefore, the same grammar that gives /kaba/→[kaba] also gives /katba/→[kata], contrary to FCD.

[4] To keep the tableaux manageable, I have left out the constraint Dep(C) and candidates violating it, such as [ka.ʔa]. For present purposes, we can assume that it is top-ranked, imposing the order ⟦{ka.ba, ka.a, ka.pa} ≻ ka.ʔa⟧, which will not affect the outcome in (6).

The language described in (6) and (7) has voiced obstruents in the inventory, deletes voiced obstruents from clusters when the other consonant is not voiced or not an obstruent and deletes the first consonant otherwise. According to FCD, languages like this do not exist, and the theory of targeted constraints is intended to explain why. The example in (6) and (7) shows on the contrary that the targeted-constraints model *can* produce a language that is inconsistent with FCD if ONSET is included in the hierarchy. To put it another way, TC's factorial typology runs into difficulties when ONSET is added to the limited constraint set.

In the next section, I will address some attempts to revive TC's results by replacing ONSET or NOVCDOBS with targeted constraints. These highly local solutions really miss the point, however. By fundamental properties of OT, losing candidates do not necessarily remain losers when additional constraints are considered. Constraints interact, and higher-ranking constraints can affect the activity of lower-ranking ones. Therefore, the presence or absence of *β* in the inventory is not reducible simply to competition between **β* and MAX. TC's problem is not with ONSET specifically; rather, the problem is with any constraint(s) that can deactivate **β* in specific circumstances by knocking out all the candidates that lack *β*. To truly answer this argument, it is not enough to tinker with ONSET or NOVCDOBS; instead, it is necessary to identify the class of potentially problematic constraints or constraint interactions abstractly, to exclude them from CON by principle or stipulation and to reanalyse phenomena where constraints in this class have proven useful. This is a daunting task and may prove impossible.[5]

4 Revisions of the targeted-constraints analysis

In TC, the only targeted constraints mentioned are T-NOWKC and its near relatives. It has been suggested, however, that the specifics of the argument in §3 could be overcome by replacing ONSET or NOVCDOBS with targeted constraints. As I have already shown, the specifics of these constraints have little to do with the broader problem that TC faces, which stems from basic interactional properties of OT. Nonetheless, in this section, I will evaluate these suggestions, showing that they bring difficulties of their own and do not appear to be viable. Two general

[5] To give a sense of the diversity of constraints that could adversely affect TC's explanation for FCD, imagine a markedness constraint against adjacent [+round] vowels (Anttila 2002). It could block the mapping /kobu/→[kou] without affecting the /katba/→[kata] and /kabta/→[kata] maps. A chain-shift mapping can also produce surface *b*'s from underlying *p*'s: /kapa/→[kaba], /kaba/→[kaβa] (see Campidanian Sardinian for a similar phenomenon; Bolognesi 1998). The chain-shift mapping is interesting since the constraint that inactivates NOVCDOBS, thereby allowing the /p/→[b] mapping, is from the faithfulness family, but is not a positional faithfulness constraint (see Gnanadesikan 1997, Kirchner 1996 and Łubowicz 2002, to appear, for discussion).

themes emerge from this discussion: (i) because targeted constraints do not rank dissimilar candidates, some of the key results of markedness theory prove elusive when some classic OT markedness constraints are replaced by targeted constraints; (ii) many typological generalisations that superficially resemble FCD cannot be explained with targeted constraints, appearances to the contrary. There are strict limits on what kinds of generalisations can be explained with targeted constraints.

4.1 Targeted T-ONSET

The specific problem raised in tableaux (6) and (7) might be answered by adopting a targeted version of ONSET. (This suggestion comes from Colin Wilson.) The idea is that T-ONSET compares V.CV and V.V only if C is, in a sense that can be made precise, sufficiently similar perceptually to no consonant at all. This would mean that two candidates can be compared if they are identical except for the presence of something like [ʔ] or a homorganic glide in one but not the other. On this view, T-ONSET regards [kaba] and [ka.a] as non-comparable, while still favouring [kaʔa] over [ka.a] as required in languages with hiatus-resolving epenthesis. Formulated in this way, T-ONSET would not protect *b* in (6), and so it would not help maintain *b* in the inventory. (Readers can ascertain this by mentally removing the ONSET column from (6), since T-ONSET treats all three candidates as non-comparable with one another.)

The problem with T-ONSET is that it is unable to discharge many of the responsibilities of the original ONSET constraint, which it is intended to replace. Here are some examples:

(i) Epenthesis of consonants other than [ʔ] or homorganic glides is problematic. For example, Axininca Campa epenthesises *t* in forms like /i-N-koma–i/→[iŋkomati] 'he will paddle' (McCarthy & Prince 1993 and references there). T-ONSET regards [iŋkomati] and *[iŋkoma.i] as non-comparable with one another. Therefore, it cannot favour the correct candidate.

(ii) Phonologically conditioned allomorphy presents difficulties. For example, in Mascaró's (1996) analysis of the Catalan personal article, the choice between the allomorphs *l'* and *en* depends on untargeted ONSET, which favours *l'Einstein* over **en Einstein* 'the Einstein'. (The *en* allomorph shows up preconsonantally, where *l'* is syllabically impossible: *en Wittgenstein*, **l'Wittgenstein*.) Since T-ONSET is limited to comparing candidates that are minimally different perceptually, it wrongly treats *l'Einstein* and **en Einstein* as non-comparable.

(iii) In reduplicative infixation in Timugon Murut (McCarthy & Prince 1993), ONSET must favour [a**ba**balan] over *[**a**.abalan] 'often bathes' to account for why the reduplicative morpheme (in boldface) is infixed after initial onsetless syllables but prefixed if the word begins with a consonant ([**bu**bulud] 'ridge'). Targeted T-ONSET cannot compare [a**ba**balan] with *[**a**.abalan]; if it could, then of course it could also compare [kaba] with [ka.a].

As I noted in §2, classic OT constraints impose stratified partial orders on the entire candidate set, no matter how different the candidates are. Comparing *l'Einstein* with **en Einstein* is not a problem for a classic markedness constraint. By design, targeted constraints make more limited comparisons. For instance, T-NoWkC can compare [kaba] with [katba], but it cannot compare either of them with [kata]. This may be a virtue of T-NoWkC, but it appears to be a serious liability for T-Onset. Classic Onset has been used successfully in ways that resist targeting. This is a desirable situation: the theory is doing what it is supposed to do when a constraint like Onset makes correct predictions that go well beyond a local descriptive problem like [ʔ]-epenthesis.

4.2 Targeted T-NoVcdObs

In TC, non-contextual markedness constraints like *Pl(lab, dor) or NoVcdObs are assumed not to be targeted. The discussion thus far has simply followed TC on this point. TC does hint, however, that 'perhaps all non-contextual markedness constraints ... are in fact targeted' (p. 171, n. 13).

Implementing this remark, an anonymous reviewer has suggested that the problem in (6) and (7) can be answered by making NoVcdObs into a targeted constraint, defined as follows:

(8) T-NoVcdObs
For each voiced obstruent occurring in some candidate, prefer a candidate that is identical in every way except that the corresponding obstruent is voiceless (anonymous reviewer).

According to this definition, T-NoVcdObs can compare [kapa] with [kaba] or [katpa] with [katba], which differ only in the voicing of an obstruent, but it cannot compare [ka.a] with [kaba] or [kata] with [katba], which differ in the *presence* of a voiced obstruent. In processual terms, one might say that T-NoVcdObs favours devoicing but not deletion of voiced obstruents. According to the reviewer, this move not only solves the problem in (6) and (7), but it also explains why no known language eliminates voiced obstruents from codas by deleting them, a conundrum first raised by Lombardi (2001).

In the discussion below, I first sketch the reviewer's proposal. I then explain (§4.3) why T-NoVcdObs must refer to 'corresponding' segments, and I show that in consequence T-NoVcdObs (like T-Onset) is no longer able to discharge some basic responsibilities of markedness constraints. Finally (§4.4), I argue, contrary to the reviewer's claim, that targeted T-NoVcdObs does not explain why coda voiced obstruents are never eliminated by deletion. More than answering the reviewer's objection, this discussion reveals some limits on the typological generalisations that targeted constraints can and cannot explain.

First the reviewer's proposal. Suppose untargeted NoVcdObs is replaced by its targeted counterpart T-NoVcdObs, defined as in (8). Tableaux (9) and (10) update (6) and (7) to reflect this difference.

(9) Ident[voice] ≫ Onset ≫ T-NoVcdObs ≫ T-NoWkC ≫ Max(C)

/kaba/	Id[vce]	Onset	T-NoVcdObs	T-NoWkC	Max(C)
☞ a. kaba			(kapa ≻ kaba)		
b. ka.a		kaba ≻ ka.a !			(kaba ≻ ka.a) (kapa ≻ ka.a)
c. kapa	{kaba, ka.a} ≻ kapa !				
cumu-lative	{kaba, ka.a} ≻ kapa	kaba ≻ ka.a ≻ kapa	*no change*	*no change*	*no change*

(10) *Same ranking*

/katba/	Id[vce]	Onset	T-NoVcdObs	T-NoWkC	Max(C)
☞ a. kaba			(kapa ≻ kaba)		(katba ≻ kaba)
b. katba				kaba ≻ katba !	
c. kata					katba ≻ kata !
d. kapa	{kaba, katba, kata} ≻ kapa !				katba ≻ kapa
cumu-lative	{kaba, katba, kata} ≻ kapa	*no change*	*no change*	⟦⟦kaba ≻ katba⟧ | kata⟧ ≻ kapa	kaba ≻ katba ≻ kata ≻ kapa

T-NoVcdObs cannot compare [kata] (10c) with [kaba] (10a) and [katba] (10b). This is crucially different from (7), and it means that T-NoVcd Obs cannot favour cluster simplification by deletion of the marked voiced consonant. Though this is obviously not a solution to the broader issues raised in §3, it would seem to solve the local problem for TC that (6) and (7) present.

4.3 Targeted T-NoVcdObs brings its own problems

The definition of T-NoVcdObs in (8) requires close scrutiny. Observe that it refers to the 'corresponding' obstruent in the other candidate.[6] The anonymous reviewer makes an astute argument that this is necessary for the constraint to produce the intended result. Here, I will show that it also produces unintended results that seem fatal to this constraint.

First, some background about correspondence theory (McCarthy & Prince 1995, 1999). Correspondence is a relation between inputs and outputs (or other forms). Each candidate brings with it a correspondence relation to the input. That relation is supplied by Gen; it expresses the

[6] This aspect of (8) can be seen as an attempt at greater precision than the phrase '*y* is exactly like *x* except' in TC's definition of T-NoWkC (2).

individual mappings that produced the candidate. For example, the input/output pair /$k_1æ_2t_3$/→[$k_1æ_2t_3$], with corresponding segments indicated by indices, is fully faithful, while the pair /$k_1æ_2t_3$/→[$k_1æ_2$] involves deletion and the pair /$k_1æ_2t_3$/→[$k_1æ_2t_3ə$] has epenthesis.

When (8) refers to corresponding segments in two different candidates, it is actually referring to output segments that correspond to the same input segment. In other words, corresponding segments in two different candidates must derive from the same source if they are to be compared by this constraint. For example, T-NoVcdObs can compare [$k_1a_2p_3a_4$] with [$k_1a_2b_3a_4$] because [p_3] and [b_3] each correspond with the same segment in the input /$k_1a_2b_3a_4$/. This point may seem rather technical, but it is important.

Now we come to the reviewer's argument for why the definition of T-NoVcdObs must refer to corresponding segments. Suppose the input is /$k_1a_2p_3b_4a_5$/. Among the candidates are two that differ in which of the medial consonants has been deleted, [$k_1a_2b_4a_5$] *vs.* [$k_1a_2p_3a_5$]. If T-NoVcd Obs were defined in a way that did not mention correspondence, it would be able to compare these two candidates, and it would wrongly favour [$k_1a_2p_3a_5$], thereby once again subverting the explanation for FCD. That is why the reviewer proposes the definition in (8): T-NoVcd Obs cannot compare [$k_1a_2b_4a_5$] and [$k_1a_2p_3a_5$], despite their superficial resemblance, because the *b* and *p* do not stand in correspondence with the same input segment. Segments derived from different input sources are non-comparable under T-NoVcdObs.

Because FCD refers to all aspects of markedness and not just voicing, this idea about T-NoVcdObs has to be generalised if it is to work. At the very least, every non-contextual markedness constraint on consonants must fit the same definitional frame as (8). In other words, the reviewer's proposal entails that no featural markedness constraint can ever say that one segment is more marked than another unless both are derived from the same input segment. This is a broad claim with problematic consequences.

Markedness constraints are often used to compare segments that are not derived from the same source. They are, for example, called on to account for which segments are epenthesised (see Baković 2000: 85–86, de Lacy 2000, Kitto & de Lacy 2000, Lombardi 2002, McCarthy & Prince 1994, 1995: 259, Pulleyblank 1988, Smolensky 1993, among many others). The idea is that the epenthetic mapping /n_1a_2-a_3/→[$n_1a_2ta_3$] is more harmonic than /n_1a_2-a_3/→[$n_1a_2da_3$] because the latter incurs a violation of NoVcdObs. But targeted T-NoVcdObs cannot make this comparison, because epenthetic segments do not have input correspondents, so different choices of what to epenthesise cannot be compared. In general, targeted featural markedness constraints cannot account for the unmarkedness of epenthetic segments, giving up one of the basic results of OT and of underspecification theory before it.

Similar problems arise in other applications of non-contextual markedness constraints. For instance, in reduplicative emergence of the unmarked

(Alderete *et al.* 1999, McCarthy & Prince 1994, Spaelti 1997), markedness constraints must be able to compare candidates that have copied different segments or that have replaced a copied segment with an epenthetic one. Constraints that use the correspondence-based definitional frame of T-NoVcdObs cannot do this.

These remarks give further support to the point made at the end of §4.1: there is a danger in too greatly limiting the scope of action of a targeted constraint. Conventional OT constraints are unlimited in their scope, since they impose a stratified partial order on the entire candidate set. But targeted constraints are intentionally limited – sometimes too much so, as has just been shown about T-NoVcdObs and other targeted featural markedness constraints.

4.4 Targeted T-NoVcdObs and Lombardi's conundrum

Many languages have syllable-final obstruent devoicing; according to Lombardi (2001), no known language deletes syllable-final voiced obstruents or epenthesises a vowel to make them syllable-initial. The anonymous reviewer claims that targeted T-NoVcdObs resolves this conundrum.

The reviewer's point is technically correct, but in an uninteresting way. Targeted T-NoVcdObs will not induce deletion of or epenthesis after syllable-final voiced obstruents. It can compel devoicing of obstruents regardless of their syllabic position. To get devoicing of just codas, however, it would be necessary to rank T-NoVcdObs below the positional faithfulness constraint Ident-Onset[voice], as in Lombardi's analysis. But this move abandons a key element of the targeted-constraints programme, which includes a pointed critique of positional faithfulness (Wilson 2001: 178ff). T-NoVcdObs's 'success' in solving Lombardi's conundrum is therefore illusory.

Setting aside the failed T-NoVcdObs constraint, let us look at TC's actual analysis of final devoicing (pp. 186–188). The responsible constraint is targeted NoWeakVoice, defined as in (11).[7]

(11) T-NoWeakVoice (T-NoWkVce; Wilson 2001: 187)

Let x be any candidate and α be the [voice] feature of a word-final obstruent (if any) in x. If candidate y is exactly like x except that α has been removed, then y is more harmonic than x.

This constraint is not offered in TC as a solution to Lombardi's conundrum. The reason why T-NoWkVce does not help solve the conundrum tells us something important about what targeted-constraints theory can and cannot explain.

[7] Wilson assumes that voice neutralisation yields a segment unspecified for voice, distinct from [+voice] and [−voice]. I abstract away from this irrelevant complication.

Targeted T-NoWkVce does not solve Lombardi's conundrum because it can participate in deletion of final voiced obstruents under the ranking given in (12).[8]

(12) T-NoWkVce ≫ Ident[voice] ≫ Max(C)

/bad/	T-NoWkVce	Id[vce]	Max(C)
☞ a. ba			(bad ≻ ba) (bat ≻ ba)
b. bad	bat ≻ bad !		
c. bat		ba ≻ bat ! (bad ≻ bat)	
cumulative	⟦bat ≻ bad⟧ | ba	ba ≻ bat ≻ bad	*no change*

T-NoWkVce puts [bat] above [bad], and then the faithfulness constraint Ident[voice] puts [ba] over [bat]. So, even though T-NoWkVce says nothing about [ba] in relation to the other candidates, it ends up contributing to [ba]'s triumph. (This interaction closely parallels TC's analysis (p. 172) of how epenthesis can occur as a result of T-NoWkC.)

We see that, even with a limited constraint set, T-NoWkVce is not able (nor was it intended) to explain why final devoicing is never achieved by deletion. Yet this case seems superficially similar to the FCD problem – evidently similar enough to lead an anonymous reviewer who is obviously knowledgeable about TC to think that Lombardi's conundrum had been resolved. Why do targeted constraints enjoy some (limited) success in explaining one typological generalisation, FCD, but no success at all in explaining another, Lombardi's conundrum? The answer reveals some basic properties of the explanations that targeted-constraints theory can and cannot supply.

A crucial aspect of TC's explanation for FCD is the assumption that no faithfulness constraints distinguish the /katba/→[kaba] and /katba/→[kata] mappings. If they did, then permuting the faithfulness rankings would allow both mappings to win in different languages. But the mappings /bad/→[ba] and /bad/→[bat] are distinguished by faithfulness, so permuting the ranking of Ident[voice] and Max(C) allows one or the other to win, as (12) shows. Having targeted markedness constraints in the theory doesn't help solve Lombardi's conundrum – the problem is with faithfulness.[9]

[8] If Dep(V) is the bottom-ranked constraint, then /bad/ maps to [badə], again contrary to Lambardi's observation.

[9] Lombardi (2001) identifies faithfulness as the source of the problem and looks to faithfulness for the solution. She proposes that /bad/→[ba] and /bad/→[bat] cannot be distinguished by faithfulness constraints, because [ba] incurs a proper superset of [bat]'s faithfulness marks, by virtue of replacing Ident[voice] with Max[voice]. Lombardi's explanation for the no-epenthesis generalisation is different: it involves rejecting the contextual constraint NoWkVce in favour of NoVcdObs plus positional faithfulness.

This leads to a more general question: under what conditions will targeted constraints account for typological generalisations? Imagine that the following conditions hold. There is an input /I/ with three output candidates, fully faithful [I] and two unfaithful competitors, [A] and [X]. There is a classic OT markedness constraint M that imposes the order ⟦{A, X} ≻ I⟧ – i.e. [A] and [X] are assigned the same number of marks as each other, and both are assigned fewer marks than [I]. Typological research has revealed that languages sometimes satisfy M by mapping /I/ to [A], but no language does so by mapping /I/ to [X]. We want to know whether this observation can be explained by adopting, in place of M, the targeted constraint T-M, which imposes the order ⟦⟦A ≻ I⟧ | X⟧.[10]

For the explanation to go through, both the /I/→[A] and /I/→[X] mappings must be equal in terms of faithfulness and markedness, except for T-M. To see why this is so, assume that they are unequal in terms of faithfulness or markedness, and then see where the explanation fails:

(13) a. *Unequal in faithfulness*
If /I/→[A] incurs a faithfulness mark that /I/→[X] lacks, then /I/→[X] will be more harmonic whenever /I/→[A]'s mark is ranked high enough. Therefore, typological generalisations with this property cannot be explained using targeted constraints; an example of this is (12). Conversely, if /I/→[X] has all of /I/→[A]'s faithfulness marks plus others, then the typological generalisation can be explained, but targeted constraints are not needed. For example, NoCoda is satisfied by the mapping /patak/→[patakə] but never [patakəʔə] – a classic OT economy-of-epenthesis result that does not require targeted constraints.

b. *Unequal in markedness*
If some markedness constraint or transitive chain of constraints says ⟦X ≻ A⟧, then there are rankings where /I/→[X] will be more harmonic than /I/→[A], even if T-M is targeted and does not favour [X] over [I]. Conversely, if no markedness constraint or chain says ⟦X ≻ A⟧, if at least one says ⟦A ≻ X⟧ and if the mappings are equal in faithfulness, then the typological generalisation can be explained, but targeted constraints are not needed. For example, epenthesis of [a] and [ã] will incur identical faithfulness marks under some assumptions about Con, but classic OT markedness ensures that [ã]-epenthesis will never be observed in oral contexts.

There are, then, some strict limitations on the typological generalisations that can be explained using targeted constraints. Generalisations that have the apparent form of FCD, or even simpler ones, may prove intractable to targeted-constraints analysis despite superficial appearances. Lombardi's observation that coda devoicing is never achieved by

[10] T-M could in addition impose the order ⟦A ≻ X⟧. But if it did so, then the untargeted constraint M would do so too, and so there would be no reason to invoke targeted constraints in the first place.

deletion or epenthesis is typical in this respect: because the maps /bad/ →[bat], /bad/→[ba] and /bad/→[badə] are distinguished by faithfulness, targeted T-NoWkVce has nothing to offer.

The typological generalisation FCD is more complex because it includes an additional layer of contingency related to the contents of the inventory. T-NoWkC imposes the order ⟦⟦kaba ≻ katba⟧ | kata⟧. The candidates [A] = [kaba] and [X] = [kata] are not distinguished by faithfulness constraints. There is a markedness constraint, NoVcdObs, that asserts the ⟦X ≻ A⟧ order (i.e. ⟦kata ≻ kaba⟧), but it is, or is supposed to be, tucked safely out of the way by the contingency that voiced obstruents do occur in the inventory. The anonymous reviewer's targeted constraint T-NoVcdObs actually eliminates the need for this contingency, since T-NoVcdObs does not make the ⟦X ≻ A⟧ assertion. The argument in §3 showed that NoVcdObs is not always tucked safely out of the way, while the argument in §4.3 showed that T-NoVcdObs is problematic for other reasons.

It is appropriate to conclude this section with illustrative examples of typological generalisations that can and cannot be explained using targeted constraints, together with the assumptions about other constraints that underlie the explanations. These examples are useful because they simplify matters, avoiding TC's necessary engagement with matters of inventory structure.

The first example, showing success of the targeted-constraints model, is hypothetical though not implausible. Suppose it were observed cross-linguistically that dissimilation of /lVlV/ sequences always affects the first /l/, changing it to [r]. We therefore want to explain why OCP-[lateral] always produces mappings like /lala/→[rala] and never /lala/→ [lara]. Making this into a targeted constraint is the first step:

(14) T-OCP[lateral]

Let x be any candidate containing the sequence [l_1Vl_2V]. If candidate y is exactly like x except that [l_1] has been replaced by [r], then y is more harmonic than x.

This constraint gives the harmonic order ⟦⟦rala ≻ lala⟧ | lara⟧. To ensure that T-OCP[lateral] will never support the /lala/→[lara] mapping, two additional conditions must be met. First, as seems reasonable, there can be no markedness constraint or chain that gives the order ⟦lara ≻ rala⟧. Second, there can be no faithfulness constraint, such as Beckman's (1997, 1998) initial-syllable faithfulness, that favours [lara] over [rala]. Under these assumptions, this imaginary typological generalisation has been explained. T-OCP[lateral] says that [rala] is more harmonic than [lala]. The faithfulness constraint Ident[lateral] favours [lala] over [lara]. Since no constraint, markedness or faithfulness, favours [lara] over [rala], it is impossible for [lara] to win under any ranking.

The second example presents a case where the targeted-constraints model does not seem to be useful. The constraint responsible for nasal

harmony is satisfied by spreading [nasal] from consonant to vowel (/ma/ →[mã]), but never by denasalisation (/ma/→[ba]). Suppose there is a targeted constraint intended to explain this:

(15) T-SPREAD[nasal]

Let x be any candidate containing the sequence [NV_{oral}]. If candidate y is exactly like x except that [V_{oral}] has been replaced by [V_{nasal}], then y is more harmonic than x.

This constraint yields the partial order ⟦⟦mã ≻ ma⟧ | ba⟧. Even though [ba] is non-comparable with the other candidates, the typological generalisation is not safely in hand. There are two potential problems, one involving markedness and the other faithfulness. If there is a markedness constraint $*V_{nas}$ that imposes the order ⟦{ba, ma} ≻ mã⟧, then that constraint can support the undesired /ma/→[ba] mapping. On the faithfulness side, it has been argued that symmetric IDENT[+F]/IDENT[−F] or MAX[F]/DEP[F] constraints are required (see Lombardi 2001, Pater 1999, Pulleyblank 1996, among many others). If so, then the targeted-constraints model cannot provide an explanation for this typological generalisation, nor for any other where the mapping [−αF]→[αF] is observed but the mapping [αF]→[−αF] is not. That is because /ma/→[mã] and /ma/→[ba] will violate different faithfulness constraints – IDENT[−nas] *vs.* IDENT[+nas] – and permuting the ranking of those constraints can cause either mapping to win. This example, then, reinforces one of the points of §3: the success of a TC-style explanation for a typological universal depends as much on the other constraints in CON as on the targeted constraints themselves.

5 Conclusion

The theory of targeted constraints introduced in Wilson (2001) is a very interesting revision of OT. It is also a far-reaching revision, altering the fundamentals of how constraints and EVAL work.

The argument for this theory rests on its explanation for the observation that VC_1C_2V clusters are simplified by deleting C_1 but never C_2 – as long as C_2 is in the inventory of the language as a whole. Though adopting a targeted constraint can account for this observation under a very restricted constraint set, the explanation does not generalise when additional constraints are considered. This problem emerges from a fundamental characteristic of OT: a markedness-over-faithfulness ranking M ≫ F is no guarantee that M will always be active on the relevant candidates. Constraints interact, and markedness or faithfulness constraint(s) dominating M can render it inactive under specific circumstances.

This problem of partial activity of M was illustrated with the interaction of ONSET and NOVCDOBS. In response to this illustration – though not to the general problem – targeted versions of these constraints were considered and shown to be inadequate. Two general themes emerged

from this discussion. First, targeted constraints give up some of the candidate comparisons of the original non-targeted constraints, and this can mean losing some attractive results obtained from markedness theory. Second, there are real limitations on what kinds of generalisations can be explained with targeted constraints, limitations that are exquisitely sensitive to the details of other constraints in CON.

Nonetheless, TC makes a valuable contribution in raising the question of why some markedness constraints can compel certain unfaithful mappings but not others. In work originally circulated in 1995, Lombardi (2001) was the first to discuss this problem at length (see §4.3).[11] The overall issue is a very important one, since it really is about what phonological systems taken as a whole can and cannot do.

Because it attributes differences among languages to the ranking of universal constraints, OT is an inherently typological theory. For this reason, OT directly confronts the analyst with basic typological problems like those that Wilson and Lombardi discuss. It is telling that, despite decades of sophisticated research on phonological rules and representations, the questions that Wilson and Lombardi address were never previously asked, much less answered.[12]

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[11] Early mentions of the issue include Prince & Smolensky (1993: 112, note) and McCarthy & Prince (1995: 328–329).

[12] It is sometimes thought that feature geometry or other representational enhancements of rule-based phonology supply the answers to these questions. In the words of an anonymous reviewer, 'most non-linear phonological theories, e.g. models of feature geometry, incorporate an explicit theory of rules which makes clear predictions about what rules, and thus sound systems, can and can not do. In fact, it was precisely in response to the excessive power of *SPE* formalism that such models were developed! While I would agree that the formalism in some models may be too powerful for deletion processes, for other types of processes, like assimilation, predictions are clear-cut. Such models allow for typological observations to be made, as in OT, but, unlike OT, they also provide a formalism which attempts to restrict what can and can not occur.' The reviewer's comments merely underscore my point: the literature on non-linear rule-based phonology does not ask or answer the questions raised by Lombardi and Wilson. The reviewer's opinion that OT fails 'to restrict what can and can not occur' is simply uninformed. For relevant discussion, see Chapter 3 of McCarthy (2002), especially the references on page 181.

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