Cycles, Non-Derived-Environment Blocking, and Correspondence

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1. Introduction

The notion of morphologically 'derived' environment plays a role in phonology in two different ways. In some cases the phonology 'misapplies' precisely in those environments, as in the celebrated example *cònd[e]ns-átion* (Chomsky and Halle, 1968), where the bracketed vowel is unreduced despite its lack of stress, in contrast to morphologically underived *háp*p[ə]*n*, where reduction occurs as expected. In other cases one finds the opposite situation, in which the phonology misapplies to *un*derived environments, as in *v[áy]tamin* or *sén[ay]le*, where a certain vowel shortening does not occur, in contrast to derived *sen[í]l-ity*, where it does.

As Kiparsky (1993, p.278) notes, rule-based phonology grants no theoretical status to the notion of 'derived environment' and thus needs to be supplemented with additional machinery. The traditional supplements have been the 'cycle', to account for the first type of misapplication, as in *còndens-átion*, and the 'strict cycle condition' to account for the other, as in *v[áy]tamin*. Matters are different in a certain specific version of Optimality Theory, in which 'derived' environments are simply those to which the notion of output-to-output 'Correspondence' is applicable. In that version of OT, formally developed in McCarthy and Prince (1994, 1995), McCarthy (1995), Benua (1995, 1997), and anticipated in some of its essentials in Burzio (1991, 1992, 1993, 1994a,b), Burzio and DiFabio (1994), and to be further defended in this article, the basic architecture of the theory consists of three types of constraints: purely phonological constraints: 'Phon'; constraints imposing Input-Output faithfulness: 'IO-F'; and constraints imposing Output-Output faithfulness: 'OO-F'. These constraints will interact in ways established by their relative rank as usual in OT. The range of interaction among the three types will then be defined by the six logical possibilities in (1) and (2).

(1) a. Phon >> OO-F >> IO-F
b. OO-F >> Phon >> IO-F
c. OO-F >> IO-F >> Phon

(2) a. Phon >> IO-F >> OO-F
b. IO-F >> Phon >> OO-F
c. IO-F >> OO-F >> Phon

In a theory such as this in which there are no derivations, generalizations which were formerly expressed derivationally should follow from constraint ranking, with the rankings in (1)-(2) as the source of major generalizations. More specifically one might expect that generalizations such as those proposed within Lexical Phonology, in terms of rules differing by systematic clusters of properties such as cyclicity, non-application to derived environments, structure-preservation, having lexical exceptions (the 'lexical'/ 'non-lexical' distinction), should either reduce to one of the rankings in (1)-(2) or prove spurious.

This article takes on a portion of that task, by claiming that all observed 'misapplication' of phonology consists of Phon constraints holding an intermediate rank, as in either of (1b), (2b), in fact generalizing the results achieved within the domain of reduplication in McCarthy and Prince (1994, 1995/ to appear). Each of (1b), (2b) characterizes a situation in which a 'Phon' constraint prevails

over the domain of constraints it dominates, respectively some IO-F and OO-F constraint, relating to underived and derived environments respectively. Furthermore, in each case, that Phon constraint will be blocked over the class of complementary environments, controlled by constraints that dominate it in turn. The other cases in (1)-(2) will not be quite as intriguing. Those in (1a) and (2a) will be cases where a given member of Phon always applies, and those in (1c) and (2c) the cases where it never does. As for the difference between (1) and (2): the ranking 'OO-F >>IO-F' versus the opposite ranking, that turns out to be important in its own right, and would deserve a whole separate discussion, as will be noted in the conclusion.

Beside asserting the necessity of output-to-output Correspondence in OT, this article further asserts its sufficiency in dealing with allomorphy, leading to the rejection of the traditional notion of 'Underlying Representation' (Burzio 1994a, 1996a,b).

The article is organized as follows. In section 2 I consider the 'Correspondence' account of cyclic effect, essentially reviewing recent literature. In section 3 I compare the notion of 'input' in OT with the traditional notion of underlying representation, giving reasons why, unlike the former, the latter is dispensable in OT. In section 4 I turn to blocking in non-derived environments, distinguishing two different subtypes. One of the two subtypes, addressed in 4.1 and instantiated by English vowel shortening, will be shown to follow from the proposed approach, reducing to one of the expected ranking possibilities, but crucially only if there is no underlying representation. The second subtype, reviewed in 4.2 and represented by Finnish assibilation, will be shown to be consistent with that conclusion, but require a somewhat different account, along the lines of Kiparsky (1993). Subsection 4.3 briefly reviews the theoretical history of blocking in non-derived environments, while 4.4 addresses the special status of affixes, which do not appear to behave like other derived environments. Section 5 concludes.

2. Cyclic Effects

In Burzio (1994a) (henceforth 'PES') I provide detailed arguments that the stress of the italicized vowels in both (3b) and (4b) reflects a direct, surface-to-surface 'metrical consistency' with the corresponding items in (3a), (4a) rather than the principle of the 'cycle' or some other special provision.

(3)	a.		b.	
		med**í**cinal		med**ì**cinálity
		div**í**sible		div**ì**sibíliy
		nap**ó**leon		nap**ò**leónic
		acc**é**leràte		acc**è**lerátion
		ant**í**cipàte		ant**í**cipatòry
		phen**ò**menólogy		phen**ò**menológic
		pers**ó**nify		pers**ò**nificátion

		assímilable	assìmilabílity
(4)	a.	accépt	accéptable
		propagánda	propagándist
		américan	américanìst

Specifically, the organization held responsible for the patterns of stress preservation in (3), (4) is the constraint hierarchy in (5) (PES, p. 165f, 312f.).

(5)	a. Metrical Well-formedness	(MWF)	>>
	b. Metrical Consistency	(MC)	>>
	c. Metrical Alignment	(MA)	

The MC of (5b) is an instance of OO-F, imposing metrical identity of surface forms. The metrical constraints in (5a,c) each standing for a small cluster of constraints, are both instances of Phon. Roughly speaking, the first defines the range of well-formed feet, and the second imposes alignment of metrical structure with phonetic edges. Given the ranking in (5), MC is correctly predicted to succeed in misaligning the metrical structure at either edge as in (6), but not in enforcing exceptional feet as in (7).

(6)	a.	me(dìci)(nálity)	b.	a(mérica)(nìstϕ)
(7)	a.	*(cómpensa)tòry, *(làryngo)lógic	b.	*ca(tàs)tróphic, *e(xìs)téntial

In (6a) the metrical structure is misaligned at the left edge as an overt syllable remains unparsed, while in (6b) there is misalignment at the right edge as a non-overt syllable is parsed. (In (6b), there is also a misalignment at the left edge, but that is independent of MC). In (7), on the other hand, each of the marked feet, which would satisfy MC (relative to *cómpensàte*, etc.) is disallowed by higher ranked Metrical Well-formedness (there are no unary feet or ternary feet *(σHσ)* in the PES analysis). Hence MC must be violated, as in *compénsatòry*, etc.

The hierarchy in (5) of PES is an instance of the ranking schema in (1b) above in the way illustrated in (8).

(8)	a.	MFW	>>	MC	>>	MA
	b.			OO-F	>>	Phon >> IO-F

The OO-F of (8b) is instantiated by MC just above it, while Phon is instantiated by MA. As for the IO-F of (8b) it is implicitly instantiated by the assumption of PES that English stress is prevalently regular rather than lexicalized. In OT, this entails that the phonology must dominate IO-F.[1]

[1] It is worth noting, however, that there is a certain degree of *ir*regularity, especially where lower-ranked MA is involved. Many nouns and adjectives exhibit the misalignment of *ro(bústϕ)*, *ce(méntϕ)*

This reanalysis of 'cyclic' effects carries over to the noted failure of vowel reduction in *còndˈ[e]ns-átion*, assuming the partial mini-grammar in (9).

(9) OO-F >> *V >> IO-F

In (9), ***V*** is taken to refer to full vowels and to be a member of a markedness hierarchy under which [ə] is the least marked vowel. Vowels will correctly fail to reduce in stressed positions assuming a higher ranked ('positional') IO-F constraint at work in those positions, along the lines of Beckman (1996). In *condˈ[e]nsation*, failure of reduction will be compelled by the higher ranked OO-F in (9), given *condˈ[é]nse*.[2]

The above account of cyclic effects is modeled on the account of misapplication of phonology in reduplicative systems of McCarthy and Prince (1995) (henceforth 'M&P'), who develop the formal theory of 'Correspondence'. They identify two instances of correspondence, each imposing identity or 'faithfulness' constraints: Input-to-Output correspondence, and correspondence between Base and Reduplicant. The first results in IO-faithfulness constraints, which take over the role of the 'Parse' and 'Fill' constraints of Prince and Smolensky (1993). The second results in BR-faithfulness, now an instance of the more general OO-faithfulness of the present and other recent discussions.

M&P note misapplications of phonology such the one in (10) in Madurese.

(10) **ỹã**t-n**ẽỹã**t 'intentions'

In Madurese, vowels are nasalized if and only if they follow a nasal, as in the base form *nẽỹãt* in (10). In reduplication, however, they can be induced by reduplicative identity, as in the reduplicant *ỹãt*, where no nasal precedes. Cases like (10) will receive a Correspondence account in terms of the ranking in (1b)/ (8b) above. By dominating IO-F, certain members of Phon will give rise to the regularity observed in the base *nẽỹãt*, while by being dominated by OO-F they will allow the apparent violation of that regularity in the reduplicant *ỹãt*. Just as the phonological cycle once seemed applicable to some of the cases in (3) above, so it may at first seem applicable to cases like (10) as well. Nasalization would apply on the root cycle, only then followed by reduplication. M&P point out cases like (11), however, in Klamath.

(while that of verbs and of adjectives in *-ic* follows from MC (PES, Burzio 1994b). Since this occurs in a minority of cases, the facts are consistent with the ranking in (8), aside for the problem, which unique/ unambiguous ranking cannot deal with, of accounting for semi-regular patterns.

[2] Matters are more complex along several different dimensions, though, as noted in PES, 4.4. Reduction does not fail in all such cases, e.g. *infˈ[ə]rmation*, and does not otherwise succeed in all unstressed positions: *pródˈ[ʌ]ct*. This would seem to require further elaborations on the notion of positional IO-F. Note also that minimal pairs like *mórˈ[ʌ]n*, vs. *áprˈ[ə]n* raise a variability issue similar to that of the preceding footnote: IO-F is generally but not always and completely overcome by Phon.

(11) a. hosc∂nwa ‘makes vomit’ b. Wic-W**i**cl’i ‘stiff’

In Klamath, vowels are reduced in non-initial closed syllables, as in (11a). Under reduplication, this part of the phonology misapplies, however, as in (11b). This case is different from the Madurese one in (10) because here misapplication occurs in the base. That difference makes it completely intractable in derivational terms, as morphological and phonological operations cannot be ordered relative to one-another (the standard impasse of serialism). In (11b), correct reduplication presupposes the correct form of the base, and vice-versa. In contrast, the misapplication of phonology in (11b) continues to follow from domination by OO-F as in (1b)/(8b). However the difference between (10) and (11) is not captured by the present discussion, which somewhat simplifies M&P's. Our ‘Phon’ of (1b)/ (8b) actually lumps together two of M&P's constraints, a general markedness constraint and a context-specific constraint. The former-type constraint rules out nasalized vowels in Madurese and unreduced vowels (in closed syllables) in Klamath. The latter-type constraint, dominating the former, imposes nasalized vowels in post-nasal contexts in Madurese and non-reduced vowels in initial syllables in Klamath. The ranking ‘OO-F >> Phon’ of the present simplified discussion in fact only holds relative to the more general markedness constraint, the more specific one remaining undominated. On this more fully articulated account, the Phon constraint will now correctly apply in whichever component --base or reduplicant, the specific, undominated constraint targets. Misapplication will occur in the other component, only targeted by the general markedness constraint, whence the difference between (10) and (11) (see M&P for greater explicitness on this point).

The Klamath case in (11) refutes rule ordering and the cycle in ways similar to the pairs in (12) on the PES analysis.

(12) a. pre(v**é**ntɸ)/ pre(v**é**nting) b. aca(d**é**micɸ)/ aca(d**é**mical)

Verbs and adjectives in *-ic* have exceptional stress patterns, a ‘misapplication’ consisting of a violation of Metrical Alignment (5c) above. Their affixed forms in *-ing* and *-al* respectively, however, have regular stress patterns. This behavior can be shown to follow from OO-F under the same ranking needed for the cases in (3) and (4) above if each pair in (12) is evaluated as a whole, like the base-reduplicant pair in (11). Other initially similar pairs behave differently, however. E.g. *paréntal* does not result in **pa(réntɸ)*, despite similarly misaligned *ce(méntɸ)*. The nature of the distinction seems clear at least intuitively, although it will not be pursued formally here. In general, calculation by correspondence seems to activate only items that are immediate substrings or (co-strings) of the candidate, as in the cases in (3) and (4). Activation of superstrings, as in (12) seems to occur only with closely related items, strictly sharing syntactic category and semantic content. (For a partially different view, and its formal implementation, see Benua 1997). Both the cases in (11) and those in (12) would then point to the generalization being not quite in terms of ‘derived’ environments, but more broadly in terms of environments to which OO-F is relevant. It is this broader generalization that proves the ‘cycle’ ineffective.

M&P's theory of OO-Correspondence has been extended beyond the domain of reduplication in McCarthy's (1996) study of Rotuman, in Benua's (1995, 1997) comprehensive study of ‘Transderivational Identity Effects’ and in Benua and McCarthy (this volume), bringing M&P's line

of work, direct descendant of Prince and Smolensky (1993), closer to the already similar, if less formally developed, positions of PES. Other researchers have also effectively asserted the role of OO-Correspondence within OT over that of derivations, notably Buckley (1995), Duanmu (1996), Kenstowicz (1995), Itô and Mester (1996).

In sum, a clear consensus is emerging within OT research that phonological calculations relate surface forms to one-another. This conclusion is fully consistent with the 'parallel' character of OT, and removes one of the last vestiges of the derivational theory --the cycle. Empirical arguments against the cycle have relied on the observation that the actual generalizations are broader than the cycle could express, as shown by (11)-(12), while other arguments have used the opposite type of observation, that the actual generalizations are narrower than the cycle can express. As noted in PES (p. 187f), from the point of view of the cycle there is little reason why stem stress should be preserved in *medìcinálity* and the other cases of (3), but not in **catàstróphic* and the other cases of (7).[3]

The empirical inadequacies of the cycle have an expected echo at the conceptual level. A long tradition of use (insightfully reviewed in Cole 1995) has tended to obscure the fact that it is a stipulatory provision. It does not follow from the general theory that has underlying representations and rules that the rules should apply in cyclic order. The conclusion that in a structure **$[_B$ ...A ...]** the surface form of A must first be calculated to correctly calculate B is an admission that surface rather than underlying representation is relevant, contradicting the main premise. In contrast, OO-Correspondence is part of the main architecture of the theory, at least in the version of it defended here. It is not an ancillary notion alternative to the cycle, but rather a central one alternative to underlying representation, as we see in the next section.

3. The Input versus Underlying Representation

Reliance on OO-Correspondence by phonological analysis raises the natural question of whether morphological analysis should not just follow suit. That is, if the sound structure of *condensation* is calculated from the surface form *condense*, couldn't its morphological structure also just consist of the word *condense*, plus *-ation*, dispensing with underlying representation (UR) altogether? M&P's analysis of reduplication certainly suggests that morphology and phonology go hand in hand, the identity between base and reduplicant being equally relevant to both, and the present approach will explicitly assume an affirmative answer to that question. On such UR-less, but OO-Correspondence-based theory, words sharing a stem can be seen as in correspondence over that portion, and similarly for words sharing an affix. This conception, independently proposed in the context of an analysis of English stress in PES, turns out to be in essence the conception long

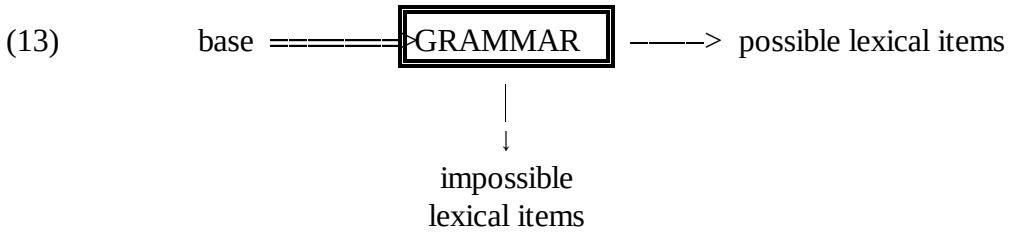
[3] The present approach is able to correctly broaden predictions that were too narrow (*prevént* <= *prevénting*) by generalizing over representations rather than derivations; and to correctly restrict predictions that were too broad (**catástrophic* <= *catástrophe*) by employing violable constraints, whose effectsare automatically suspended under domination.

advanced by J.Bybee (see Bybee, 1988, 1995). In turn, the latter seems implementable along OT lines under Correspondence theory. The proposed conception also has points in common with Aronoff's (1976, 1994) "word-based" morphology.

The type of misapplication of phonology reviewed above, then, suggests, by invoking OO-F constraints, that UR may be superfluous. The other type of misapplication, to be discussed in the next section, will indicate more explicitly that UR must not exist. Before turning to that case, however, it will be useful to distinguish the notion of UR, which need not exist in OT, from the notion of input, which obviously must.

The fist relevant notion to consider is that of the 'base'. In OT, the latter refers to the class of all possible inputs to the grammar. Since all definable properties of lexical items are attributed to the grammar in OT, none is attributed to the base, which is thus taken to be 'rich' (Prince and Smolensky's 'richness of the base'). As the class of all possible inputs, the base thus includes everything (every possible structure). Each grammar is thus such as to partition that class into possible and impossible lexical items, schematically as in (13).

(13)



The grammar has this effect by virtue of being an input-output device. Some inputs will have an output, others will not. The class of *actual* 'outputs', i.e. lexical items, will then be some (random) subset of the class of possible ones. The question that arises at this point is what is the class of *actual* inputs, given the class of actual outputs, graphically, as in (14).

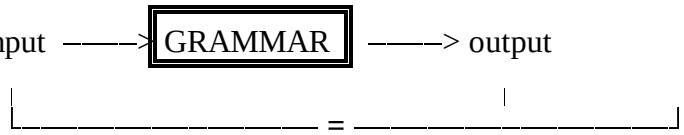
(14)

That class is indeterminate as things stand because, while the grammar gives a unique output given the input, it does not do the reverse. For example, the output *[ɔ́mérɔ́kɔ́]* could result from the exact same input, or from */æmerikʌ/*, given an appropriate grammar able to assign stress and reduce unstressed vowels. Some additional hypothesis is therefore necessary to identify the class of actual inputs given the class of actual outputs.

It will be useful at this point to address the problem in two steps and put aside for the moment morphologically derived (or otherwise dependent) items such as those considered in the previous section, whose calculation requires coordination with the other items (by OO-F, on the present approach). Concerning the other class, i.e. underived items, Prince and Smolensky (1993) (henceforth P&S) advance the hypothesis known as 'lexicon optimization'. On that hypothesis, the actual input,

among all the ones that would yield the correct output, is the one that does so 'optimally', that is with the least amount of constraint violation. It is easy to see that (remember: all allomorphy aside) this means that the actual input *equals* the actual output. The reason is that any input different from the output, like */æmerik/* for *[ə́mérəkə]* would only add violations of IO-F without ever avoiding any other violation in return.[4] Under P&S's lexicon optimization, then, the input-output relation is schematically as in (15).

(15)



This means that there are two conditions conjunctively relating input and output: identity and grammar-relatedness. So, for example *[ǽmerəkə]* is not a possible input-output because it fails to satisfy grammar-relatedness. Given to the grammar of English as an input, the latter would output *[ə́mérəkə]*, or perhaps *[ǽmerik]*, or some other, but not **[ǽmerəkə]*. In contrast *[ə́mérəkə]* is a possible input-output given the grammar of English.

Now the claim illustrated for P&S in (15) appears to be non-distinct (again: allomorphy aside) from the PES claim that there is only surface representation and no UR. The reason is that if input and output are identical, then surely there is only one representation rather than two, and the grammar is to be understood as a structure-checking device (e.g. like the 'binding theory' of syntax), rather than a structure changing one as in derivational theories.

Before putting allomorphy into the equation, one further important distinction related to the notion of input must be introduced. The grammar as given so far has one major internal partition: that between Phon and IO-F constraints. That partition reflects on the internal structure of the input-output. Under lexicon optimization, IO-F is always satisfied, but Phon is not. For instance, in *ə́mérəkə* there is one violation of *ONSET*, there are further violations involving the greater than minimal number of syllables, the marked character of various segments and so forth. Hence, not all input-output is alike. All satisfies IO-F, but some 'activates' IO-F constraints into compelling violations of Phon, while some does not, schematically as in (16).

(16)

	INPUT-OUTPUT. Internal partition:	**GRAMMAR**. Internal partition:
a.	Active: compels violations of Phon	IO-F

[4] This discussion is based on the first of two formulations of lexicon optimization P&S consider. The second formulation embodies the hypothesis that, everything else being equal, the input is minimally specified. So far as I can see at this time, this alternative would not lead to the conclusions drawn in the text. On the other hand, P&S do not provide concrete arguments to support such minimal specification hypothesis.

b.	Inactive: satisfies Phon	Phon

Clearly, the 'active' input-output in the above sense is the unpredictable part of the representation, which must thus be associated with memorization, while the inactive input-output is the predictable part and hence only possibly, though not necessarily, memorized. As P.Smolensky (p.c.) notes, the active/ inactive distinction in (16) may be indeterminate, due to the massive parallelism of the system. So for example in *[ærɔ̃zównɔ̃]* there is a violation of a Phon constraint '***V:**' barring long vowels, but there are two possible aspects of the input-output that could force that violation. One is the long vowel itself, the other is the stress. A non-derivational grammar of English allowing stressed penultimates only if they are heavy would be able to calculate either aspect from the other, thus leaving it indeterminate which is actually an active input, alias memorized. No general problem arises in this connection, so far as I can tell.

There is an important respect in which the distinction between active and inactive input is quite unambiguous, however. It concerns the difference between contrastive and non-contrastive variation, illustrated in (17a,b).

(17) a. **Non contrastive variation:** English *p/p*^{h}: *[p*^{h}*it/ spit]*

b. **Contrastive variation:** English *p/b*: *[rip/ rib]*

Under lexicon optimization, both types of variation are present in the input-output and all four sample words are represented in their phonetic form. The difference between the two cases is that only in (17b) is the variation due to active input. Specifically, the *[b]* violates a markedness constraint barring voiced obstruents, so that that combination must thus be specified in the (active) input. In contrast, the *[p]* satisfies that constraint and hence involves no active input, at least relative to that constraint. The variation in (17a), on the other hand, is not due to active input at all. The marked member of the pair, namely *p*^{h} is present in the output because of a specific phonological constraint imposing aspiration of obstruents in onset position. Hence non-contrastive variation instantiates the ranking 'Phon >> IO-F' (input inactive), while contrastive variation instantiates the opposite ranking 'IO-F >> Phon' (input active). This is what makes the former predictable or 'allophonic' while the latter is unpredictable. (See also Kirchner, 1996).

Variation which is contrastive and unpredictable in general could still be predictable in specific contexts. For instance the distinction between nasal *n, m* is contrastive in general: *dine/dime*, but is neutralized in nasal-obstruent clusters: *cou[n]t, ba[ŋ]k, ca[m]p*. This results from the fact that, while IO-F dominates the a-contextual markedness constraint that -let us say- rules out more marked *m*, it is in turn dominated by a specific constraint ruling out non-homorganic nasal-obstruent clusters. In contrast, IO-F is dominated by both contextual and markedness constraints in the aspiration-type variation. The three different situations are summarized in (18), where the intended effects of individual constraints are given in parentheses.

(18) a. **Non-contrastive variation: English *p/p^h***

$Phon_{context}$ >>	$Phon_{mark}$ >>	IO-F
(aspirate onsets)	(*aspirated obstruents)	(aspirated obstruents)

b. **Contrastive variation never neutralized: English *p/b***

IO-F >>	$Phon_{context}$ >>	$Phon_{mark}$
(voiced obstruents)	(e.g. final devoicing)	(* voiced obstruent)

c. **Contrastive variation neutralized contextually: English *m/n***

$Phon_{context}$ >>	IO-F >>	$Phon_{mark}$
(nasal assimilation)	(labial & nasal)	(*labial & nasal)

Note that (18b) presupposes the existence not only of a markedness constraint, but also of some contextual constraint(s) such as the one(s) responsible for final devoicing in languages like German or Russian, although neither Phon constraint will have any effect under that ranking (e.g. in English). We thus take the same constraint types to be involved in all cases, each type of variation resulting from a different ranking schema.

Hence, the expressive power once held in terms of whether or not some variation was 'underlying' is retained in terms of whether or not that variation is present in the *active* input (all variation being present in the input at large under lexicon optimization). Note here that, similarities notwithstanding, the 'active' input is not just the old UR under a different name. The reason is that, unlike UR, the active input cannot be characterized as a level in any meaningful sense. While a 'level' is generally defined by its inherent properties, the active input has no inherent properties. The latter consists of any array of features (using this term broadly to include prosodic and autosegmental structures) chosen from the range of possibilities permitted by the grammar. Hence all the properties that the active input does have are grammar-given rather than inherent. For instance, the *p/b* distinction in English is part of the active input by virtue of the ranking in (18b), a property of the grammar. In contrast, the *p/p^h* distinction is *not* part of the active input, and that is by virtue of the ranking in (18a), again a property of the grammar. Matters are quite different for the traditional UR. In terms of the latter, the difference between the two types of variation -- *p/p^h* and *p/b* is only partially attributable to the grammar, alias the 'rules'. One may presume the existence of a rule turning *p* to *p^h* in contrast to no rule turning *p* to *b*, but, to correctly characterize the facts, one needs to postulate in addition that *p^h* cannot be present in UR, while *b* can. That is to say, one needs the notion of 'underlying' inventory, a notion which is not definable via the rules of the grammar and is hence an inherent property of UR. To the extent that inventories appear to be principled rather than random sets, some principles will be needed, but traditional rules prove ineffective in subsuming such principles (Kisseberth, 1972), whence a need for a UR, which thus not only collects the idiosyncratic and unpredictable but also has specific inherent properties.

In sum, under 'richness of the base', all properties are grammar-given. To the extent that a 'level' is defined as a coherent representation of specific properties, there is no level of UR in OT, aside from allomorphy. The reason is that, while one can refer to the unpredictable aspects of an output representation as the 'active' input, there are no inherent properties to that notion, since active input is simply that input for which the ranking 'IO-F >> Phon' holds --a property of the grammar.

Turning now to allomorphy, on the radical version of Correspondence theory that has no UR altogether, the above picture remains substantially unchanged. The only change will be that one more set of constraints is added to the grammar: OO-F constraints, expressing a second type of faithfulness, parallel to IO-F. Just as IO-F constraints interdigitate with Phon constraints, so OO-F constraints will interdigitate with the other two types to yield the overall hierarchy. Then, just as it partitioned the 'input' representation in the way illustrated in (16) above, the set of Phon constraints will also partition the representation of the 'correspondent', where the 'correspondent of α' is a representation ß referred to by OO-F constraints in the calculation of α.[5]

On the present approach, morphologically related items, like *electric*/ *electric-ity* can have independent active inputs even over the portions that they appear to share morphologically. This will be a major departure from mainstream generative tradition, that has always maintained a common UR/ input. The effects formerly attributed to a common UR/ input will follow here from OO-F.

There is evidence that OO-Correspondence can apply multiply. For instance, in Italian, several formation based on *-ere* conjugation verbs are transparently in correspondence with both the participle and the infinitive simultaneously, as with *ascens-ore* 'elevator' based on the participle *asces-o* 'ascended', but featuring the *n* of the infinitive *ascend-ere* 'ascend' (see Burzio, 1996b). This raises no formal problem within OT, since multiple sets of OO-F constraints, with independent rankings, can all apply simultaneously. It does raise the empirical problem of determining, independent of phonological analysis, which items are allowed to be correspondents to which others, and by what ranking of OO-F constraints.[6] The general assumption underlying the present conception is that OO-Correspondence relations are established by shared content in sound and meaning. This view makes no distinction between stems and affixes, and hence accounts for the fact that affixes tend to be metrically stable just like stems do, as argued in PES and illustrated in (19).

(19)	títan	ti(tánicɸ) /	*(títani)c
	tríumph	tri(úmphan)t/	*(tríum)(phàntɸ)

[5] In general, any subset S of the full constraint hierarchy H will partition both input and correspondent into their parts which are active and inactive for S.

[6] But the problem is independent of theoretical choice. It also arises if UR is used, in the form of establishing how much weight to give to each surface allomorph in the determination of UR, independent of the specific facts at hand.

The failure of the stems in (19) to preserve their stress under affixation (in contrast to the cases in (3), (4) above) requires postulating that the affixes themselves are being metrically consistent, parsing as they do in other items (see PES, p.226f, 263f, 302f). In a system without UR, affixes are simply parts of items that, collectively, stand in correspondence over that part, hence another instance of multiple correspondence. The question that arises perhaps generally, but perspicuously with affixes, is the following. When intems stand in OO-Correspondence such that the active input of one results in some output in others because of OO-F, to which of the items must the active input be assigned, and which of the others are to be taken to have merely OO-faithful representations? In the specific case of affixes, e.g. English *-ic*, the question will be which of *academic, napoleonic, tonic*, etc. has the active input, specifying segmental content and metrical properties of *-ic*, and which others merely inherit them via OO-F?[7] The answer is that, in the general case, the issue is indeterminate, and it will in fact not matter which of the above items has the active input, so long as OO-F is satisfied. This is similar to the indeterminacy of the active input in *ær♂zówn♂* noted above (either the long vowel or the stress). No adverse consequence ensues from this indeterminacy --a chicken-and-egg situation due to the parallel architecture with its mutual interdependencies. The only cases where it will matter which item has the active input are those in which OO-F is violated. For example, for the item *cátholic* there must be some active input specifying the exceptional metrical parse *-i)cϕ*, which would otherwise give **ca(thólicϕ*). That input can be common to *árabic* and a few other similar exceptions, creating again some indeterminacy within the class of exceptions, a class which is internally regular. The point is that there must be a difference in active input distinguishing the 'regular' (majority) class from the 'irregular' (minority) one. Hence at least one member of each class must contain the active input relevant to the distinction. The other members need not contain any active input, except for some minimal specification identifying them as members of the relevant class. Their output will otherwise follow from OO-F. As another example, the *in-/il-* allomorphy of *in-active, il-legal* will require that the nasal be specified in the input of at least one member of the class of prevocalic *in-*'s. The class of *il-* allomorphs will arise as a violation of OO-F compelled by a high-ranked member of Phon imposing assimilation. Hence the *académic*/ *cátholic* allomorphy, metrically: *-icϕ)* versus *-i)cϕ*, results from the ranking 'IO-F >> OO-F', while that of *in-active, il-legal* is due to the ranking 'Phon >> OO-F'.

There is one particular class of cases that may seem to reassert the existence of UR against the present proposal, illustrated by the pair *dam(n)/ damN-ation*, in which the *n* is phonetically present only in the noun. An analysis based on the UR */damN/* accounts for the contrast in terms of a constraint or rule simplifying word-final clusters. In contrast, the present approach needs to postulate that that the *n* is part of the input (active, relative to OO-F) of the noun, raising the question of why, alongside of this contrast, one does not find, for instance **confir/ confirM-ation*, where the *m* would also be in the input just for the noun. The advantage provided by UR in this connection disappears, however, if we evaluate candidate pairs in the manner of (20).

[7] Thanks to P.Smolensky for bringing this to my attention.

(20)		with UR		w/o UR	
		Phon	IO-F	Phon	OO-F
a. damn	damn-ation	*		*	
b. dam	damn-ation		*		*
A. confirm	confirm-ation				
B. confir	confirm-ation		*		*

The two systems (with and without UR) are equivalent because they give equivalent evaluations of each set of candidate pairs. It is clear from this comparison that the pair in (B) is more marked than the one (b). The reason is that (B) loses to (A) in a way in which (b) does not lose to (a). What makes the difference is the phonology, which blocks (a) by means of the prohibition against final clusters *mn*, not matched by a comparable prohibition against the final *rm* of (A) . Hence the asymmetry between (b) and (B) in (20) is traceable to the phonology in the UR-less system, just as it is in the UR-based one. The difference is that the present system, which can specify independent inputs for the noun and the verb, sees the pair **confir/ confirMation* as only marked rather than impossible, in contrast to the UR-based system, that has no way to express this phonologically unmotivated divergence from a common UR. Far from being incorrect, the prediction of the present system is is massively fulfilled within 'level 1' morphology, where irregularity of this sort runs rampant, as in *compEl/ compUlSive*, where the portions in caps must be given by independent inputs --a point to which I briefly return.[8]

In sum, in the class of cases like *dam(n)/ damNation*, in which some element of UR would have surfaced only in an affixed form and not in its base for phonological reasons, the present approach will postulate an active input in the derived form which, in a sense, will also fail to generalize to the base for phonological reasons, namely 'Phon >> OO-F'. Hence there seems no loss of generalization in the reinterpretation of this class of cases, that has many other members in English,

[8] Note, however, that this discussion raises a rather fundamental issue, tackling which is beyond the scope of this paper, of how to formally prevent the type of global evaluation used in (20) from eliminating all irregularity. Allowing the latter evaluation, based on comparison of candidates that have *different* inputs, is tantamount -by giving preference to candidates with more harmonic inputs- to a reversal of the ranking "IO-F >> OO-F" into "OO-F >> IO-F", which should eliminate morphological irregularity. In particular, in (20) actual *dam/ damnation* should lose to more OO-F-harmonic **dam/ damation*. This is not incorrect in general, given comparable sum/ summation, but it is not true of this specific pair. The problem is in the empirical dichotomy of domains such as English "level 1" affixation that combine considerable idiosyncrasy with considerable regularity.

Thanks to Laura Benua for stimulating discussion of this class of cases, though the views express here do not necessarily agree with hers.

like *bom(b)/ bomBard*, *lon(g)/ elonGate* (see Borowsky, 1993) and other languages. English vowel reduction also gives rise to cases of this sort rather massively. E.g. in *par[é]ntal*, the *e* must be present in the active input of this item, given its absence in the base form *[pærəɹnt]*.

To recap this section, P&S's conclusion that, under 'lexicon-optimization' and aside from morphological relatedness, the input equals the output, and the PES's conclusion that there is no UR, appear to be non-distinct conclusions. If input equals output, then there is a single representation, which the grammar 'checks' for well-formedness. Some of the input-output is 'active' relative to phonological constraints in the sense of inducing their violation, while some is inactive. 'Non-predictable' or contrastive variation is registered in the active input, while 'predictable' or non-contrastive variation is that which is present only in the non-active input. The 'active' input is similar to the old UR in some respects, but it is not a 'level' in any reasonable sense, because it lacks inherent properties.

In dealing with allomorphy, P&S's use of the traditional UR does constitute a substantive difference from the position taken in PES. However, the further developments of OT in McCarthy and Prince (1994, 1995, to appear), Benua (1995, 1997), Benua and McCarthy (this volume) and others, point to further convergence, acknowledging at least the superfluousness of UR, in various classes of cases. In the following section we see an argument that UR is not just superfluous but false.

4. Derived Environments

Many cases have been brought to light in which some phonological regularity occurs only in morphologically derived environments, an effect labeled as 'Non-Derived Environment Blocking' (NDEB). Although all such cases have generally been regarded as constituting a single generalization, it now appears that two different subcases need to be distinguished. The first subcase is illustrated in (21).

(21) a. electri[s]-ity, lyri[s]-ist, opa[s]-ify
b. [k]ick, a[k]in, bas[k]et, tro[k]ee, leu[k]emia, ar[k]eology

In the derived environments of (21a) velar softening occurs (compare *electri[k]*, etc.), while in the underived envoronments of (21b) it does not. The environments of (21a) are derived not only morphologically by involving affixation, but also *phonologically*, in the sense that affixation crucially creates the structural conditions relevant to the velar softening generalization: '*k / __ i'. Matters are different for the cases in (22), which exemplify the other subcase.

(22) a. i) div[i]n-ity, n[æ]tur-al, t[æ]bul-ar,
ii) blasph[ə]m-ous, asp[ə]r-ant, molec[yə]l-ar
iii) im-m[ə]grant, bi-c[ə]cle, anti-th[ə]sis
iv) expl[ə]n-ation, prov[ə]d-ential, volc[ə]n-ology

b. v[ay]tamin, d[ay]nosaur, d[ay]namo

As argued in PES (esp. sectn. 10.3), the vowel shortening of each of the cases in (22a) contrasting with the lack of shortening in (22b), reduces to the single constratint in (23).

(23) **Generalized Shortening**: *V in affixed environments

If this account is correct, the cases in (22a) are 'derived' in an exclusively morphological sense, the affixation contributing nothing specific to the phonological environment.

In this section, I will first consider this second case of NDEB in 4.1 below, arguing that, within OT, it simply reduces to the 'emergence of the unmarked' in the sense of McCarthy and Prince (1994). Crucially, however, this will hold only if UR does not exist. In 4.2, I will then turn to the other case of NDEB, exemplified in (21), adopting in part the analysis of Kiparsky (1993). In subsection, 4.3 I will then briefly review past accounts of NDEB, and in 4.4 turn to the special status for NDEB of the affixes themselves.

4.1 Morphologically derived environments

A very long tradition had distinguished the 'trisyllabic' shortening of (22a,i) from the other cases of shortening. If one accepted that distinction and focused attention on the trisyllabic cases, it would then appear as if the phonologically relevant environment arose via affixation (which always adds some syllables). As argued in PES, however, that distinction is spurious, since there is no phonological environment in which shortening is not attested --foot antepenultimate, penultimate, and final --each illustrated in (24), exhausting the range of possibilities.

(24)

		GS	SP
a.	diví:ne di(vínity)		
b.	blasphé:me (blásphemou)s		*
b'.	desí:re des(í:rou)s	*	
c.	expláin (èxpla)nátion		*

There is one important *descriptive* difference among the various environments: shortening in foot penultimate syllable as in (24b,b') is sporadic as shown by the (b/b') contrast (and *excí:tant*, *homicí:dal*, *bipó:lar*, *unicýcle* compared with (22a,ii,iii). But this follows from the fact that in this and only this environment Generalized Shortening (GS) (23) is in conflict with Metrical Consistency (MC) (5b) above, an instance of OO-F. Assuming a tie between them will make sense of the variation in (24b,b'), simulataneous satisfaction of both constraints being blocked by undominated Metrical

Well-Formedness (5a), an instance of Phon. In contrast, no conflict arises in 'trisyllabic' (24a) or in (24c), in the former case because both of GS and MC can be satisfied silmultaneously under Metrical Well-Formedness, in the latter because violation of MC is compelled independently of GS by Metrical Well-Formedness (PES, sectn. 10.3).

The PES analysis thus reduces the considerable descriptive complexity of English vowel shortening to GS (23). The question it leaves open is what is the nature of GS. The answer to that question seems now quite clear in the wake of both Prince and Smolensky (1993) and McCarthy and Prince (1994). The first part of GS, given in (25), is simply a markedness constraint of the type proposed in Prince and Smolensky (1993, ch. 9), expressing the fact that long vowels are universally marked (hence ranked above the corresponding markedness constraints for short vowels, which was used in (9)).

(25) **Markedness**: *V:

The second part of GS, singling out morphologically derived environments, is the same effect found in the 'emergence of the unmarked' cases that McCarthy and Prince (1994) attribute to the ranking in (2b) above, repeated in (26).

(26) **Emergence-of-the-unmarked schema**: IO-F >> Phon >> OO-F

McCarthy and Prince (1994) consider discrepancies between base and reduplicant such as those in (27) (See also Alderete et al (1996)).

(27)	a. Diyari:	**tʲilpa-tʲilpa**rku	(less marked prosodic structure)
	b. Nookta:	**či-čim**s-`i:ħ	(less marked syllable)
	c. Tülatulabal:	**?ɨ-pɨtɨ**ta	(less marked segment)

They argue that such discrepancies follow from the schema in (26), where the specific instances of OO-F involved are among the constraints that regulate the identity of Base and Reduplicant (Max, and Base-Dependence). The base is able to display more marked structure than the reduplicant, because such markedness is defined in terms of (some members of) Phon which is dominated by relevant IO-F constraints --the usual account of marked structures. The reduplicant, on the other hand, exists solely by virtue of its relation with the base, a relation separate from (though similar to) that between input and output and thus subject to separate constraints, apparently lower ranked for each of (27), whence the stronger effects of Phon over the reduplicant.

Now shortening as in *divi:ne*/ *divinity* will receive the comparable account of (28).

(28) input: */diví:n/*

IO-F	Phon: *V:	OO-F

a. dívin	*		
b. diví:n		*	

correspondents: */diví:n/* */+ity/*			
c. diví:nity		*	
d. divínity			*

The tableau in (28) assumes that calculation of unaffixed *diví:n* does not rely on OO-F. Recall that this is general, but an issue that remains to be explored, bare verbs like *prevént* exhibiting correspondence effects with their affixed forms, like *prevénting*, while there seems no comparable effect relative to nouns, e.g. **parént*/ *paréntal*. The calculation of *diví:n* in (28) would actually remain unaffected under participation of OO-F (see, however, discussion of (34) below). On the other hand, the calculation of the affixed form *divinity* crucially requires non participation of IO-F, entailing the conclusion in (29).

(29) There is no 'Underlying Representation'.

The reason is that UR is precisely the hypothesis that there is a common input to allomorphs of the same morpheme. On that hypothesis, *divinity* would violate IO-F, just like **dívin*, and GS (23) would remain a mystery.

In the particular case of 'trisyllabic' shortening, an alternative may seem available that would not not exclude UR. One would take the stress to be the active input, common to both basic and derived items. A long vowel, violating GS, would then be compelled in *diví:n* by undominated metrical constraints, but not in *divínity*, given the antepenultimate syllable. As argued in PES (ch.5 and 10.3), an analysis that derives vowel length from stress is viable in many cases but ultimately fails, however, as can be seen from (30).

(30) a. rább**i:** rabb**í**nic
b. syllábi**fy:** syllàbifi̲cátion
c. blasph**é:**me bláspheˍmous

Neither of the long vowels in (30a,b) are stressed, as argued in PES (p.48-52), hence vowel length must be part of the active input. Those long vowels will be predicted not to surface in the affixed items only if they do not share that input (UR) with the basic forms --the conclusion drawn for (28). Underlying (active input) stress is thus insufficient for (30a,b). It is furthermore false for (30c), where it would yield a ranking paradox, since IO-F for stress must dominate ***V:** for *blasphé:me*, but must

be dominated by it for *blásphemous*. In contrast, the account of (28) extends directly to each case in (30), the variability of penultimate shortening shown by (30c) versus *desí:re*/ *desí:rous* followong as in (24) above.

This accont of English vowel length allomorphy has thus eliminated all language-specific properties, leaving only constraint ranking. GS (23) reduces to a universal markedness constraint targeting long vowels. In English, this constraint will be violated in underived environments because dominated by IO-F. It will be satisfied in derived environments in general because it dominates OO-F, and will be violated again in a specific set of derived environments where it ties with Metrical Consistency, a specific instance of OO-F. Cross lingusitic variation, due to re-ranking of ***V:** will be expected to yield the following three basic types.

(31) a. IO-F >> OO-F >> *V: (Latin)

b. IO-F >> *V: >> OO-F (English)

c. *V: >> IO-F >> OO-F (Italian)

The case in (31a) is that of a language with distinctive vowel length in all environments, such as Latin. The case in (31b) is that of English, with distinctive vowel length neutralized in derived environments. That of (31c) is the case of a language without distinctive vowel length, like Italian. A comparison of English with Italian is in fact of further relevance.

Italian does have long vowels in stressed open penultimates, e.g. *anc[ó:]ra* 'still', like English, but, unlike English, only in such environments. This follows from the two different ranking schemas for contrastive and non-contrastive variation given in (18) above and repeated here.

(32) a. **Non-contrastive variation**: $Phon_{context}$ >> $Phon_{mark}$ >> IO-F

b. **Contrastive variation**: IO-F >> $Phon_{mark}$

While, in English, variation in vowel length is due to the ranking (32b), in Italian it is due to (32a), namely the fact that, although the markedness member of Phon, ***V:** dominates IO-F as in (32a), it is itself dominated by a contextual member of Phon that excludes stress on light penultimates -- in the PES analysis, the ill-formed trochaic foot *(Lσ). Such constraint will compel a violation of ***V:** exactly in stresses open penultimates, whence the fact that long vowels exist only in this context. Some other constraints must impose stress on those syllables, however, and that must be IO-F_{stress}, also dominating ***V:**. Hence Italian has 'contrastive' stress, as shown by minimal pairs like *ancóra*/ *áncora* 'still'/ 'anchor' (with *o* phonetically long in the first item), while it does not have contrastive vowel length. One could not have claimed that Italian had 'underlying' stress, however (again revealing the inadequacy of UR), because the constrativeness of stress is neutralized elsewhere. So there is no antepenultimate stress over heavy penultimates (**ágosto*), and no pre-antepenultimate stress (**ámerica*). This follows from taking IO-F_{stress}, which dominates ***V:**, to be in turn dominated

by constraints on well-formed feet --the PES's 'Metrical Well-Formedness' (MWF) set of (5a) above, including the *(Lσ) just mentioned. The overall ranking in Italian is then as in (33).

(33) $\underset{\text{(M WF)}}{\text{Phon}_{\text{context}}}$ >> $\text{IO-F}_{\text{stress}}$ >> $\underset{\text{(*V:)}}{\text{Phon}_{\text{mark}}}$ >> $\text{IO-F}_{\text{V-length}}$

In (33), the constraints relative to vowel length (first, third and fourth) instantiate the non-contrastive variation schema (32a), while the stress constraints (first and second) instantiate the schema for contextually neutralized contrastive variation (18c) above, except for the absence of the markedness constraint (for stress), inconsequential given its bottom rank.[9]

Note that if we take English to simply reverse the ranking of the last two constraints in (33), we will expect that English could also compel long vowels by $\text{IO-F}_{\text{stress}}$ like Italian, in addition to doing so by $\text{IO-F}_{\text{V-length}}$. This is in fact the indeterminacy of *arizó:na* noted above: either the long vowel or the penultimate stress could serve as the active input. In its Italian counterpart *arizó:na* there is no such indeterminacy: stress is the active input.

In sum, while it may have seemed completely impossible to reduce the radically different distributions of vowel length in English and Italian to the same 'rules' (say with different orderings), they do reduce to the same constraints, but with different rankings. Italian vowel length is non-contrastive because IO-F is subordinate to Phon. In English, it is contrastive in non-derived environments because IO-F is superordinate to Phon. The contrastiveness disappears in derived environments because those generally invoke lower-ranked OO-F, subordinate to Phon.

Derived forms can still exhibit some idiosyncrasy of vowel length in English, as in *desi:rous* versus *blasphemous*, or *obe:sity* versus *divinity*, though not in Italian. This follows from the same ranking 'IO-F >> Phon' of (28)-(31b) for English versus the opposite ranking for Italian, the idiosyncrasy coming from active input associated directly with the derived form. Note here that the ability to associate active input directly to morphologically complex forms may seem to void the asymmetry that GS (23) correctly expressed (if only by stipulation) by making explicit reference to 'affixed environments'. That is, the question is now why aren't pairs like * *blásphem*/ *blasphé:mous* attested, violating OO-F, but satisfying ***V:** in one member, just like the actual pair. This asymmetry now reduces to the one needed for **parént*/ *paréntal*. That is, in general, unaffixed forms seem to be calculated solo, rather than by OO-Correspondence. The asymmetry is then accounted for as in (34).

(34)

	IO-F	*V:	OO-F
a. blasphé:me		*	
blásphemous			*

[9] One could simply postulate a '* metrical structure' constraint.

b. blásphem			
blasphé:mous		*	*

In (34) both *blasphé:me* and **blásphem* are optimal for their inputs. However, there is a crucial difference between actual *blásphemous* and **blasphé:mous*. The former is optimal so long as ***V:** and OO-F tie as we are assuming. The latter, however, is optimal on an input-long vowel only if IO-F dominates not only each of ***V:** and OO-F but also their conjunction, which is evidently not the case. Rather, the latter conjunction --a local conjunction in the sense of Smolensky (1995), must dominate IO-F.[10] On this account, input long vowels in affixed items will only be expected to surface when they correspond to long vowels of the base item, exactly as in *obé:sity* and *desí:rous*.[11]

One important restriction exhibited by NDEB is that it is only found with 'contrastive' type variation, that is variation that neutralizes constrastive distinctions, such as English vowel shortening, which neutralizes the distinction betwen short and long vowels, a contrastive one, given *fi:ne*/ *finn*, etc. NDEB is not found with the other, 'predictable' type of variation, like English aspiration, which applies to all environments, derived or not (*p^hit/ rap^{h}idity*). This restriction is directly accounted for by the above discussion, specifically by the inconsistency of the ranking schemas in (18a) and (26), repeated in (35).

(35) a. **NDEB**: IO-F >> Phon >> OO-F

b. **Non-contrastive variation**: Phon >> IO-F

In order to be confined to derived environments, a variation must fit the schema in (35a), but in order to be non-contrastive, it must fit the one in (35b) --a contradiction. We have seen that there is a sense in which Italian also has vowel shortening, like English. However, Italian shortening is non-contrastive, and as we now expect, it makes no distinction between derived and underied environments.

The above account, which sees NDEB essentially as phonological regularization in derived environments, will carry over to cases like (36) (PES p.323, fn.7).

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[10] Note that PES does not presuppose strict domination of constraints, but rather numerical ranking. See the analysis of items in *-ary*/ *-ory*, p. 237-239. Smolensky's 'local conjunction' is a way to allow numerical-type ranking under specific circumstances.

[11] Note that this reasoning, required for (34), raises the issue of fn.8. In the case of (34), evaluation is by item, rather than setwise, unlike in (20). This leads to the conclusion that both types of calculations are relevant, which is not contradictory so far as I can see.

(36) a. órchestra b. orchéstral

The underived item in (36a) is a relatively rare case of antepenultimate stress in the presence of a heavy penultimate --a foot *(σHσ)* in the PES analysis. As in the shortening cases, the morphological derivation of (36b) contributes no phonologically relevant material, the overall number of syllables remaining just the same. The account of (36) will consist of taking the prohibition *(σHσ), part of Phon, to be dominated by IO-F, but to dominate OO-F, whence the 'regularization' of (36b).[12]

Note that there is no ranking contradiction in the fact that (36b) requires 'Phon >> OO-F' while the cases in (3) and (4) above (*medìcinálity*, etc.) require the opposite ranking, since the Phon constraints involved are different: high ranking Metrical Well formedness (5a) in the case of (36b), versus low ranking Metrical Alignment (5c) in the case of (3) and (4) above.[13]

Other cases amenable to the same 'Emergence of the Unmarked' account are listed in (37).

(37) **Other 'Emergence of the Unmarked' cases**:

a. Italian syncopated participles (Burzio, 1996b):

as.**cen**.dere 'ascend' as.**ce**.so 'ascended' (less marked syllable)

b. Catalan stressed vowel lowering (Kiparsky, 1993, p.293 and reff.; Mascaró, 1976):

s**é**ntrə 'center' s**ɛ́**ntric 'centric'
direkt**ó** 'director' direkt**ɔ́**ri 'directory' (segmental regularity)

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[12] Not all feet (σHσ) are allowed in this manner, however. Syllables closed by sonorants and *s* seem to be special in this respect, yielding less than full fledged heavy syllables (PES, p. 206ff).

[13] The case in (i) is slightly more complex, but ultimately reduces to a similar ranking schema.

(i) a. cátholic b. cathólicìsm

The item in (ia) is exceptional (compared with the penultimate stress of most adjectives in *-ic*: *ascétic, erótic*, etc.), and this will be by satisfaction of IO-F. The Phon constraint responsible for the regularization of (ib) is PES's (p. 166) 'Strong Retraction' imposing a binary foot before a foot which is 'weak' (i.e. which has only secondary stress). The latter is normally outranked by OO-F, as in *a(mérica)nìst*, but here it appears to prevail. The reason for this would seem to be that the sequence *icism* is strongly associated with stress on the immediately preceding syllable (*ascéticìsm, eróticìsm, exóticìsm*, etc.), thus yielding that same pattern in (ib) by OO-F across *icism* items, perhaps in 'local conjunction' with the noted 'Strong Retraction'. In turn the general pattern of *icism* items comes from both Strong Retraction and to OO-F with the *-ic* adjective (*ascétic, erótic*, etc.).

c. Catalan unstressed mid-vowel reduction (Kiparsky, 1993, p.294 and reff.; Mascaró, 1976):

b**o**stón 'Boston'	b**u**stun-yá 'Bostonian'	(less marked segment)
kát**e**drə 'academic chair'	katədrátic 'holder of an academic chair'	

d. French ***h*-aspiré** (Kiparsky, 1993, p.294 and reff.)

Hitler 'Hitler'	(h)itlérien 'hitlerian'	(loss of marked segment)

e. Turkish disyllabicity condition (Inkelas and Orgun, 1995, p.770).

ham 'unripe'	***fa-n**[14] '(note) fa-2SG.POSS'
	fa-dan '(note) fa-ABL
	(avoidance of marked prosodic structure)

f. Japanese two mora requirement (Itô, 1990; Kiparsky, 1993)

su 'vinegar'	**choko** 'chocolate (truncation)'
	***cho**

These cases seem to be like English vowel shortening, and unlike the cases to be discussed in the next section, in that affixation does not seem to alter the environment in any phonologically relevant way. The case in (a) involves emergence of a less marked syllable. The one in (b) the emergence of a language-specific regularity and the one in (c) a typical simplification of vowel inventory. (See, however, Kiparsky 1993 for an alternative view of the relevant environment for cases (b,c)). Cases (d, e) involve elimination rather than the repair of a marked structure.[15]

To conclude, I have argued that the 'Generalized Shortening' of PES, which captured all English vowel length allomorphy except for the types *Can**a:**dian* and *w**i**dth* under a single constraint, now itself reduces to a universal markedness constraint barring long vowels, whose workings under various ranking circumstances are visible in other languages. Its effects in English are restricted to morphologcally derived environments (NDEB) by virtue of the 'Emergence of the Unmarked' ranking schema of McCarthy and Prince (1994), (1995/ to appear) given in (26) above. Intuitively, in the pervasive interplay of lexical storage and lexical calculation, the long vowel of *divi:ne* is

[14] For some speakers cases like this become grammatical with a lengthened vowel: *faadan* (Inkelas and Orgun, 1995, p.771).

[15] The violation of OO-F compelled by the phonology would consist of a null or empty output.

independently stored as such (active input) and this entitles it to exist under language specific arrangements (IO-F >> Phon). The corresponding vowel in *divinity*, however, is not so independently stored, but rather calculated in relation to the one of *divi:ne*. That relation is subject to a different type of arrangement (Phon >> OO-F), by which a comparably marked structure (**divi:nity*) would lose. This account crucially presupposes the PES surface-to-surface conception of morphology. On the traditional, UR-based conception, the two items in question would necessarity share the input morpheme */divi:n/* by definition of UR, excluding any account of shortening. The well-known limitation of such NDEB to variation which is contrastive directly follows from the fact that the latter is by definition the variation in which lexical storage can play a role (IO-F >> Phon), entailing a ranking consistent with the one involved in the Emergence of the Unmarked, while non-contrastive variation entails just the opposite ranking.

4.2 Phonologically derived environments

A second type of NDEB, exemplified by English velar softening (21) above, involves environments which are 'derived' not only morphologically, in the sense of containing an affix, but also phonologically, in the sense that the affix provides some of the phonologically relevant material. The proposal presented above will be insufficient for at least some of those cases, for which it is clear that the phonological aspects of the derived environment are crucial. Kiparsky (1973a), (1993) notes the following type of paradigm with Finnish assibilation.

(38) a. halu**t**-a 'want-INF' halu**s**-i 'want-PAST'
b. **t**ila**t**-a 'order-INF' **t**ila**s**-i 'order-PAST'
c. **t**ila 'room'

d. äi**t**i 'mother'

Assibilation turns *t* to *s* before *i*, but in general only when the latter belongs to a different morpheme. In particular, the form *tilas-i* in (38b) shows that the above 'Emergence of the Unmarked' account is insufficient, since the sequence *ti* is presumably in a morphologically derived environment, hence subject to OO-F rather than IO-F, and yet is not undergoing the assibilation. The relevant factor here thus seems to be whether or not the assibilation environment is created morphologically.

Kiparsky (1993) proposes for (38) the account in (39) (my paraphrase, LB), which I will partially adopt below.

(39) a. The first *t* of *tilat-a* is fully specified underlyingly as *t* (otherwise it would turn to *s* in this context). The second *t* is underspecified as an archi-segment *t/s*.

b. The assibilation rule works only in a feature-filling fashion, hence only with *t/s* and not with *t*, whence *TilaS-i*

c. A general default rule applying after the specific assibilation rule turns *t/s* into *t*, whence *tilaT-a*.

This account would have the following direct (and crude) translation into the version of OT that has UR, under the same specification/ underspecification assumptions (assuming that underspecification is possible with forms that exhibit allomorphic variation):

(40) IO-F >> $Phon_1$: **ti* >> $Phon_2$: **s*

The *t*'s which are fully specified in UR surface as such thanks to the undominated IO-F. Those which are underspecified as *t/s* surface as *s* before *i* due to $Phon_1$, and as *t* elsewhere due to $Phon_2$.

This account, in either version (rules or constraints), cannot be quite correct, however. The reason is that in order to correctly exclude * *[tilat-i]*, which would result from full specification of the second *t*, one must make the crucial assumption in (41).

(41) UR contains the minimal specifications *consistent with the surface form of the 'base'*.

The base form in this case would be the infinitive *tilat-a*, where the *t* is not followed by *i* and thus can -and therefore must- be underspecified. This then makes it a prey to the assibilation rule/ constraint, whence *tilas-i*. The assumption in (41) cannot be maintained, however. Any definition of 'base' that is met by infinitive [*tilat-a*] but not by (hypothetical) past tense *[*tilat-i*] will be equally met by English *dam(n)* rather than *damNation*, yielding no specification for the *N*, and hence excluding any account of the contrast with, say, *sum*/ *summation*. Rather, in general UR needs to take account of all surface allomorphs, including potential **tilat-i*, which will, however, invalidate the account in (39).[16]

To overcome this problem, Kiparsky's analysis needs to be re-thought along the following lines. The relevant specification for the morpheme */tilat/* must be not each of the *t*'s in particular, but rather the autosegmental transition in continuancy between the first *t* and the *i*. Let us for the moment take the traditional view that there is a lexicon of morphemes, rather than one of full words (as in PES). There will then be no comparable specification for the second *t* since no *i* follows it within that morpheme. We may then naturally attribute a different status to IO-F constraints that deal with (larger) autosegmental structures of the sort mentioned than to those that deal with specifically segmental structure, and postulate the ranking in (42).

(42) $IO\text{-}F_{ti}$ >> Phon: **ti* >> $IO\text{-}F_{t}$

The first *t* of */tilat/* will now be immune to Phon (assibilation) in (42), by invoking the higher ranked IO-F in (42), while the second one will not be immune, by invoking only the lower ranked IO-F, thus undergoing assibilation before *i*.

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[16] Thanks to Paul Smolensky for pointing this out.

If we now turn to the (PES inspired) version of OT that does not have UR, we will simply need to convert (42) into (43).

(43) $OO\text{-}F_{ti}$ >> Phon: **ti* >> $OO\text{-}F_{t}$

On the ranking in (43), surface form *tilasi* will be unfaithful to the surface form *tilata* in exactly the same way and for the same reasons that it was unfaithful to the UR */tilat/* on the more traditional version of the theory. The sequence *ti* must be part of the active input of either item *TIlasi*/ *TIlata*, the other item acquiring it via OO-F, while the single *t* must be part of the active input of *tilaTa*, thus making this alternation similar to that of *dam(n)/ damNation*. The ranking in (42) is also needed alongside of (43), to avoid **Silasi*, etc. In addition, $OO\text{-}F_{t}$ will have not to dominate $IO\text{-}F_{t}$ to avoid the leveling of **tilaSa*/ *tilaSi*. Exclusion of the form **tilaT-I*, in which the second *ti* sequence is specified in the active input just like the first, follows in the manner illustrated in (44).

(44)

	$OO\text{-}F_{ti}$	Phon: **ti*	$OO\text{-}F_{t}$
a. tilaT-i tilaT-a	*	*	
b. tilaS-i tilaT-a			*

In (44a), the input specification for a *ti* transition cannot be maintained in the related form that has no *i*, thus yielding a greater number of violations than in the competing pair in (44b).[17]

Note that the restriction to contrastive or 'neutralizing' variation, which seems general to NDEB, follows for this second case as well on the present analysis (as it would on Kiparsky's). The reason is again that non-contrastive variation results from the ranking 'Phon >> IO-F' (35b) above, now inconsistent with the ranking in (42) (needed to maintain the sequence *ti* in *tilasi*).

We have so far seen two of the three logically possible cases of 'derived' environments: morphologically only, as with the shortening environment of *div[i]nity* and the assibilation environment of *[t]ilasi* (where assibilation fails); and both phonologically and morphologically derived, as with the assibilation environment of *tila[s]-i*. It remains to consider environments which are 'derived' only in a phonological sense. Kiparsky (1993) discusses the alternation in (45a,b), contrasting with the one in (a',b'), and providing such a case.

(45) a. vesi 'water-NOM-SG' a'. kuusi 'fir-NOM-SG'

[17] Of course the alternation in (44a) would be possible under independent input specifications in the two items, but that is the more 'costly' treatment reserved to exceptions.

b. vete-nä ‘water-ESS-SG’ b’. kuuse-nä ‘fir-ESS-SG’

The cases in (45a,a’) are both monomorphemic and yet are phonologically ‘derived’ because of a phonological rule raising final *e* to *i*, in Kiparsky’s analysis. The latter *i* does assibilate a preceding *t*, while the underlying final *i* of *äiti* in (38d) above does not. The cases in (45a’,b’) differ from those in (45a,b) by having an underlying */s/* rather than */t/*.

While there are no phonological derivations in OT, these cases follow from the present approach as well. The contrast in (45a,b) is again similar to the *dam(n)*/ *damNation* case. There is active input, in the form of */e/*, in the derived form (45b). The effects of the latter input are then suppressed by the phonology (outranking OO-F) in (45a), which turns word-final *i* to *e*. The constraint responsible for this must dominate the assibilation constraint ***ti* of (42)-(43) above to exclude **vete*. The rest of the grammar is as in (42) and (43) above. The sequence *ti* is not present in (45a), because it is enforced neither by OO-F, being absent in (45b), nor by IO-F, being absent in (45a)'s active input. Hence Finnish assibilation occurs in (45a) despite the fact that it is not a ‘derived’ environment in the morphological sense, because, as in morphologically derived environments, there is no active input *ti*.

The pair in (45a',b') is the same as the one in (a,b) for the */e/* part of the active input of the derived form. However, */s/* rather than */t/* is here in the active input, of either form, passed on to the other via OO-F.[18] Note that the paradigm in (45) again falsifies Kiparsky's own assumption in (41) above that UR contains the minimal specifications required by the base form. That assumption would correctly lead to underspecified *s/t* for (45a,b), but would fail to distinguish it from (a',b'). For the latter pair, the full paradigm needs to be inspected to correctly determine underlying */s/* rather than underspecified *s/t*.

In sum, certain cases of NDEB require an account partially along the lines of Kiparsky (1993). What makes this account necessary is the fact that in such cases, like Finnish *[t]ilas-i* an enviroment which is morphologically but not phonologically derived remains immune to a phonological effect, requiring a phonological solution. On the other hand, the account proposed in the previous subsection is not supplanted by the present one, to the extent that the earlier cases were derived in an exclusively morphological sense, making a purely phonological solution impossible. This second account of NDEB does not provide an argument against UR, but the first one does. On the other hand, the second account does not provide an argument *for* UR, since it can be straightforwardly cast in UR-less terms. However, the UR-less account differs from the UR-based one in *not* predicting that phenomena like assibilation could not occur on a purely morphological basis, as in hypothetical *TIla*/ *SIla-na*. If it turns out that there are no such cases, a principled distinction will remain to be found

[18] It is therefore easy to see that this excludes hypothetical **mati*/ *matena*, like Kiparsky's analysis. With *ti* in the active input for *mati*, *matena* violates OO-F satisfying nothing else.

between them and the cases of the previous subsection.[19]

The literature provides a considerable number of cases of NDEB beside the ones discussed so far, a non-exhaustive list of which is given in (46) below. While the Polish case in (46b) in which only the second *s* palatalizes is just like the Finnish assibilation case, for most of the other cases it is not clear at the moment which of the two above solutions should apply.

(46) **Further NDEB cases**

a. Korean palatalization (Kiparsky, 1973; Iverson and Wheeler, 1988)

/ko**t**-i/ -> [ko**c**-i] '(sun)rise' ma**t**i 'knot'

b. Polish palatalization (Kenstowicz, 1994; Rubach, 1984)

/**s**erwi**s**-e/ -> **s**erwi**ś**-e 'service-LOC.SG'

c. Swedish ***k* -> *ç*** (Kiparsky, 1973)

/**k**ämp-a/ -> [**ç**]ämp-a 'fight (verb)' **k**itt 'putty'

d. Pre-coronal laminalization in Chumash (Poser, 1993)

/**s**-tepu?/ -> [**š**-tepu?] 'he gambles' **s**tumukun 'mistletoe'

e. Finnish C gradation, affecting onsets of closed sylables (Kiparsky, 1973, 1993)

/ha**tt**u-n/ -> [ha**t**u-n] 'hat-GEN' si**tt**en 'then'

f. Sanskrit ***ruki*** rule (Kiparsky, 1973, 1993)

/agni-**s**u/ -> [agni-**ṣ**u] 'fire-DAT-PL' ki**s**alaya 'sprout'

g. Icelandic Umlaut (Anderson, 1969; Kiparsky, 1993)

/h**a**rd-um/ -> h**ö**rd-um 'hard-DAT-PL' **a**kur 'field'

h. Chamorro vowel lowering in stressed closed syllable (Chung, 1983; Kiparsky, 1993)

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[19] The same issue or question arises for the reduplication cases just as well on McCarthy and Prince's analysis. If reduplication cases like *si-tila* (with assibilation only in the reduplicant) do not exist, principled reasons will have to be found. I know of no such cases at the moment.

/lap**i**s-su/ -> lap**é**s-su ‘(my) pencil’ l**í**stu ‘quick’

i. Indonesian nasal substitution (Pater, to appear)

/mə**N-p**ilih/ -> mə**m-**ilih ‘to choose’ ə***mp***at ‘four’

j. Consonant gradation and V lowering in Estonian (Kiparsky, 1973)

/l***ugu***/ -> l**oo** ‘story-GEN’ l**uu** ‘bone-GEN’

k. Finnish cluster assimilation (Kiparsky 1973)

/pu**r-n**ut/ -> pu**rr**ut 'bitten' ho**r**na 'hell'

l. Mohawk ***kw -> kew*** (Kiparsky 1973)

/**k-w**i'stos/ -> **kew**i'stos 'I am cold' rú:**kw**eh 'man'

n. Basque vowel assimilation (Hualde, 1989)

/lag*u*n-**a**/ -> laɣ*u*n-**e** 'the friend' m*u*ɣ**a** 'limit'

4.3 Past Accounts of NDEB

As Kiparsky (1993) argues, earlier accounts of NDEB had proved inadequate. He finds some degree of empirical adequacy in the Revised Alternation Condition of Kiparsky (1973a), given in (47).

(47) **Revised Alternation Condition** (Kiparsky, 1973a)

Non-automatic neutralization processes apply only to derived forms.

However, the condition in (47), Kiparsky notes, ‘is really no more than a descriptive generalization dressed up as a principle and unstatable as a formal condition on phonological rules’. In contrast to this impasse, we have seen that NDEB reduces to constraint ranking. We have also seen that the restriction to ‘neutralization’ processes follows from the fact that other processes instantiate the ranking ‘Phon >> IO-F, antithetical to both of the accounts of NDEB given above. The restriction to ‘non-automatic’ processes also follows in the same way. A process which is not automatic is by definition one for which there are lexical exceptions. As mentioned above, ‘exceptions’ are analyzed here as allomorphs that have separately specified inputs, as with *obe:se*/ *obe:sity* (exception to shortening), or *compel*/ *compulsive* (morphological exception). For a phonological exception to occur, the ranking ‘IO-F >> Phon’ must hold. If a process is ‘automatic’, i.e. exceptionless, then the

opposite ranking must uniquely hold, again precluding both types of NDEB. Hence both exclusions from non-derived environments and exceptions (within derived environments) require the ranking 'IO-F >> Phon', whence their coextensiveness.[20] The descriptive adequacy of (47) is therefore understood from the present point of view.

A major attempt to overcome the conceptual difficulty that (47) raises for rule systems was made in terms of the 'Strict Cycle Condition' (Mascaró, 1976), a specific restriction on the mode of application of cyclic rules that would effectively exclude them from environments which are not 'derived' either in the morphological or the phonological sense. If the present proposal is correct, there can in fact be no correlation between 'cyclic' and NDEB effects, and the generalization captured by ascribing both effects to 'cyclic' rules would have to be spurious. The reason is that, as we have seen, cyclic effects result from the ranking 'OO-F >> Phon >> IO-F', while NDEB effects reflect just the opposite ranking 'IO-F >> Phon >> OO-F'.[21] Note for instance that English vowel reduction, which yields the noted cyclic effect of *cond[e]nsation*, gives no indication of failing in underived

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[20] Given this characterization of 'non-automatic', the further qualification to neutralizing processes would in fact seem redundant. It is redundant in the present system, which does not contemplate a category of non-neutralizing effects (requiring 'Phon >> IO-F') which are non-automatic, i.e. with exceptions (since that would entail 'IO-F >> Phon'). This category of effects is given in Kiparsky's (1973a) four-way classification, contrasting with the three-way classification givenn in (18) above. We leave this issue open.

[21] This is a simplification, since diagnostics for cyclicity of rules are not exhausted by the consistency or preservation effects of section 2 (*cond[e]nsation*, etc.). Another diagnostic is simply multiple application of a rule through the derivation --an ordering paradox without the cycle (see Kenstowicz, 1994, p. 205f. for an illustration of this type of case). In OT, this type of effect (like other rule ordering paradoxes) is subsumed under the general parallel character of the theory. As with the cyclic effects considered in the text, this effect too should bear no correlation with NDEB.

Note as well that, aside from its utilization as an account of NDE effects, 'strict' cyclicity effects have, at least in the more general case, a trivial account in the present system. Such effects are illustrated by the Catalan paradigm in (i) (Kenstowicz, 1994, p. 206-208, from Mascaró, 1976):

(i) a. ru**í**nə 'ruin' b. ru**i**n-ós 'ruinous' c. ru**i**nus-ísim 'very ruinous'

Catalan reduces unstressed post-vocalic high vowels to glides. Assuming a cyclic account of the non reduction in (b) (reduction precedes removal of the earlier stress), the question is why should reduction fail again on the next cycle in (c), the answer to which would be strict cyclicity (the environment of application of the rule is fully contained within an earlier cycle). On the present approach, the cyclic effect in (b) is attributed to the ranking 'OO-F >> Phon' as usual. Non-reduction in (c) follows from the same ranking. Hence 'strict cyclicity' trivially reduces to invariant ranking (although the full set of facts handled by Mascaró's original analysis would require further discussion).

environments. See Kiparsky's (1993) discussion of other cases showing lack of correlation between the two properties.

The next influential attempt was made by Kiparsky (1982) in terms of the 'Elsewhere Condition' (EC), which stipulates disjunctive ordering between rules whose environments of application stand in a subset-to-superset relation. In such cases, the more specific rule (applying to the subset of environments) has priority, and the more general rule will apply only disjunctively, i.e. to the complementary subset. Kiparsky proposed to reduce NDEB to EC by postulating that there is an 'identity rule' that applies to underived lexical items, e.g. *i:vory*. Any phonological rule whose structural description is met by the bare lexical item, like tri-syllabic shortening, would enter into the general-to-specific relation targeted by EC, and would thus be blocked by the disjunctive ordering thus imposed, the (item-specific) identity rule being the more specific of the two.

The account proposed above bears considerable similarity to the EC account, confirming the correctness of Kiparsky's early insights, but shares none of its problems. As Prince and Smolensky (1993, p.106-108) note, 'elsewhere' effects are an automatic consequence of violable constraints (an inference that they refer to as 'Pāṇini's theorem'). In a constraint hierarchy 'C-spec >> C-gen', where *C-spec* is the more specific constraint and *C-gen* is the more general one, the effects of the former will be observable whenever it is applicable, and those of the latter elsewhere. Should the opposite rank hold, the 'elsewhere' effect will simply not obtain (as if there was a single constraint or rule applying). No particular condition needs to be stipulated, as it does when a rule --not an inherently violable device, needs to be turned off. In the above account, the relevant hierarchy is 'IO-F >> Phon'. The first constraint will be satisfied whenever applicable, as in the initial portion of Finnish *tilas-i*, or English *i:vory*, and the second elsewhere, as in the final portion of *tilas-i* or English *div[i]nity*, both derived environments lacking an active input. IO-F (the specific constraint) is the counterpart to Kiparsky's identity rule. But, while IO-F constraints are an essential component of OT architecture, 'identity' rules are specific artifacts in the rule-based theory. The basic empirical observation is that the identity of underived lexical items competes, sometimes successfully, with the principles that calculate sound structure in general. Competition presupposes some comparability of character. In OT, such comparability is given by the fact that calculations involve evaluation of alternative representations. Underived lexical items can compete because they constitute candidate representations. In a system in which the calculations are derivational, underived lexical items have no basis for competing unless one takes the extraordinary step of converting them into types of derivations via 'identity' rules.[22]

In sum, among previous accounts of NDEB, the Revised Alternation Condition characterization is substantially correct, but only descriptive, while the Strict Cyclicity characterization does not seem empirically correct. NDEB is clearly an 'elsewhere' effect, but both the 'Elsewhere Condition' and the 'identity rules' required in a rule-based framework are specific stipulations. The account proposed above gives essentially the effects of the RAC; it correctly

[22] Insistence on the totally representational character of lexical organization has been a long-standing theme in the work of J. Bybee.

predicts that cyclic and NDEB effects should not be coextensive; and gives the correct 'elsewhere' effects by the simple virtues of constraint ranking. As for the account of NDEB given in Kiparsky (1993), we have found that it is correct modulo certain modifications, but insufficient for environments which are derived only morphologically.

4.4 The Status of Affixes

Outer affixes do not generally behave like derived environments. This is particularly clear from English vowel shortening, as noted in PES (p.232). Shortening applies multiply to stem vowels: *fI:nI:te/ in-fInIte*, but does not apply to outer affixes. Items like *satIr-I:ze, oxYd-I:ze, salIv-A:te* have shortened stem vowels but long affixal ones. Affixes shorten their vowels when embedded, as in *organ-Iz-ation, articul-At-ory*. This fact is not predictable from stress, as shown by *mètamórph-I:ze*, where there is no stress on the long vowel. The opposite dissociation, stress on a short vowel can be shown indirectly, by noting that in *còntradíct-ory*, a heavy syllable before *-ory* receives stress. Hence in *articul-At-ory*, from *articulatA:te*, there would be stress if there were no shortening, but shortening occurs nonetheless. In PES, which simply stipulates Generalized Shortening (23) above, the restriction of shortening to affixed (rather than affix-containing) environments is simply part of the stipulation. The resilience of outer affixes to allomorphy is more general, however. As noted in Burzio (1996b), Italian lacks unstressed allomorphs of participial affixes *-út-, -ít-* in outermost position, so that preservation of stem stress from the infinitives in (48a) is either impossible or possible only via syncopated suppletive forms of the affixes, as in (48b). In embedded position, however, unstressed *-ít-* shows up, as in (48c).

(48)	a.	bátt-ere 'beat'	b.	batt-út-o 'beaten'	c.	bàtt-it-óre 'beater'
		vínc-ere 'win'		vín-t-o 'won'		vìnc-it-óre 'winner'

The anti-allomorphy of outer affixes is at play as well in cases like *titán-ic* as noted in (19) above, where the metrical consistency of the affix prevails over that of the stem, which would give **títan-ic* instead (PES, p. 302-304).

Outer affixes may thus seem to behave like non-derived items, subject to IO-F rather than OO-F. Without UR, this view is not expressible, however, since as discussed in sectn. 3. above, for affixes we take the active input to be present on one occurrence of the affix only (indeterminately which one), the other occurrences being held faithful to the former by OO-F. We therefore need to postulate that outer affixes are subject to a higher-ranked version of OO-F than stems. There is independent reason favoring this view. First, there are other distinctions requiring different ranking of OO-F constraints. As noted below and discussed in PES, sect. 10.4, and in Benua (1997), 'level 1' and 'level 2' affixes appear to impose OO-F constraints of different rank on their stems. Second, there is reason to view identity effects as having a self-sustaining character. Items that satisfy OO-F constraints in some ways (semantically/ segmentally/ metrically) turn out to be relatively more faithful in others as well (PES, p.276, 307f), suggesting that the ranking of OO-F constraints is in a sense 'self-adjusting'. The fact that OO-F is relevant to both morphology and phonology would just be an instance of this: morphological relatedness, a relatively course-grained type of similarity, seems

coextensive with the application of phonologically relevant OO-F constraints, imposing finer-grained identity. Now since outer affixes (at least suffixes) are major determinants of semantic structure at least by contributing specification of syntactic category, we will indeed expect on the above reasoning that instances of the same affix will collectively stand in an OO-Correspondence relation imposing relatively high-ranked OO-F. This view is supported by the fact that category shift makes outer affixes behave as if they were embedded, witness noun/adjective *altern-Ate*, with a short *A* compared with the verb *altern-A:te* (PES, p. 294f). As noted in Burzio (1996b) this is quite similar to Italian unstressed participial *-it-* showing up in nominalizations like *vínc-it-a* 'a winning' comparably to embedded *-it-* of (48c) above, and in contrast to impossible participle **vínc-it-o*. The interpretation of this is that the shift in category puts semantic distance between these and the main occurrences of the affixes, causing OO-F constraints to self-demote.

Beside morphological embedding and change of category, another set of circumstances can force affixes into allomorphy, related to the allomorphy of the stems. When satisfaction of OO-F in stem and affix are mutually exclusive, the affix appears to prevail (as in *titán-ic*) if the class of stems affected is relatively small. When that class is large, the stem prevails, forcing the affix into allomorphy. As argued in PES (p. 302f), suffix consistency prevails in *titán-ic*, because, for reasons related to it syllabic structure, *-ic* cannot guarantee metrical consistency of the stem for all of its stems. In, for instance, *linguíst-ic*, or *carcinogén-ic*, there is no metrical parse of the suffix: *-i)cϕ* or *-icϕ*), that would yield preservation of the stress of *línguist* ot *carcínogen*. In contrast, there is always a viable parse with *-ist*, as in *a(mérica)(n-ìstϕ)*, or *propa(gánd-is)t*. Hence *-ist* is metrically allomorphic because this benefits the totality of its stems (stress "neutrality"), while *-ic* is metrically invariant because only a subset of its stems would benefit from its allomorphy. This view also sheds light on the fact that 'regressive' voicing assimilation induced by an affix, as in *wi[v]es*, *le[f]t* occurs in a small class of items, while with the larger class assimilation is progressive, affecting the affix instead (*dog[z]*, etc.). What this suggests is that, while OO-F for outer affixes outranks OO-F for stems, optimization is (or can be) global (the point made in Burzio, 1994b). Large classes entail a potentially large number of stems violating OO-F, while the overall number of violations of OO-F by affixes is inherently contained (to two or three).The reason is that different occurrences of the same affixal allomorph (e.g. all occurrences of plural *[z]*) will satisfy OO-F relative to each other, and hence will not count as independent violations of OO-F, unlike say *wife/ wives, knife/ knives*, etc.[23] To the extent that a large number of violations of generally lower ranked stem OO-F seems to prevail over a small number of violations of generally higher ranked affix OO-F, there may be a challenge to Prince and Smolensky's claim that constraints stand in relation of 'strict' domination to one-another (fn.10). We leave this issue open.

In sum, occurrences of the same affix are related to one-another by OO-F, and an active input triggering IO-F is assigned to one of the occurrences. Because of their relative prominence in the overall structure, outer affixes (at least suffixes) are subject to high-ranked OO-F, whence the fact that they do not generally behave like other morphologically 'derived' environments. Affixes are

[23] The ranking 'Stem consistency >> Affix consistency' of PES (57), p. 254 refers to this set of circumstances (large classes of stems). The opposite ranking holds otherwise, as in the text.

forced into allomorphy by embedding, category change, or to avoid massive violations of OO-F by stems.

5. Conclusion

In a theory of morpho-phonology that uses Output-to-Output correspondence within OT, two important facts that had formerly required specific provisions reduce to the simple effect of constraint ranking that Prince and Smolensky call 'Pāṇini's theorem'. In OT, a constraint will be violated and hence appear to be blocked over the domain of constraints that dominate it. Both 'cyclic' effects and NDEB are instances of such apparent blocking of phonological constraints.

Cyclic effects reduce to domination of phonological constraints by OO-F constraints, resulting in blocking over derived environments. NDEB similarly reduces to domination of phonological constraints by IO-F constraints, resulting in blocking over underived environments. In each case, the phonological constraints will be satisfied regularly over the complementary set of environments, provided that they dominate the complementary set of constraints: IO-F, and OO-F respectively.

Calculation of morphologically derived forms via OO-F constraints, which each of these accounts presupposes, argues against the traditional notion of UR. The account of cyclic effects makes UR superfluous (i.e. non-existence of UR sufficient), while the account of one subclass of NDEB falsifies UR (i.e. it makes non-existence of UR necessary). We have seen that, if there was a UR, pairs like *divi:ne*/ *divinity* would have a common input */divi:n/* by definition of UR, leaving no explanation why a phonology which abhors long vowels should prevail in one case but not in the other.

On the proposed conception, which deals with morphological relatedness in terms of OO-Correspondence rather than common input, derived forms need not, but may, have an active input of their own independent of that of the base form. We have seen that the contrast between *blásphemous* and *desí:rous* requires that kind of input. The reason is that the grammar cannot provide that distinction since the base forms *blasphé:me* and *desí:re* are relevantly non-distinct. To the extent that *blásphemous* thus has a short vowel by active input in contrast to *desí:rous*, then it will obviously have an active input independent of that of its base *blasphé:me*. While cases like this may seem rather subtle, they are in fact the tip of a very large iceberg that includes the pervasive morphological irregularity found with 'level 1' type affixation, as in *compel*/ *compUlS-ive*, *syllabify*/ *syllabifiC-ation*, *problem*/ *problemAT-ic*, *horizon*/ *horizonT-al*, *president*/ *presidentI-a*, *habit*/ *habitU-al*, *rabbi*/ *rabbiNic*, where the capitalized portions in each case need to be specified as active input to the derived form only, massively reasserting the point just made for *blásphemous*. Bound stems, e.g. as in *STUPEND-ous* are clearly just one end point in the scale of morphological irregularity: the stem is here entirely given in the input for the affixed form, there being no correspondent form for the stem, though there is one for the affix. The two logical possibilities created by the demise of UR: active input in the base (only), and active input in the derived form (only) are thus both instantiated: by NDEB, and by morphological irregularity respectively.

Morphological irregularity, such as found with 'level 1' type affixation in English, correlates with several other properties including NDEB, as listed in (49).

(49) **'Level 1' affixation**

a. Morphological irregularity/ bound stems
b. Semantic irregularity
c. NDEB effects
d. Cyclic effects only with contrastive variation
e. Low productivity

While limitation of space force postponement of this discussion to a separate study, there is reason to believe that the cluster of properties in (49) finds a unitary account in the partial ranking 'IO-F >> OO-F' modulo a partial reinterpretation of the account of cyclic effects of sectn. 2. above. In contrast, the complement set of properties, which appear to obtain with 'level 2' type affixation would seem to follow from the reverse ranking 'OO-F >> IO-F' obtained by re-ranking of OO-F. Partial conclusions in this general direction are already drawn in PES 10.4, Benua (1997).

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