

Lexicon and Grammar: unequal but inseparable

LUIGI BURZIO

**Department of Cognitive Science
Johns Hopkins University
Baltimore, MD 21218
USA**

Abstract

The generative tradition has treated Lexicon and Grammar as discretely separable components that stand in a serial relation to one-another, while it has also taken two grammatical systems: the morphology and the phonology to be serially related, via the interface level of 'Underlying Representation'. This article examines a number of well-known phenomena that consistently contradict this view. In light of this, it proposes a different conception that draws on both Optimality Theory and Bybee's Network model. In this conception, lexicon, morphology and phonology all interact in parallel without any interface levels. As in both Bybee's model and in neural network models, the distinction between the lexicon and the grammar -at least the morphology part of the grammar- is claimed to be of a quantitative, rather than a qualitative kind.

Unlike traditional analyses, this approach successfully deals with all phenomena that require lexical information to attach directly to surface forms, in particular: i) morphological suppletion; ii) unproductive morphology; iii) lexically controlled phonological variation. It also successfully deals with: iv) phonologically controlled morphology, which shows that morphology cannot precede phonology.

1. Introduction	1
2. Parallel Phonology: Why the ‘Input’ is not a UR	3
3. Parallel Morphology	7
3.1 Why OO-FAITH <i>is</i> Morphology	7
3.2 Entailments, Non-derived Environments, and Lexical Conservatism	9
3.3 Of Affixes and Paradigms	20
3.4 Paradigm Uniformity: inflection or productivity?	26
3.5 Whence Suppletion?	31
3.6 Base Neutralization	36
3.7 Conclusion	38
4. Phonologically Controlled Morphology	39
4.1 Types of Cases	39
4.2 Why the Multiple ‘Inputs’ are Outputs	49
4.3 Conclusion	53
5. Lexically Controlled Variation	54
5.1 IO-FAITH over Partial Orders	54
6. Prespecification versus Co-phonologies	61
6.1 The limits of Pre-specification: ROTB	61
6.2 Co-phonologies and Lexical control	69
7. Conclusions	72
References	74

1. Introduction

The assumption that our knowledge of words implicates both a lexicon and a grammar has often been equated with the assumption that these two components, Lexicon and Grammar, constitute discrete entities which interact by way of a serial relation. The following statement, from Bromberger and Halle (1989), reported in Vaux (2003), illustrates:

- (1) “[T]he syllable structure of an English word ... is totally predictable from the sounds that compose the word. In short, both syllable structure and stress are predictable; therefore, they do not appear in the underlying representation, but are introduced into the surface representation as the result of the application of certain rules.” (Bromberger and Halle 1989: 57)

Yet, while the existence of a ‘Grammar’ alongside of a ‘Lexicon’ -as reflected in the first sentence in (1)- is a truism, the existence of an ‘Underlying Representation’ (UR) that interfaces them serially -as reflected in the second sentence- is only an empirical question. The latter only follows from the former if there are ‘rules’, an assumption no longer shared by most work in Generative Phonology. In a constraint-based approach such as Optimality Theory, the possibility exists that lexicon and grammar are not serially linked via a UR, but rather interact in parallel, with no UR.

Vaux (2003) defends the view in (1), referring to it as ‘The Morpheme Invariant’ theory –a theory in which surface allomorphs, such as for instance [pærənt]/ [pərént] of *parent*, *parental*, respectively, have a common, or ‘invariant’ UR, perhaps /pærent/. The latter is compared with an alternative called ‘The Redundant Lexicon’ theory which assumes lexicalization of full surface forms in a way in which grammatically predictable information such as the different stress and vowel reduction patterns of *parent*, *parental*, as well as their partial segmental similarity, are also and redundantly expressed in a surface lexicon which only contains forms like [pærənt], [pəréntəl], etc. This theory is ascribed to a tradition of ‘amateur linguists and psychologists’, as well as to a contemporary group of researchers that includes the present writer.

Vaux’ characterization of the debate is in my view based on two errors, one conceptual, the other factual. The conceptual error is in supposing that a theory that has massive redundancies (like the independent listing of all surface allomorphs) needs to be compared with one that does not. Redundancies are antithetical to theories, and as such they merely identify the bad and the ugly among them, not a specific class of theories that deserve attention. The factual error is in maintaining that the work of mine he cites instantiates the ‘Redundant Lexicon’ theory. The issue that my previous work addresses is not really whether there should be a ‘redundancy’ –a matter that we can safely leave to ‘amateurs’, but rather whether lexicon and grammar interact serially, by way of a UR, or in parallel, without UR, as noted above (Burzio 1996).

The present article addresses this issue systematically. In it, I claim that exactly the same kinds of arguments that have successfully advanced the parallel approach to phonology, also obtain with respect to the interaction of phonology with the lexicon and the morphology. This leads to the conclusion that an even more general parallel system than the one proposed in Prince and

Smolensky (1993) needs to be entertained –exactly the opposite of Vaux’ (2003) conclusion. In broad outline, the argument for the parallelism of lexicon and phonology and against the ‘serial interface’ level of UR will be as described in (2) and (3) below.

(2) **UR is both unnecessary and insufficient:**

- a. It is unnecessary because ‘Output-to Output’ Faithfulness constraints in Optimality Theory (OT) can play an equivalent role. For instance, the form of the stem in *parent-al* seems substantially calculable directly from the surface form of *parent* (Output to Output), requiring no UR.
- b. It is insufficient because of the existence of suppletion. In cases like *go/ went*, *compel/ compuls-ive*, **arbore/ arbore-al*, the surface allomorphs in each case need to come from independent or partially independent inputs (with the non existent form **arbore* receiving no input at all). This is true by the very definition of ‘suppletion’. Hence the claim inherent in UR that surface allomorphs have a common input (Vaux’ ‘morpheme invariance’) is false at least for these cases.

(3) **All interactions between the lexicon and the grammar or between morphology and phonology that are logically conceivable under a parallel architecture are in fact attested.** In particular:

- a. The phenomenon of **phonologically controlled suppletion** reveals that morphological decisions are sometimes made based on the output of the phonology. In alternations like Italian *vád-o/ and-iámo* ‘I go/ we go’, the choice between suppletive allomorphs *vád-/ and-* is based on the position of the stress as determined by phonological calculation of the whole word. Similarly, the choice between allomorphs *a/ an* in English, as in *an apple/ a pear* depends on prior syllabification, as does the choice of *beau/ bel* and other similar pairs in French, as in *beau garçon/ bel ami* ‘nice boy/ nice friend’, etc. At least on the face of it, this interaction is thus inconsistent with the traditional view that the lexicon/ morphology simply ‘feeds’ into the phonology, serially.
- b. The phenomenon of **lexically controlled phonological variation** shows that phonological decisions are sometimes made on a lexical basis, as if the lexicon had a presence downstream of the phonology, again inconsistently with the traditional view. For instance English vowel shortening is variable in metrically penultimate syllables: *blásphemous/ desí:rous*, yet the variation is lexically fixed: **blasphé:mous/ *desí:rous*. Similarly, vowel reduction in syllables closed by sonorants is also variable and yet lexically fixed within a dialect: *Agamémn[ɔ̃]n/ ápr[ə]n*, **Agamémn[ə]n/ *ápr[ɔ̃]n*; British *Pentag[ə]n* vs. American *Pentag[ɔ̃]n*. Also similarly, Hungarian vowel harmony can variably fail in certain situations, but many lexical items exhibit only a fixed choice: *mutagén-nek* ‘mutagen-DAT’ (harmony)/ *pallér-nak* ‘foreman-DAT’ (no harmony): Hayes (2004).

Attempts have been made to account for both (3a) and (3b) within a traditional architecture, but

it will be argued below that they are only partially successful, showing the fundamental inadequacy of that architecture.

The rest of the article is organized as follows. In the next section, I review some of the arguments for parallel phonology for later comparison with arguments for parallel morpho-phonology. In section 3, I outline the theory of surface-based, parallel, morpho-phonology. In section 4, I discuss the phenomenon of phonologically controlled suppletion: (3a). In sections 5 I take up lexically controlled variation: (3b), developing an account of it in the UR-less framework. In section 6 I review the two main traditionalist proposals for dealing with variation: ‘Prespecification’ of URs and ‘Partial Orders’ of constraints, pointing to the respective inadequacies. In section 7 I draw general conclusions.

2. Parallel Phonology: Why the ‘Input’ is not a UR

An unshakable argument for parallelism is provided by situations in which there is a mutual dependency: some A is dependent on some B, but the same B is also dependent on A. A simple case of this sort is in the relation between stress and vowel length in Italian, instantiated by the two generalization in(4a, b).

(4) **Italian Stress and Vowel length** (Burzio 1994a: 2.4, and refs.).

- a. Stress is on the penultimate syllable if it is heavy; and on the antepenultimate otherwise:

a.gós.to	a.mí:l.co	an.có:l. ra	A.mé.ri.ca	án.co.ra
‘August’	‘friend’	‘still (adverb)’		‘anchor’

- b. Long vowels occur only in stressed, open penultimate syllables.

The characterization in (4a) omits the case of final stress: *virtú* ‘virtue’ etc., for ease of exposition, but the statement in (4b) would hold in any event. The mutual dependency in (4) is in that stress information is needed to lengthen vowels in just the environments stated in (4b), while at the same time vowel length information is needed to provide a unitary account of penultimate stress, which invariably requires a heavy syllable, as stated in (4a). This situation is paradoxical for a serial organization in that in order to correctly lengthen vowels, stress would need to be assigned first, but in order to assign stress under the single generalization in (4a), vowel length would have to be determined first. Hence, within the derivational framework of (1) above, there will be no viable account of Italian stress. The ultimate reason for this is that the latter is neither ‘totally predictable’ from the underlying ‘sounds that compose the word’: *áncora/ ancó:ra* having identical URs, nor totally unpredictable, since structures like **ámerica*, **ágosto* never occur. An attempt to assign stress underlyingly to capture the *áncora/ ancó:ra* contrast would necessarily result in a type of ‘duplication’ since such URs would have to have the -typically grammatical- property of excluding cases like **ámerica*, **ágosto*. An alternative attempt to assign the stress grammatically would result in rules that contain lexical lists: penultimate stress with {*ancora* ‘still’, *amico*, ...} (but not *ancora* ‘anchor’, etc.), also a form of duplication. At the same time, this move would also result in a ‘conspiracy’. Since in this approach vowel length

would be introduced by rule after stress, the stress rules for *ancó:ra* and *agósto* would remain unrelated: stressing light and heavy syllables, respectively. Yet the combined effect of the former rule plus lengthening would yield the same surface effects as the latter rule: stress on a heavy penultimate –a conspiracy by unrelated parts of the grammar.

Ordering paradoxes can rather generally be converted into either conspiracies or duplications in this fashion, but such strategies are not types of solutions –only palliatives to the logical contradiction. The only general solution to ordering paradoxes is to eliminate ordering by way of a parallel approach. The parallel, OT-style analysis of (4) is given in (5), where ‘σ’ is a syllable of any weight, and ‘H’, ‘L’ are heavy and light ones, respectively.

(5) FOOT: (H σ)/ (σ L σ) >> IO-FAITH (stress) >> *V: >> IO-FAITH (V-length)

The rightmost two constraints in (5) express the lack of contrastive vowel length in Italian in standard OT fashion: the relevant Markedness constraint dominates the corresponding Faithfulness. At the same time, the dominant status of the leftmost two constraints ensures that vowels will be allophonically lengthened in exactly the right contexts: (4b). For instance, a word like *an(có:ra)* will have penultimate stress as part of its input. While a stress change will be opposed by IO-FAITH (stress), the non existence of the foot type *(L σ) will force the stressed vowel to lengthen instead, yielding compliance with the foot type (H σ). The foot typology in (5) is that of Burzio (1994a), where (most) final syllables are not taken to be extrametrical, but the present discussion does not depend on that specific choice in any direct way.

The hierarchy in (5) correctly characterizes the hybrid properties of Italian stress: partly lexical, partly grammatical. The role of the lexicon in (5) and in OT in general is represented by IO-FAITH constraints and their rank. IO-FAITH (stress) in (5) is dominated, and hence its role is limited. Nonetheless, because it in turn dominates other IO-FAITH constraints: IO-FAITH (V-length), it can still determine the outcome under specific circumstances: choosing between penultimate and antepenultimate stress when the penultimate syllable is open: *áncora/ ancó:ra*. Other lexical choices, like **Ámerica*, **ágo:sto*, will be correctly foreclosed.

This type of argument for parallelism seems incontrovertible and is broadly accepted. As mentioned above, I will show that it extends beyond the internal structure of the phonology in ways that show that morpho-phonology as a whole is also a parallel system.

The conclusion that the only viable account of the facts in (4) is along the lines of (5) is consonant with the present claim that there is no UR as we see below, yet such an analysis does employ the notion of ‘input’, which may be regarded as similar to the UR of (1) above. As I discuss next, such similarity is illusory.

In order to be part of a theory, any putative level of representation will minimally need to be definable in terms of some properties that it has. Indeed, traditional URs had specific properties: they were thought to be made up exclusively of ‘phonemes’, ensuring that allophones and other predictable properties would be inserted by rule, exactly as in (1). However, the input in OT is assumed to have *no* properties, as stated in Prince and Smolensky’s (1993) ‘Richness of the

Base' lemma. This difference is ultimately relatable to the different types of computation involved: rules apply to specific structural descriptions, hence their inputs must have specific properties, while constraints apply -either vacuously or not- to any structure. With no properties, OT's inputs can therefore not be understood as a 'level' of representation. Rather, while the input is a contributor to the structure of the output, the nature and extent of its contribution is totally controlled by the constraint ranking, as discussed in connection with (5). It would therefore be mistaken to attempt to also define that role in some other fashion, by ascribing the input to a specific 'level'.

If the input has no properties in general: the 'Richness of the Base', it nonetheless does have specific characteristics relative to each individual output. The words in (4): *agosto*, *America*, etc., all need to have different inputs to result in different outputs, and the question will then be what those inputs, presumably stored in some mental lexicon, are. A perfectly coherent answer is that they are just the corresponding outputs. In a parallel system, the grammar can be construed as a device that simply 'checks' the surface forms. The checking consists of taking each surface form as an input, and verifying that it is produced unchanged as an output. Items like *agosto*, *América* are members of such surface lexicon of Italian, because they pass the checking test. Hypothetical **agosto*, **Ámerica*, are not because they fail the test. The grammar in (5) is not sufficiently explicit to predict how such degeneracies would be repaired (*América*/ *Árica*/ other), but this is immaterial to the present point. Hence inputs that are different from observable outputs must be entertainable hypothetically or transitorily, but there is no reason to believe that they make it into the mental lexicon. Rather, since surface forms exist, it seems to follow as the null hypothesis in the present approach that nothing else exists. This hypothesis is in fact known in Prince and Smolensky's work as 'Lexicon Optimization', whereby an input is 'optimal' with respect to its output if it is identical to it –a hypothesis independent of the internal structure of Optimality Theory, but independently plausible, though excluded in the serial model.

Suppose now that someone were to protest that such a lexicon of surface forms is a 'redundant lexicon' –a position closely related to that of Vaux (2003), to which I will return. Such a critique would be misguided because the present definition of 'lexicon' is grammar-inclusive. Under this definition there is no 'redundancy' since everything that is grammatical, like the impossibility of **agosto* in Italian is properly attributed to the grammar, though it is reflected in the surface lexicon. Such a critique would be based on an internal contradiction consisting in evaluating a parallel system by assuming that the categories of the serial system are still true, like the grammar-exclusionary notion of the lexicon in (1). Note that one could choose to give an exclusionary definition of the lexicon even in the present system, as follows: Every surface form *S* has an internal partition *I* / *G* such that everything in '*I*' is contributed by the input by dominance of IO-FAITH over MARKEDNESS, while everything in '*G*' is contributed by the grammar by dominance of MARKEDNESS over IO-FAITH. The exclusionary lexicon is now the set of all *I*'s. The 'redundant lexicon' critique is now again properly applicable, and is in fact just the familiar 'Richness of the Base' criterion (ROTB), prescribing that no grammatical properties may be attributed to the input. But, while now applicable, such critique would prove unfounded for the analysis in (5), since –as I have shown– the latter is fully compliant with ROTB as all observed regularities come from the grammar.

Returning to the role of mutual dependencies in supporting a parallel architecture, English provides a case similar to the Italian one, also involving stress and vowel length, as shown in (6).

(6) English Vowel Shortening		FOOT: (Ḥ σ)/ (σ̣ L σ)	*Ṿ:	OO-F (stress)
a.	Systematic: defá:me/ (dèfà)(má:tion)		✓	—
b.	Variable:	blasphé:me/ (blásphémous)	✓	*
b'.		desí:re/ de(sí:rous)	*	✓
c.	Systematic:	diví:ne/ di(vínity)	✓	✓

The analysis in (6) is that of Burzio (1993, 1994a Sect. 10.3, 2000a). In English, Latinate affixation causes shortening of long vowels, but the effect is either systematic or variable, depending on the metrical context. In the parallel system of the present discussion, this difference is reduced to constraint conflict. In the variable cases of (6b, b'), satisfaction of the shortening constraint *Ṿ: conflicts with preservation of stem stress: OO-FAITH (stress), as stress on a light penultimate is banned in English just as in Italian, the same foot types apparently holding in both languages. The variation of (b/ b') will follow from assuming that the grammar imposes no particular ranking of the rightmost two constraints in (6). Forms like *blásphémous* (6b) and *desí:rous* (6b') will thus be equally optimal. I return below to the issue of the lexical control over this variation, excluding the alternative **blasphé:mous* and **désí:rous*.

In contrast to the variation of (6b/b'), there is no variation in the 'trisyllabic' case in (6c) (aside from isolated exceptions), and this is because there is no comparable conflict: shortening does not interfere with preservation of stem stress because, unlike penultimates, stressed antepenultimates are not required to be heavy, as independently shown, e.g., by *América*, and as expressed in the foot typology. Shortening is also systematic in the stress-adjacent position of (6a) and this time it is because adjacent stresses are not permitted. This is also expressed in the foot typology in (6) that excludes unary feet. With preservation of stem stress banned independently of vowel length, there is again no conflict and hence no reason for variation in (6a). Vowel shortening is thus correctly predicted to always obtain.

Such unified account is again only possible in the parallel analysis of (6). In a serial analysis, in order to account for the variation of (b, b'), one would have to postulate a shortening rule applying to selected items (Kiparsky 1979). This would have to precede stress assignment, since the stress depends on whether or not shortening has applied. But in order to know whether shortening should apply systematically or unsystematically, the metrical parse, hence stress, would have to be known in advance, since it is the position in the metrical foot that makes all the difference. The two conclusions: shortening before stress; stress before shortening, are paradoxical.¹ Hence in a serial organization the only recourse would be to accept multiple

¹ This conclusion cannot be circumvented by supposing that shortening is -for whatever reason- just variable in penultimate syllables regardless of metrical structure. Penultimate syllables followed by *-ic* exhibit systematic shortening: *tonic*, *conic*, *volcanic*, etc. The reason for this is that such syllables are metrically antepenultimates, as in (*tónicø*), (*volcánicø*), etc., in the

shortening provisions, exactly as in all literature prior to Burzio (1993). This yields either conspiracies or duplications, depending on the exact formal relation between those provisions (see Burzio 1994a for a review).

In sum, I have examined some sample arguments for the parallel architecture of Optimality Theory based on the existence of mutual dependencies. The latter are logically inexpressible in a sequential calculation. Attempts to manage them sequentially results in either duplications or conspiracies, and these still constitute standard arguments for parallelism: Kager (1999: 55-56); McCarthy (2002: 53-55, 71-75). I have also noted that the ‘input’ in OT does not have the properties that can characterize a level of representation, and that in a parallel architecture a lexicon of surface forms can be straightforwardly entertained without there being any ‘redundancy’ between lexicon and grammar. See also Bybee (2001, 29) for a similar point.

3. Parallel Morphology

3.1 Why OO-FAITH *is* Morphology

It is beyond dispute that surface forms can inherit phonological properties from other surface forms to which they are morphologically related. For instance *américanist* has the stress of *américan*. On its own, it should have been **americanist*, with the same antepenultimate stress as *antagonist*, where there is no **antagon* to inherit from. The question is what makes this inheritance possible. A naive observer would simply answer that whatever permits inheritance of meaning and segmental structure from *américan* presumably also permits inheritance of stress: end of story. The present view is that the naive observer’s answer is correct. It assumes that the suffix *-ist* has the property in (7), which need not make any particular distinction among segmental, prosodic or semantic properties.

- (7) **Surface Morphology:** $-ist \Rightarrow / N_$
 (The affix *-ist* must be preceded by a structure that is identical to a noun in the lexicon)

The provision in (7) is a surface constraint that embodies simultaneously both morphological and phonological properties. It can be understood both as a subcategorization frame for this affix, which attaches to nouns, and as a type of faithfulness constraint in OT: the material preceding *-ist* must be identical (faithful) to a noun. Like other OT constraints, it will then be violable. It is in fact violated by *antagonist*, given the non existence of **antagon*, but it is satisfied by *américanist*, both segmentally and prosodically. The reason a naive observer would be capable of the above simple answer is that they would not be familiar with the claim in (8), which precludes it:

- (8) Surface allomorphs have a common input (= Underlying Representation)

analysis of Burzio (1994a). At the same time, penultimates that are also initial fail to shorten rather generally unless followed by *-ic*, as in *tó:nal*, *mó:dal*, *lí:ar* etc. This follows from the foot typology in (6) and the unavailability of an antepenultimate syllable. Hence metrical structure is key.

The claim in (8) is the one made by the traditional ‘morpheme invariant’ theory referred to in Vaux (2003): for each set of allomorphs there exists a unique lexical representation from which all are calculated. Such traditional view was carried over into Prince and Smolensky’s (1993) formulation without specific argument and has entered into most OT work to date as a result. Under (8), the hypothesis that there is ‘Lexicon Optimization’: the input equals the output, must necessarily be cast aside any time there is allomorphy: since allomorphy is defined by different outputs, the inputs could not at the same time be identical to their outputs (Lex.Opt.) and identical among themselves: (8). In contrast, no such qualification is necessary in the present view that does not subscribe to (8). Rather, morphologically complex forms like *américanist* are still just surface forms that are ‘checked’ by the grammar. The only difference is that such checking will now invoke (7) –just another constraint.

Note at this point that (8) would define one property of URs. It would therefore make it legitimate to view UR as a level of representation, unlike the notion of input taken in its more general sense. That is, the OT notion of input would not in itself force the postulation of a level different from the surface, but the specific decision in (8) on how to account for allomorphy would. The question is therefore no longer whether UR defined as in (8) is a proper ‘level’ (it is), but rather whether it is true. The approach in (7) is meant to claim that it is not true: surface allomorphs are related only to other surface allomorphs, and thus (8) is false.

The inheritance of phonological properties that follows directly from (7) will place an immediate burden on (8): since English stress is largely predictable, the common input to *América*, *améric-an*, *améric-an-ist* cannot contain the stress, either by OT’s ‘Richness of the Base’ criterion or by the equivalent ‘non-redundant lexicon’ criterion of the pre-OT framework. This yields an ‘insufficiency’ argument against UR: If such bare-bone -stressless- UR exists, why is it not used, yielding **américanist*? Something else seems necessary²

The traditional response to the insufficiency argument –a response that has carried over into some OT work, is of course the ‘phonological cycle’, which forces the phonology to interact with morphological structure in specific ways. There are, unfortunately, serious conceptual and empirical problems with this move. A general conceptual problem is that, on the background of (8) which assigns a role to UR, the cycle just lets surface forms in through the back door. In a structure like *améric-an-ist*, the cycle prescribes that the phonology must apply three different times: once for each surface form. There is no conceptual reason for this in a theory that features (8). The empirical problem is that there are more inheritance effects than the cycle can account for, including those in (9).

² Since the notion of input in (8) is synonymous with that of lexical entry, the question is whether one could apply the inclusionary notion of lexicon of the previous section to (8), in which case such input could contain the stress. The answer is yes, but (8) would then just converge with the present view in which the form [américan] is both the input to its own calculation (inclusionary sense of input), and to the calculation of [américanist] as prescribed by (7). The only remaining issue would be terminological: since all forms involved are surface forms, there would seem little sense in calling some ‘underlying’.

(9)	Inheritance effects:	Examples:
a.	Affixal Correspondence	Affixes compete with stems for metrical consistency (Burzio 1994a, b): <i>bar(bár-icø)/ tit(án-icø)</i> , <i>títan/ *títanic</i> .
b.	Multiple Correspondence	The noun corresponds with both infinitive and participle in Italian <i>vinc-ere/ vin-t-o/ vinc-it-ore</i> (Burzio 1998).
c.	Metrically controlled suppletion	Suppletion enables each allomorph to maintain fixed metrical properties: Italian <i>vád-o/ vá-i/ and-iámo/ and-áte</i> ‘I/ you SG./ we/ you PL. go’ (Carstairs 1988; DiFabio 1990).
d.	Paradigm Uniformity	Uniform stress in Spanish <i>amába/ amábamos</i> ‘I/ we loved’ compared with Latin (Harris 1973).

In the next two subsections, I review each of the phenomena in (9) in detail, and present a general approach that includes surface constraints like (7) to deal with them. It will become evident that supplementing UR (8) with cyclic application of phonology provides no match.

3.2 Entailments, Non-derived Environments, and Lexical Conservatism

In Burzio (2000b), (2002 a, b) I introduce the hypothesis in (10).

- (10) **Representational Entailments Hypothesis (REH):** Mental representations of linguistic expressions are sets of entailments. E.g. a representation consisting of A and B corresponds to the entailments: $A \Rightarrow B$, $B \Rightarrow A$ (if A then B; if B then A).

As I discuss in that work, the hypothesis in (10) is consonant with known properties of neural behavior, and is in that respect independently natural. At the same time, it is key to meeting a number of empirical challenges that include those in (9) above. Broadly speaking, the hypothesis in (10) provides a general schema for characterizing faithfulness relations in OT, both IO-FAITH and OO-FAITH. Once grounded in that hypothesis, all such relations become forms of ‘attraction over distance’, in the sense that the magnitude of the attraction/ FAITH, expressible by an OT ranking, will depend on the overall distance between the representations rather than being fixed. One can see how attraction obtains by way of the illustration in (11).

(11) **Attraction as entailment violation**

Entailments violated by $\neg C$ in some R2,
given some R1= A, B, C:

Varying the structure of R2:

I	II
$A \Rightarrow C$	
$B \Rightarrow C$	$A \Rightarrow C$
A	A
B	$\neg B$
$\neg C$	$\neg C$

In this illustration, there is a representation R1 schematically consisting of three components A, B, C. This could be some morpheme -for example-, and A, B, C segments or features. Suppose then that in certain contexts, a markedness constraint *C would demand an allomorphic variant

of R1, describable as $R2 = A, B, \neg C$. This variation would violate the two entailments $A \Rightarrow C$, $B \Rightarrow C$ generated by R1 under (10): column I. This is the ‘faithfulness’ that the constraint *C needs to contend with. Suppose now instead that, because of other markedness constraints or other factors, the allomorphic variant M’ also features $\neg B$ in addition to $\neg C$, so that $R2 = A, \neg B, \neg C$. In that case, the same markedness constraint *C is opposed by only one entailment: $A \Rightarrow C$ – a weaker faithfulness effect: column II. The formerly violated $B \Rightarrow C$ is now satisfied vacuously, as B no longer holds. We will thus expect cases in which some repair ‘ $C \Rightarrow \neg C$ ’ will obtain only if some other repair ‘ $B \Rightarrow \neg B$ ’ has also independently obtained. This syndrome is widely attested cross-linguistically, and has long been known under the name of ‘Non-Derived Environment Blocking’ (NDEB). The case in (12) provides an illustration.

(12) **NDEB in Campidanian Sardinian**

a.	[f]amilia/ sa [v]amilia	‘family/ the family’	$f \Rightarrow v$	$[-\text{voice}] \Rightarrow [+ \text{contin.}]$
b.	[p]isci/ belu [\beta]isci	‘fish/ nice fish’	$p \Rightarrow b \Rightarrow \beta$	$[-\text{voice}] \Rightarrow [-\text{cont.}]$
c.	[b]ia/ sa [b]ia	‘road/ the road’	$b \Rightarrow * \beta$	$[+ \text{voice}] \Rightarrow [-\text{cont.}]$

The facts in (12), from Łubowicz (1999 and refs.), show that in this language obstruents can undergo both voicing and spirantization when in post-vocalic position. However, spirantization occurs only if voicing has also occurred, as in (12b) and not as in (12c). The latter (12c) is a ‘non-derived environment’ over which spirantization ‘blocks’. It is easy to see that voicing is the repair ‘ $B \Rightarrow \neg B$ ’ of the above discussion, while spirantization is ‘ $C \Rightarrow \neg C$ ’, occurring only if the former occurs, as shown in (13).

(13) **NDEB as attraction under the REH**

	I	II
Entailments violated by [+continuant]	$F! \Rightarrow [-\text{continuant}]$	
given input /p/: $F!$, $[-\text{voice}]$, $[-\text{continuant}]$	$[-\text{voice}] \Rightarrow [-\text{continuant}]$	$F! \Rightarrow [-\text{continuant}]$
	$F!$	$F!$
Varying the structure of the output:	$[-\text{voice}]$	$[+\text{voice}]$
	$[+\text{continuant}]$	$[+\text{continuant}]$
	$*[\phi]$	$[\beta]$

In (13) let the features [continuant] and [voice] refer to the initial segment of the nouns in (12), and ‘F!’ refer to the remaining features of that segment or the remaining structure of the whole morpheme, for that matter. The input representation is the attractor R1 of (11) above, and (13) considers the case of (12b) where there is a word-initial /p/. When the output is faithful except for the change in continuancy as in column I, this change incurs a two-entailment violation, but when a change in voicing has independently occurred, then the change in continuancy is facilitated, now incurring only one violation, as in column II. The exact numbers: one and two, are of course in themselves not meaningful. Since ‘F!’ is shorthand for multiple features or properties, any entailment ‘ $F! \Rightarrow x$ ’ will be shorthand for multiple entailments. What is of significance is that in the condition of column II there will be fewer entailments violated than in the condition of column I: a weaker faithfulness effect in the OT system. The blocking of (12c) then occurs because -mutatis mutandis- it does instantiate the conditions of column I, voicing

being already present in the input. The case in (12a) shows that voicing is itself not contingent on some other change. In the OT analysis, the voicing constraint must thus be ranked above even the stronger faithfulness effect. The overall translation into standard OT notation would be as in (14), where intuitive rather than properly technical labels are used.

(14) VOICING >> FAITH_{ND} >> SPIRANT. >> FAITH_D

The higher-ranked FAITH_{ND} in (14) applies in ‘Non-Derived’ cases (maximal attraction), while the lower-ranked FAITH_D applies in derived ones (weaker attraction). SPIRANT. dominates only the latter and thus only affects derived cases, while VOICING dominates all, and thus always succeeds. The duplication of FAITH in (14) is to break a potential ranking paradox. The REH (10) resolves the paradox by deriving the ranking of FAITH constraints from entailment summation. I return below to Łubowicz’ (1999) account of NDEB.

Note that while the present view maintains that all stored forms are outputs, there is no commitment to the complementary conclusion that all output forms are stored. In the case of the alternations in (12), it seems more plausible to suppose that the citation forms on the left are stored, while the phrasal structures on their right are not. The REH (10) puts this issue into a sharper perspective: since all representations generate entailments, all forms in (12) will do so as well. Nonetheless, it is evidently the case that the entailments due to the forms on the left have priority, or else such forms should become identical to those on the right. I take this to be the effect of frequency. The forms on the left occur in the majority of environments: post-consonantly and post-pausally. The usual entailment summation thus awards them priority.

In Burzio (2002a) I argue that the NDEB of (12) is the tip of a larger iceberg of attraction effects that pervades both phonology and morphology, from the structure of segmental inventories, where attraction and ‘dispersion’ (Lindblom 1986, Flemming 1995) are flip sides of the same coin, to affixal syncretisms – the leveling of affixes in inflectional paradigms, all of which can be addressed in terms of the REH (10). What is directly relevant in the present context, however, is the role of (10) in providing for the range of observed surface-to-surface relations, in particular those listed in (9). The REH predicts that a faithfulness relation, in the more specific form of ‘attraction’, will obtain between or among any neighboring representations. Since allomorphs are neighbors by definition: same or closely related meanings and -except for suppletion- closely related forms, the REH establishes that any given surface allomorph will be in a faithfulness relation with each of the other allomorphs simultaneously –Kenstowicz’ (1996) ‘Uniform Exponence’. Although certain relations exhibit important asymmetries like the one just noted for (12) and others to which I return below, the REH itself merely predicts a tendency for all morphemes to remain uniform in their surface manifestations. This places affixes on a par with stems, consistently with the observation in (9a) above applicable to each of the cases in (15).

(15) Affixal Correspondence

a. English	b. English	c. Classical Arabic nominals
i. bar(bár-icø)	i. prevènt-abíl-ity	i. ...CVCC-V

- | | | |
|-------------------|-----------------------|-----------------|
| ii. ti(tán-icø) | ii. inhàbit-abíl-ity | ii. ...CVC-V |
| iii. *(títan-i)cø | iii. *inhàbit-ábl-ity | iii. *...CVC-CV |

In the English case in (15a), given again in the analysis of Burzio (1994a), affix *-ic* has the consistent metrical property of placing stress on the immediately preceding syllable, contrasting with most other suffixes, cf. (*bárbar-ou*)sø. One might claim that this is just an input property, but this claim would be incorrect, since such property is calculable from surface relations. First, the re-stressing character of *-ic* and other suffixes in contrast with the stress-preserving character of yet others like *-ist*, (which is *not* a ‘level 2’ affix: Burzio 1994a, Sect. 9.5, 1995) is predictable from syllable structure. By containing a heavy syllable, *-ist* can be parsed either as a syllable or as a full foot, as in *propa(gánd-is)tø*, *a(mérica)(n-istø)*, respectively, and this is sufficient to guarantee preservation of stem stress in all cases (the secondary stress of *américanist* was ignored in the preliminary discussion above). Note that the variable metrical/ extrametrical status of a final syllable with a null nucleus or some other equivalent provision (extrametricality à la Hayes 1982) is amply attested independently: (*hónes*)t/ *ro(bústø)*, etc. In contrast to *-ist*, affixes like *-ic* that do not comprise a heavy syllable exclude a foot parse **(C-icø)*, as there is no foot **(Lσ)*: (6) above. This in turn results in a certain number of items necessarily re-stressing their stems, e.g.: *állergy/ al(lérgicø)* or *al(lérgi)cø*, not **(álller)(gìcø)*, cf. (*álller*)(gìstø). Suffixes to which this happens take on a fixed metrical parse instead, as in (15ai, ii) despite the fact that a variable parse could still accommodate *some* of the stems: (15aiii). This dichotomy: for any specific affix, either stem consistency or affix consistency but nothing in between, is consistent with the present notion of faithfulness based on entailment summation. Representations that have re-stressed stems contribute negatively to summation of entailments of the form ‘the current suffix must be preceded by material that is *metrically* identical to an existing item in the lexicon’. Such summation is what yields OO-FAITH constraints like (7) above and their rank, as I argue below. Because of unavoidable violations like *allérg-ic*, negatively contributing to summation of identity entailments like (7), affixes like *-ic* will thus end up imposing a lower-ranked form of OO-FAITH (stress) on their stems. This is then why, in the competition between stem and affix for control of metrical properties (FAITH-stem/ FAITH-affix) the affix wins over the stem in such cases, imposing a fixed metrical pattern rather than accommodating the stem stress --indeed as in (15aiii). Hence the first property of *-ic*: that of being re-stressing is calculable, and should therefore not be attributed to the input. The second property, that of being *pre-stressing* is also calculable, and is thus also not an input property as I discuss next.

The penultimate-stressing character of *-ic* is relatable to the many *-ic/ -ical* alternations: *académic / académical*, etc. (exactly as in Chomsky and Halle 1968, 88). Such pairs form types of mini-paradigms, which attain stress uniformity only if *-ic* parses in the manner of (15ai, ii). Affixal consistency will then ensure the same parse even when an *-ical* variant does not exist: *??titanical*. This account thus crucially relies on surface-to-surface relations that have no derivational basis (no derivation of *titanic* from *??titanical*; or -surely- of *titanic* from *barbaric*), and specifically on the assumption that affixes are subject to OO-FAITH/ correspondence relations is on a par with stems. Without such an assumption, the property exhibited by Latinate affixes of being either ‘stress neutral’ or re-stressing would have to be stipulated for each affix, and the precise correlation with their syllabic structures will be purely accidental (Burzio 1994a, Sect. 8.4).

The examples in (15b) illustrate the fact that the suffix *-able* undergoes epenthesis to *-abil-* before *-ity*. Such epenthesis cannot be motivated solely by syllable structure, since it does not occur with otherwise comparable *-y*: *prevént-abl-y*. Uniformity of stress readily comes to mind in this connection: **prèvent-ábl-ity* (no epenthesis) would re-stress the stem, as would - presumably- **prèvent-ábil-y* (epenthesis). This account of (15bi) is insufficient for (15bii), however, since **inhàbit-ábl-ity* would in itself be stress-preserving. Consistency of the affixal outcome *-ability* must therefore be invoked in addition: a type of affixal uniformity. Similar consistency over the outcome *-ably* would correctly also exclude **inèvit-ábil-y* despite its stress-consistency with *inèvit-able*. Hence affixal uniformity seems again required.

The case in (15c) is based on McCarthy (2005), who notes that, in Classical Arabic, nominal stems exist in both of the forms given in (15ci, ii): ...CVCC- and ...CVC-, unlike verbal stems, which only exist in the form ...CVC-, as shown in (16) below. McCarthy insightfully argues that the reason for this asymmetry is related to the different types of inflections involved. Verbal inflection exists in the form -CV, e.g. *-ta* ‘2ND SING. MASC.’. When occurring before such an inflection, a hypothetical ...CVCC- stem would be forced to simplify to ...CVC- to meet syllabification requirements, as in (16).

(16) Classical Arabic verbs (McCarthy 2005).

- a. Existing stems: ...CVC-CV (successful syllabification)
- b. Non-existing stems: ...CVCC-CV (would simplify to CVC-CV)

To ensure the correct outcome in cases like (16b), it is of course necessary to assume -as McCarthy does- that FAITH-affix dominates FAITH-stem, else the affix could simplify instead, yielding ‘...CVCC-V. The further fact that the more complex ...CVCC- verbal stems are never attested, even before V-initial inflections: *-a* ‘3RD SING. MASC.’ is attributed by McCarthy to Paradigm Uniformity (PU), which keeps the form of the stem constant before varying suffixes, as in (17).

(17) Paradigm Uniformity over verbal stems (McCarthy 2005)

- a. /...CVCC-CV/ ⇒ [...CVC-CV] (simplification as in (16b))
- b. /...CVCC-V/ ⇒ [...CVCC-V] (would violate PU of stem given (17a))

Nominal stems, on the other hand, exist in both forms ...CVC-, ...CVCC- of (15ci, ii) above, and this is -according to McCarthy- because nominal affixes are all V initial, never C initial as in (15ciii). As McCarthy (n.13) admits, though, this is a curious accident. Such ‘leveling’ of nominal affixes to just -V is descriptively parallel to the leveling of verbal stems to ...CVC- of (17). McCarthy’s own logic should then lead to the conclusion that -along with PU of stems- there is also PU of affixes, as in (18).

(18) Paradigm Uniformity over nominal affixes (hypothetical)

- a. /...CVCC-CV_i/ ⇒ [...CVCC-V_i] (simplification of the affix)
- b. /...CVCC-CV_i/ ⇒ * [...CVCC-CV_i] (would violate PU relative to the affix)

The subscript *i* in (18) is to indicate that it is different realizations of the *same* affix (occurring with different stems) that are being considered, just as (17) considers different realizations of the same stem. From this point of view, verbs and nouns would not differ systematically in the input form of their affixes as McCarthy suggests (a violation of Richness of the Base), but rather only in terms of ranking: verbs would take ‘dominant’ affixes (FAITH-affix >> FAITH-stem), while nouns would take ‘recessive’ affixes (FAITH-stem >> FAITH-affix). This would of course still call for an explanation, but it in fact seems in line with the account of similar differences in Greek given in Tantalou and Burzio (2003) based on the REH (10), where affixes are indeed sometimes dominant, sometimes recessive. That account attributes the ‘dominance’ i.e. higher ranked faithfulness of certain affixes to the larger number of semantic fields that they express. This higher dimensionality results in a larger number of entailments, yielding the more robust faithfulness effect. This criterion seems directly applicable to the Classical Arabic case: the (dominant) verbal affixes provide semantic specifications for number, gender and person (as well as aspect), while the (recessive) nominal ones specify only number and case (and rarely gender).

In sum, there is evidence from each of the cases in (15) that affixes tend to uniform exponence, just like stems.

At the same time as it predicts that surface-to-surface correspondence should obtain with all allomorphy whether of stems or affixes, the REH (10) also predicts that such correspondence should be multiple, from each allomorph to each of the others: (9b). If affixal correspondence is true as just argued, it must obviously be multiple since with affixes there is no unique ‘base’, but rather only multiple surface forms that feature the same affix. The cases in (19) illustrate the relevance of Multiple correspondence to stems, even aside from the case of Paradigm Uniformity just mentioned, which will be addressed later.

(19) Multiple Correspondence/ Lexical Conservatism

a. Italian	b. French	c. English
i. v <u>í</u> nc-ere asc <u>é</u> nd-ere to win to ascend	i. belle [bɛl] nice (FEM.)	i. cartóon
ii. v <u>ín</u> -T-o asc <u>é</u> -S-o won (PART.) ascended (PART.)	ii. beau [bo] nice (MASC.)	ii. cartóon-ist fásc-ist
iii. v <u>í</u> nc-IT-óre àsc <u>en</u> -S-óre winner elevator	iii. bel ami [belami] nice friend (MASC.)	iii. *?cartoon-íst-ic fasc-íst-ic

In each of the cases in (19), the form in (iii) manifests a relation with both (i) and (ii) simultaneously. In the Italian case, the agentive nouns in (iii) contain a participial morpheme (in upper case) and must therefore be related to the participles in (ii) to that extent. At the same

time, they also contain material that only the respective infinitives in (i) and not the participles have, as underscored. Similarly, in the French case the adjective in (iii) has the masculine gender of the form in (ii), but the phonological structure of the feminine form in (i). I return to the English case shortly. The phenomenon in (19a) is analyzed in Burzio (1998, 1999, 2003), where it is referred to as ‘Multiple Correspondence’. The one in (19b) is dealt with in Steriade (1999), who refers to it as ‘Lexical Conservatism’. The two designations are close equivalents. The ‘conservative’ character of both (19a, b) is in that an expected allomorphic variant of the form in (ii) merges in full or in part with the independently existing form in (i) as in (iii), rather than giving rise to some new variant, the grammar thus being ‘conservative’ in the production of allomorphs. Specifically, in the French case, while the masculine form in (ii) must serve as an input to the calculation of the form in (iii), one would expect the phonological constraint ONSET to favor the presence of a consonant in the output, as in a hypothetical candidate of the form [bɔC_ɹ], where C_ɹ is a consonant of some kind. Such candidate output apparently neutralizes with the independently existing, consonant-final, [bɛl] despite the different gender and different vowel. Evidence similar to that provided by (19a, b) also obtains in Hebrew according to Bat-El (2005). See also Rebrus and Törkenczy (2005) for partially similar effects in Hungarian. Such neutralization of allomorphic variants is in the present approach another attraction-over-distance effect, not fundamentally different from the neutralization of segmental contrasts (coda devoicing, etc.) as characterized in some of Steriade’s other work: (2000, 2001). The feminine allomorph in (i) obviously has exactly the same meaning as the masculine one, except for gender, whence the high degree of proximity/ attraction. Similarly to the French case, in the Italian cases in (19a), the agentive affix *-óre* requires a participial stem (a subcategorization effect like the one in (7) above). In the left-hand case in (19a), however, this would give rise to **vìn-t-óre*, ill-formed due to the clashing stresses. The phonological repair aimed at preserving both stem stress and stem syllabification would then produce something like *vìn.C_ɹV_ɹ.t-óre*, and such phonologically desirable structure again neutralizes with independently existing outputs: the output *vínc-* [vínč] of infinitive *vínc-ere* in (i) and the output *-it-* of items like *spèd-it-óre* ‘sender’ segmentally regular from their respective participles: *sped-ít-o* ‘sent’. Again we find no difference between stems and affixes: both stem and affixal material is repaired ‘conservatively’. The right-hand case *àscen-s-óre* is equally to the point though slightly different in detail. I argue in Burzio (1998) that the re-introduction of coda *n* from the infinitive contributes a degree of prosodic prominence to the syllable, which serves a surrogate for preservation of stress from the participle (the loss of the *n* in the participle being a markedness reduction, as I discuss in that reference).

Steriade’s Lexical Conservatism approach bears a close relation to the REH (10). Her formalization is roughly as in (20a, b) (my own paraphrases. LB).

(20) **Lexical Conservatism**

- a. An allomorph M’ has a property P only if an independently existing allomorph M has property P.
- b. If allomorphs M, M’ share property P, then they also share property P’.

The formulation in (20a) gives the general format of Lexical Conservatism, while (20b) is the form of a number of specific constraints that Steriade proposes in her analyses, involving

various choices of P and P'. It is easy to see that (20a, b) are crude versions of the REH. Both (20b) and the REH state -in different ways- that the sharing of properties is an inducement to further sharing – an attraction effect. The reference to ‘allomorphs’ in (20b) seems in fact dispensable just as it is under the REH: to be allomorphs of the same morpheme is simply to share a large number of properties of sound and meaning. The notion ‘allomorph’ in (20b) can then be simply replaced with the more general notion ‘representation’ and both (20a, b) then reduce to the notion of attraction over distance deducible from the REH.

We note further that morphemes are not only invariant or ‘conservative’ internally as (20) would imply, but also externally, in combining with other morphemes in fixed ways, e.g. the ‘selection’ of stems with a fixed lexical category, as in (7) above. Hence the notion of morpheme used in (20) is not only superfluous but also insufficient to characterize invariance in the most general terms. In contrast, I will show below that morphological selection as in (7) is reducible to the REH, so that the latter will indeed prove sufficient to characterize all invariance: morpheme-internal, and morpheme-external or combinatorial.

Steriade’s discussion also emphasizes the role of ‘landmark’ properties such as stress and word edges in triggering the type of constraint described in (20b). This is not captured by the REH (10) which is in this respect itself too crude. Nonetheless, these factors are consistent with the REH. Certain specific properties –the ‘landmarks’, evidently result in stronger entailments than others, an issue for further work (see also below).

It is also clear from Steriade’s discussion, that the Lexical Conservatism framework is inherently summational: the more properties are shared, the higher the rank of the Lexical Conservatism constraint at work. In the present framework, the summation concerns the entailments: all entailments of the form ‘ $\Rightarrow C$ ’ contribute jointly the effect ‘ $*-C$ ’.

Further consequences result from the English case in (19c) (from Burzio 1994a, Sect. 9.5, based on Goldsmith 1990, 268). Here summation seems crucial again. Forms like **cartoon-íst-ic* of (19ciii) must evidently be excluded because of the stress-shift that they would entail, compare well-formed *idéál-ist/ idèal-íst-ic*, etc., where stress is maintained. Yet the effect inhibiting stress shift –the entailment ‘if the segmental structure is *cartoon* then the stress is on the ultima’, appears to be of a sufficient magnitude only when contributed jointly by both forms in (19ci, ii) *cartóon*, *cartóonist* since in the case of *fasc-íst-ic*, where one of the forms: **fasc* is missing, there is no comparable inhibition. This is fully consistent with the REH framework and entailment summation, but not with Lexical Conservatism (20) as formulated. Since no allomorph without a final stress exists in either case (only *cartóon-ist*, *fásc-ist*, respectively) Lexical Conservatism should be violated by both forms in (19ciii) equally. Hence the scope of summation needs to be extended from the number of properties that the two representations may share as expressed by Lexical Conservatism, to the number of representations that such properties may be shared with, consistently with the present hypothesis that all concurring entailments undergo summation. In (19), will not attempt a formal account of the fact that no output at all exists for such forms as **?cartoon-íst-ic*, however. It is intuitively clear, though, that such an account would rely on the entailment violation just discussed, in combination with the only moderate productivity of Level 1 formations. I return to such productivity below.

In sum, once all needed extensions are properly factored in, Lexical Conservatism becomes non-distinct from the present proposal. With regard to this general convergence, we note further that, just like the REH, Lexical Conservatism can subsume NDEB, although Steriade does not pursue this issue in her work. Comparison of the two effects is made in (21).

(21) NDEB and Lexical Conservatism

	Input	Partial repair (unattested)	Full repair
a. NDEB (Sardinian)	p...	b...	β...
b. Lex. Con. (French)	bɔ	bɔC _?	bɛl

In both cases in (21), there is a partial repair that is not attested: a voiced but not spirantized *b* in the Sardinian case, and some form identical to the input except for some epenthetic consonant in the French case. The present account was in terms of attraction in both cases: in the Sardinian case, the partial repair weakens the attraction by the input, thus making it possible for an otherwise dominated markedness constraint (SPIRANT.) to have an effect. In the French case, the partial repair critically enhances the attraction by another output [bɛl] which is normally distinct (while also weakening the attraction by the input). The Lexical Conservatism account of (21b) was discussed just above. A parallel one for (21a) is given in (22).

(22) NDEB as Lexical Conservatism

VOICING >> LEXCON (if same voicing, same contin.) >> SPIRANT. >> LEXCON (other)

The higher ranked LEXCON in (22) has exactly the format prescribed by (20b), with P and P' being the voicing and continuancy values of the morpheme-initial consonant respectively. The lower-ranked LEXCON will have the same format, requiring some weaker type of clustering that need not concern us exactly. Hence Steriade's Lexical Conservatism handles NDEB as well: the 'blocking' in non-derived environments is a form of conservatism in that the output maintains the form of its 'input' (which is also instantiated as an output) rather than producing a new allomorph. The ranking schema in (22) is plainly just the one in (14) above with some labels changed, hence the Lexical Conservatism account continues to be just the present one. This ability to successfully generalize across the two phenomena by both the REH and Lexical Conservatism is worth noting because it does not extend to competing approaches, in particular the approach to NDEB of Łubowicz' (1999). Instead of (14)/ (22), the latter analysis would postulate the ranking schema in (23).

(23) NDEB per Łubowicz (1999)

(SPIRANT. & FAITH (voice)) >> VOICING >> FAITH >> SPIRANT.

While the schemas in (14) and (22) achieve the desired differentiating effect by splitting FAITH/ LEXCON into two variants, the one in (23) achieves the same results -in essence- by splitting markedness instead, with SPIRANT. now appearing twice in the schema. The higher-ranked instance of SPIRANT. is derived in Łubowicz' analysis by postulating a constraint conjunction

with FAITH (voice). If the latter FAITH (voice) is violated as in the partial repair of (21a), then and only then will spirantization occur, because failure of spirantization will violate the top-ranked conjunction (i.e. both conjuncts simultaneously) in (23). The machinery in (23) correctly captures the notion of attraction to an input, just like (14)/ (22): a change ‘a’ (satisfying some markedness) occurs only if some other change ‘b’ (violating some faithfulness) also occurs. While formally ingenious, this solution to (21a) will be ineffective for (21b), however. In (21a), the second change: ‘b ⇒ β’ occurs because the partial repair would be both unfaithful to the input and marked. However, the partial repair [bɔC_ɹ] in (21b) is equally unmarked as the full repair [bɛl] (both satisfy ONSET in the phrase: (19biii)). Hence, the second step in (21b) cannot be due to a conjunction of markedness and faithfulness. Rather, a constraint conjunction approach would -if anything- have to feature conjunction of faithfulness to the input [bɔ], and faithfulness to the other output [bɛl], both of which are violated by the partial repair. This would seem unrelated to the solution of (21a), however.³

In sum, the phenomenon of Multiple Correspondence/ Lexical conservatism shows that phonological outputs are in an attraction relation to neighboring representations. The phenomenon of NDEB is simply the special case in which the attracting representation is the relevant input. Since the REH (10) makes no special reference to either inputs or outputs but refers only to representations, it predicts both cases equally.

Next, I turn to the case of metrically controlled suppletion of (9c), illustrated further in (24).

(24) Metrically Controlled Suppletion (Italian)

a. vád/ and-	b. -út- / -s-, -t-	c. -ísk-/ ø
i. vád-o ‘I go’	i. sap-út-o ‘known’	i. fin-ísk-o ‘I finish’
ii. and-iámo ‘we go’	ii. scé-s-o ‘descended’	ii. fin-iámo ‘we finish’

³ The faithfulness to the feminine form [bɛl] would be a type of Paradigm Uniformity, over the masculine-feminine paradigm (despite the partly suppletive character of the relation). Beside the liability noted in the text: a conjunction of two types of faithfulness seems unrelated to a conjunction of markedness and faithfulness, attraction portends further effects that are not reducible to constraint conjunction, in particular ‘parasitic’ assimilations, like the parasitic vowel-harmony of Yawelmani and other languages (Frisch, Pierrehumbert and Broe, 2004) and the long-distance assimilatory effects of Rose and Walker (2004). In such cases, similarity induces further similarity. Translated into OT this yields the relation: ‘If FAITH-A is satisfied, then FAITH-B must also be satisfied’. By contrast, constraint conjunctions express the relation: ‘If C1 is violated, then C2 must be satisfied’ -a different relation altogether. In Burzio (2005) I argue that all assimilations are in fact parasitic in the above sense, reinforcing the point. In addition, attraction is unique in finding a common basis for both assimilations and dissimilations (Burzio 2002a). Since its general form is ‘If same A, then same B’ (if two representations have the same value for A, then they must have the same value for B), it will be satisfied by either ‘same A and same B’ (assimilation), or by ‘not-same A’ (dissimilation). Constraint conjunctions cannot provide such a common basis.

iii. *vad-iámo

iii. *scénd-ut-o

iii. *fin-isc-iámo

The cases in (24) were analyzed as instantiating metrical consistency of morphemes, on a par with the *américan-ist* case in English, as early as DiFabio (1990). The metrical consistency is in the fact that each suppletive allomorph occurs consistently either with stress: *vád-*, *-út-*, *-isc-*, or without: *and-*, *-s-* (or *-t-* as in *vín-t-o* of (19a)). The affixal alternation of (24b) also enables the stem to remain metrically consistent with the infinitive: *sap-ére/ sap-út-o* versus *scénd-ere/ scé-s-o*, although there are also metrically inconsistent cases: *vénd-ere/ vend-úto*, a point to which I return below. The types of metrical consistency in (24) are hopelessly inexpressible as forms of derivational inheritance, as noted in Carstairs (1988). As such, DiFabio's analysis (in the framework of Burzio 1994a. See also Burzio and DiFabio 1994) was one of the earliest arguments for surface-based morpho-phonology.

To be sure, there are also glaring 'inconsistencies' in the alternations: the variation in segmental make up of the suppletive allomorphs. The present discussion is not to suggest that these alternations are fully reducible to grammatical principles. Rather, only that when we find segmental suppletion –a form of idiosyncrasy, we expect that it could be recruited in this fashion to serve metrical consistency. Note yet again that there is no difference between stems: (24a) and affixes: (24b, c) in this regard. From the point of view of attraction, hypothetical alternations between the forms in (24i) and their counterparts in (24iii) would create highly similar allomorphs (same segments, different stress) standing in a strong attraction relation to one another. In general, attraction can either remain unresolved, if the relevant forms are optimal, or be resolved in one of two different ways: compliance by neutralization, or evasion by enhanced distance. Suppletion provides the evasion route in (24). I return to a full account of suppletion in Sect. 3.5 below.

In sum, the non-existence of the forms in (24iiii) results from suppletion in conjunction with a type of surface faithfulness relation for which there is no derivational analog, just like the relations involved in affixal faithfulness and in Multiple Correspondence/ Lexical Conservatism cases.

This subsection has thus executed one part of the initial plan: UR is unnecessary, (2a). It has shown that the notion of Underlying Representation finds no conceptual or empirical evidence in an approach in which parallelism of resources is available. The reasons are that, while an OT 'input' need not be an Underlying Representation (Sectn.2), a UR would indeed have to be an input: (8). Given the 'Richness of the Base' criterion, however, such input would have to contain no properties that are phonologically predictable, leaving it a mystery why surface allomorphs often inherit each other's phonological properties. The attempt to bring in some surface properties by intertwining morphology and phonology into a sequential derivation: the cycle, was shown to be ineffective because of the phenomena reviewed above: affixal correspondence (*titán-ic* is not derived from *barbár-ic*); multiple correspondence (cyclic derivations establish only one-to-one relations) and metrically controlled suppletion (the alternation *vád-/ and-* satisfies surface consistency, but is not a form of derivational inheritance). In contrast, the REH (10) makes all the right predictions so far: all representations are in a relation of attraction-over-distance to one another, with no difference between stems and

affixes. Attraction to an input yields the syndrome known as ‘Non-Derived Environment Blocking’, while attraction to a neighboring output yields Multiple Correspondence/ Lexical Conservatism. Suppletion can also achieve satisfaction of attraction, vacuously, by enhancing the distance between the allomorphs.

3.3 Of Affixes and Paradigms

In this section, I consider the nature of morphology in general from the present perspective and attempt to characterize the role of affixes as modulators of the attraction relations discussed above.

The REH (10) sets a criterion for separation of representations from one-another: sharing of features or components results in entailment violation. However, complete separation of all representations from one another is not achievable in a finite representational space, thus some sharing of some value, on some coordinate, will be a fact of life. In the above discussion, I have argued that allomorphs are in attraction relations to one-another because they are highly similar in sound and meaning. The question is why do morphemes exist in the first place and what controls their distribution. The answer is that morphology and morphemes are types of space management: words intersect with one another, but in regimented ways, giving rise to intersections: the morphemes, which are themselves relatively separate from one another when semantics is taken into account. A comparable type of management is provided by phonemic inventories. Those units too, the phonemes, intersect minimally (Dispersion Theory), although the morphemes that use them intersect in their sound structures. The REH (10) does not directly make predictions as to what intersections will occur when representations are crowded into some restricted space. If any component of a given representation entails each of the others equally, then which entailments will be violated and which will be left alone when push comes to shove will remain undetermined. The REH only predicts that things will break up at their seams –the weaker entailments will be violated, the stronger ones will endure, but does not in itself identify the seams. An attempt to endow the REH with that prediction is made in Burzio (2005), where I argue based on a simple type of reasoning that, when two components A, B cooccur in some representation, they will entail each other more strongly whenever they are themselves intersecting, that is proximate in the relevant space. While I will not reproduce that reasoning here, what this means is that there is a prediction that invariant patterns should be constituted of neighboring elements, and this seems much on the right track. The ‘concatenative’ type of morphology is consistent with this prediction if one assumes that the relevant notion of proximity includes proximity in the sequence. Then, the quasi-invariant units we call morphemes will be expected to be constituted of contiguous phonemes. The root-and-pattern type of morphology, on the other hand, will constitute the obvious alternative choice. The morphemes in that case are made up of elements that are neighbors not sequentially, but by virtue of belonging to the same major class: all consonants or all vowels as in Arabic *ktb* ‘write’ *aa* ‘active, past’, yielding the stem *katab-*. It is interesting that this type of cluster, either by sequential proximity or by major class exists only if some fixed meaning is also part of the cluster. That is, although the existence of ‘empty morphs’ is occasionally reported (Anderson 1992, 53f.; Italian *-isc-* of (24) above being one), these are relatively rare, and fixed inventories

of bi-phones or tri-phones are not generally reported. While the REH in its present form is too crude to actually predict this fact, it is nonetheless consistent with it: meaning adds dimensions to the representation and higher-dimensional representations are more stable because bound together by a larger number of entailments, as noted above in the discussion of Classical Arabic inflectional affixes. There are in fact some exceptions to the non-existence of bi-phones: inventories of diphthongs are standardly reported, as are (perhaps to a lesser extent) inventories of consonant clusters. This means that while segments cannot in general cluster together without an associated meaning, they can do so when both of the relevant types of proximity obtain simultaneously: sequential proximity and membership in the same major class. This is again consistent with the present picture.

The clustering of features in the make up of segments seems to follow similar guidelines as well. Features that belong to the same subspace in some acoustic or articulatory sense tend to co-vary, like backness and rounding, which have concurring effects on the value of F2, while other features vary independently. In general, the present perspective seems to provide an entailment-based alternative to the traditional ‘feature geometry’ approach to the clustering of features –a topic for further work.

Morpheme combinations are also expected to privilege neighbors. Specifically, if a morpheme *M* combines with both an *x* and a *y*, then the amount of entailment violation is contained if *x* and *y* are neighbors. For instance, in *parent-al*, *natur-al*, the stems *parent-*, *natur-* are neighbors by virtue of both being nouns. The fact that affixes ‘subcategorize’ in the way they do is an indication that lexical categories play a prominent role in partitioning the representational space for morphemes, just like major class features do for phonemes. We do not find affixes that select, for instance, stems ending in [l], although selection for major phonological properties near the junction with the affix, like stressed syllable or monosyllabicity, is also attested as we see below. It appears, then, that by way of certain additional considerations, the REH (10) can predict that morphemes will have specific internal make ups: sequential continuity or homogeneity by major class, and that they will exhibit fixed combinatorial properties, reflecting major groupings.

The relation of the combinatorial mechanism to the REH (10) can be more specifically illustrated as in (25), for the case of English adjectival *-al*.

(25)	Lexicon	I	II	III
a.	parental	al \Rightarrow /parent__	parent \Rightarrow N	al \Rightarrow /N __
b.	natural	al \Rightarrow /natur__	nature \Rightarrow N	al \Rightarrow /N __

In (25), within the overall set of entailments generated by the representation *parental* of (a) there will be one particular subset collectively interpretable as an entailment that *-al* be preceded by *parent*, as in column (I). Some other word, like *natural* will yield the parallel, yet rather different entailment in (b). Entailments, however, are transitive (if $A \Rightarrow B$ and $B \Rightarrow C$, then $A \Rightarrow C$). Now, the English lexicon, along with *parental*, also contains *parent*, and that representation will generate, among others, an entailment that if the sound structure is [pærənt],

then the lexical category must be a noun, as in column (II) of (25a). By transitivity, then, *-al* will entail a noun to its left, as in column (III). The same will hold for *natural* and *nature*, as in (25b). Note that this transitivity effect will obtain despite the fact that [pærənt] and [pərént-] are different in their sound structure, as are [néýčə] and [náčə-]. The reason is that they are still similar enough in sound structure as well as related in meaning. Similarity consists of shared entailments. Hence, the transitivity effect in (25III) is expected, though in some weakened form in such cases. Unlike the entailments referring to the particulars of (25I), the ones referring to the lexical category in (25III) are now concurring, so that their summation will yield an entailment of higher order – the generalization expressing the selectional properties of *-al* in (26).⁴

(26) **Morphological selection:** *-al* ⇒ /N ____ (a violable subcategorization frame)

The fact that it is this particular entailment that resists violation across the lexicon and not some other, for example one to the effect that *-al* must be immediately preceded by a [t], indicates *-as* mentioned above- that lexical category plays a particularly prominent role in the representation, resulting in entailments that are inherently stronger – a kind of bootstrapping to the summation effect.

The prominent role of lexical category is confirmed by other notable effects. For instance, affixes do not undergo the vowel shortening described in (6) above. For instance, in *satir-i:ze*, shortening occurs in the stem (cf. *sati:re*) but not in the affix. Similarly, the affix in the verb *altern-a:te* and others maintains a long vowel. This suggests the ranking ‘FAITH-affix >> *V:’. However, shortening does occur *-as* if that ranking was reversed- when the affix is dissociated from its canonical lexical category, as in the nouns *altern-[ə]te*, *organ-[ə]z-ation*, etc., revealing that the entailment from lexical category to aspects of the sound structure is a main contributor to the faithfulness effect. Similar effects obtain in Italian relative to the ability of affixes to undergo re-stressing: Burzio (1998) and below. Likely related is also the fact noted in Pinker (1991, 533) that ‘verbs ...derived from nouns or adjectives are always regular [as in] *flied out* ... in baseball, not *flew out*’. The role of lexical category in each of these effect is in fact a type of NDEB, where the notion ‘derived’ is morphological rather than phonological, referring specifically to morphological ‘derivation’: loss of lexical category confers derived status, removing the ‘blocking’ effect. In the present framework, it results in the distancing that critically reduces the attraction, just as in the more standard NDEB.

The entailment in (26), which is just the same as the one in (7) above but for a different affix, is *-in* its rank- a type of lexical statistics. Because it arises via entailment summation, its rank reflects the degree to which such relations are true through the lexicon, and is thus roughly related to the psycholinguistic notion of ‘type frequency’. At the same time, like all entailments, it is also a form of grammar, potentially bearing on new formations. As grammar, it is both part of the morphology, expressing the combinatorial properties of this affix, and a type of

⁴ This process of induction of a higher-order generalization from individual instances is partially similar to the ‘minimal generalization model of rule induction’ of Albright and Hayes (2002), Albright (2005).

faithfulness constraint relevant to the phonology: it imposes a surface-identity relation between certain representations. As such, it must then be factored in as a contributor to the notion of OO-FAITH, along with the attraction-over-distance effect discussed previously. Although both effects ultimately reduce to the notion of entailment, their relative independence is clear, and is illustrated as in (27).

(27)			Selection	Attraction
a.	i.	rémedy/ remé:di-able	symmetrical	asymm.
	ii.	lévy/ lévi-able		
b.	i.	phenòmenólogy/ phenòmenológ-ic	asymm.	symmetrical
	ii.	*allérgy/ allérg-ic		

The asymmetry of (27a) is due to attraction. In (27ai) the stem is restressed due to overriding restrictions on stress assignment: no stress on the pre-antepenultimate (Burzio 1994a). This lessens the attraction by the verb *rémedy*, allowing the regular ‘*CiV*-lengthening’ process to apply. In contrast, in (27aii) the stress of the verb *levy* (as in ‘levy a tax’) is maintained, resulting in maximal attraction and blocking of the *CiV*-lengthening: **le:vable*. This is effectively a case of NDEB similar to those discussed above (*remédi-able* is ‘derived’ by restressing), and hence the notion of attraction is crucial to an account of it. On the other hand, selection in (27a) simply requires that the material preceding *-able* be identical to a verb in the lexicon, and thus would not -in itself- discriminate between the two cases. In contrast, the asymmetry of (27bi, ii) is due to selection. The case in (27bi) shows that a derived form can copy a stress of its base (here the secondary stress), while the opposite situation is virtually unattested, as illustrated in (27bii): **allérgy*, which would copy the stress of *allérgic* does not obtain, despite the fact that it is otherwise well formed like *assémbly*. Similarly, **reme:dy*, with a long vowel copied from *reme:di-able* in (27ai), also fails to obtain. This asymmetry cannot come from attraction, which is necessarily symmetrical, just like the notion of distance on which it is based. Rather, the asymmetry must come from the fact that selectional statements like (26) (typically, as I discuss below) lack symmetrical counterparts. Hence, calculation of items in *-ic* enforces an identity relation between the stem and an existing noun, but calculation of any noun, like *allergy* does not correspondingly enforce an identity relation with some existing stem to which *-ic* is attached. I return to this point (and the exceptional back-copying of stress in *-ic/ -cal* pairs) below, but the conclusion based on (27) is that both attraction and selection are needed in the characterization of OO-FAITH effects, though both are ultimately reducible to the REH.

Selectional statements like (26) are needed in a full characterization of OO-FAITH also because different affixes contribute different ranks: Level 1 affixes permit vowel shortening and other changes in their stems: *crimin-al*, while level 2 ones do not: *cri:me-less*, etc. Hence OO-FAITH must be higher-ranked in one case than in the other: Burzio (1994a), Benua (1997). If only attraction were at work, then the nature of the affix should not matter. Instead, OO-FAITH must result from the combination of both effects: attraction and selection. This combination results from entailment summation in the present approach.

The superiority of surface constraints like (26) compared with more traditional approaches to morphology is highlighted by their ability to capture certain important correlations between morphological and phonological behavior as illustrated in (28) (and discussed in Burzio 2002b).

(28)	Morphological Irregularity/ Suppletion	Phonological Regularity
a. Lev. 1	yes: <i>compUls-ive; ARBORE-al, crimIN-al</i>	yes: <i>parént-al</i> (stress) <i>natur-al</i> (V-shortening) <i>generat-ive</i> „
b. Lev. 2	no: <i>compell-ed, tree-less, crime-less</i>	no: <i>éffort-less</i> (stress) <i>cri\me-less</i> (V-shortening) <i>genera\t-ing</i> „

Affixes which tolerate regular phonological processes in their stems, like re-stressing or vowel shortening also tolerate morphological idiosyncrasy (including bound stems like *arbore-*), as in (28a), while affixes that only have morphologically regular stems block regular phonological processes. The correlation in (28) provides a clear argument for the parallelism of phonology and morphology being advocated here. If morphology and phonology were organized sequentially, then some conditions like (26) would have to hold in the morphology to express the combinatorial properties of morphemes. However, given the correlation, some other condition would also have to hold in the phonology. The need for two different conditions instead of just one would raise the familiar ‘duplication’ red flag, while the nature of the correlation would also remain a serious mystery. From this putative point of view, it would have to be the case that whenever the morphological condition is applied more loosely, the phonology must then be applied more strictly or perhaps not be allowed to apply ‘cyclically’, with no reason in sight why this should be the case. Rather, the correlation in (28) simply shows that the OO-FAITH controlling the phonology, and the workings of the morphology, are substantially one and the same: if the phonology causes a violation of a constraint like (26), then, under entailment summation, the latter’s overall rank will be lower, making it possible for morphological idiosyncrasy/ suppletion to also violate it, and vice versa. I return to a formal account of suppletion below.

Another respect in which statements like (26) differ from traditional word-formation machinery is that -as entailments- they are transitive. This permits transderivational effects such as some of those discussed previously. Consider in this regard the comparison in (29).

(29) a.	Surface Morphology:	Part. \Rightarrow / Infin-stem ____	-óre \Rightarrow / Part. ____
i.	Infin.: <i>vínc-ere</i> ; Part.: <i>vín-t-o</i>	✓	
ii.	Noun: <i>vínc-it-óre</i>	✓	✓
b.	Derivations: <i>vínc-{-út-, -t-}</i> \Rightarrow	<i>vín-t-o</i> \Rightarrow	* <i>vin-t-óre</i>

In (29ai), participle *vin-t-o* satisfies the selectional requirement of participial morphemes (top row) that they be preceded by the infinitival stem. Perfect correspondence, as in **vinc-t-o* is excluded by syllabification requirements. The selectional requirement that suffix *-óre* be preceded by a participial morpheme is analogously also satisfied by *vinc-it-óre* of (29aii), since *-it-* is such a morpheme. In addition, however, the latter form also satisfies the requirement that the participial morpheme, here *-it-* be preceded in turn by an infinitival stem. The fact that the latter is the full form *vinc-* rather than the reduced form *vin-* of the participle itself is of no immediate consequence. The infinitival stem is entailed here by transitivity: *-óre* entails a participial morpheme which in turn entails the infinitival stem, independently of the form of the actual participle. The availability of participial *-it-* only in (29aii) when it is not a determinant of lexical category is analogous to the availability of English allomorphs *-at-* and *-iz-* with short vowels under similar circumstances noted above, in the discussion of (26): loss of lexical category results in demotion of FAITH (Burzio 1998).

In contrast to the entailments in (29a), derivations lack such transitivity effects. As indicated in (29b), once the output *vin-t-o* is produced, no trace will remain of its input *vinc-*, and only **vin-t-óre* will be expected (see Burzio 2003 for more detailed discussion). The transitivity of the entailments in (29a) is now a second factor predicting the ‘Multiple Correspondence’ discussed earlier, in addition to simple attraction: stems of *-óre* nouns are in correspondence with their participles by simple selection, as well as with their infinitives by transitivity of selection. Cases like (30) also make a similar point.

(30) a. Surface Morphology:		-ist ⇒ / N ____	-ic ⇒ / N' ____
i.	cannibal; *cannibal-ist	(✓)	
ii.	cannibal-ist-ic	✓	✓
b. Derivations: cannibal-ist ⇒		∅ ⇒	* ∅

The two selectional statements in (30a) capture, respectively, the fact that *-ist* attaches to nouns, and the fact that *-ic* also attaches to nouns including those that end in *-ist* – a class I label N'. The first of these statements is vacuously satisfied by the non existence of the noun **cannibalist* in (30ai), as indicated by the parenthesized checkmark. This gap illustrates the notoriously non-productive character of Level 1 affixation. In addition, both statements in the top row are satisfied by the item *cannibalistic* in (30aii), since here *-ist* occurs attached to N and *-ic* occurs attached to N' which is a subcase of N. The fact that **cannibalist* does not exist is again of no immediate consequence, like the non-existence of participle **vinc-it-o* in (29). The outer suffix will still select the inner stem in (30) just as it did in (29), due to the transitivity of the entailments. I will argue below that unproductive morphological systems combine selectional statements like the ones in (30a) with some degree of listing. Then, by definition of ‘listing’, the listing of *cannibalistic* does not entail the listing of **cannibalist*, hence the gap remains unproblematic in the present framework. However, it is problematic for derivations, which lack the needed transitivity: since the output of the first word-formation rule in (30b) is zero, affixing *-ic* to that output should -incorrectly- also just yield zero (suffixes being bound morphemes,

unable to occur by themselves).⁵

In sum, the REH can characterize both morphemes and their combinatorial properties as ‘invariance’ effects –ways to minimize the amount of entailment violation. The latter combinatorial properties are captured by selectional entailments like those in (26), (29), (30), which will then constrain both the morphology and the phonology simultaneously in the present parallel system. In addition, because of their property of transitivity, such entailments will establish a broader network of relations among representations than do traditional resources. The phenomena in (29), (30) provide evidence for such a broader network, as do the ‘Paradigm Uniformity’ effects of (9d) above, to which I turn next.

3. 4 Paradigm Uniformity: inflection or productivity?

PU effects, illustrated in (31), are typical of inflectional paradigms.

(31) Paradigm Uniformity effects

a.	Spanish	‘love’	amáb-a, amáb-as, amáb-a	amáb-amos, amáb-ais , amáb-an
	Latin	IMP. INDIC.	amá:bo, amá:bas, amá:bat	ama:b-á:mus, ama:b-á:tis, amá:b-ant
			1SG 2SG 3SG	1PL 2 PL 3PL
b.	Italian	‘win’	vínc-ere	vín-t-o/ *vinc-út-o
		‘know’	sap-ére	sap-út-o/ *sát-t-o
			INFINITIVE	PARTICIPLE
c.	English		pervért-ing	pervért _v (pérvert _N)

Beginning with (31a), the Latin stress system excluded antepenultimate stress in the presence of a heavy penultimate, whence the uniformly penultimate stresses of Latin in (31a). The loss of contrastive vowel length in Romance made it possible for any of the Spanish forms in (31a) to receive antepenultimate stress in principle. Stress shifts in the Romance languages are extremely rare, however, most words retaining the Latin stress. Their occurrence in the underscored forms in (31a) thus reveals the special status of ‘paradigms’, and the existence of leveling pressure within them as Harris (1973) had correctly concluded. The Italian cases in (31b) illustrate the similar fact that stem stressed infinitives often have stem-stressed participles, as in the case of ‘win’, while affix stressed infinitives only have affix stressed participles, as in the case of ‘know’, as argued in DiFabio (1990), Burzio and DiFabio (1994), Burzio (1998, 2003, 2004). The English cases in (31c) show that bare verbs are stressed identically to their present participles, which in turn have regular stress: either on a heavy penultimate, as in

⁵ Noyer (1998) has identified a number of cases in Huave where an inner stem seems relevant to the calculation of a doubly affixed form along the lines of (29), (30).

pervérting, or on the antepenultimate, as in *inhábiting*: Burzio (1994a, Sect. 8.2.6). Bare nouns do not exhibit a comparable effect: *pérvert*, because nouns do not have comparably inflected counterparts. These facts also show that while bare verbs-present participles must form a ‘paradigm’ subject to Paradigm Uniformity, bare nouns-present participles must not.

The effects illustrated in (31) cannot be reduced to ‘cyclic’ inheritance, because the forms in the right column –the inheritors, cannot be derived from the ones in the left column via some operation of incremental morphology. Rather, the affix of the left-hand forms would have to be removed to allow for derivation of the right-hand forms –an implausible operation for the traditional machinery. As discussed in Burzio (2005) the effects in (31) can be accounted for under the REH (10) in the manner of (32).

(32)	Lexicon	I	II	III
a.	X-A ₁ X-A ₂	A ₁ ⇒ /X ____	X ⇒ / ____ A ₂	A ₁ ⇒ /X ____
b.	amá-ba amá-bamos	ba ⇒ /amá ____	amá ⇒ / ____ bamos	where X= / ____ A ₂

In (32), (a) gives the abstract schema, while (b) illustrates with the Spanish case -- the Italian and English cases being quite analogous. The three inferential steps in (32) are parallel to those in (25) above: a sequence X-A₁ occurring in the surface lexicon, where X is a stem and A₁ is an affix will produce the entailment in column I, and similarly for any affix A_i. An entailment in the opposite direction will also be produced, as shown for A₂ in column II. When the entailments from columns I and II are combined, the entailment in column III will result: given two forms X-A₁ and X-A₂ featuring the same stem X, an invariance effect on X will be generated from the representational entailments. The parallelism of (25) and (32) is in that in both cases an affix selects a stem with a specific property. In (32), the stem’s required property is that of also occurring combined with some other affix A₂ in the surface lexicon, while in (25) it was that of also occurring combined with a specific lexical category, like Noun. Like the effect in (25), the one in (32) is also a type of self-feeding lexical statistics. Its magnitude registers the extent to which such identity is true through the lexicon, while some degree of identity creates pressure for an even greater identity. In all three cases in (31), the relative segmental and semantic identity of the stem allomorphs creates pressure for identity in stress. For instance, hypothetical Spanish *amá-ba/ *ama-bámos* (with the Latin stress) will constitute narrowly diverging and hence mutually attracting vectors like some ABC/ AB–C, where A, B stand-in for the segmental and semantic identity of the stem X, and C/ –C represent its varying stress. Like the entailment in (25III), so the one in (32III) is thus also a simultaneous expression of both morphological relations and of identity relations relevant to the phonology.

The two abstract affixes A₁, A₂ in (32) are obviously permutable, leading to the conclusion that PU effects are inherently symmetrical: from any member of the paradigm to any other. This contrasts with the asymmetry of statements like ‘-al ⇒ / N ____’ or ‘-ic ⇒ / N ____’ noted in (27bii) above, where only a base N would appear to influence a derivative and not the other way round.

Note here that the schema in (32) must remain applicable when one of the affixes A_1 or A_2 is null as in the case of English *pervért-ing/ pervért* (31c). In that case a label A_i in (32) can simply be taken to refer to the relevant aspect of the meaning, here the category ‘infinitive’. Hence this cannot be the factor making *parént/ parént-al* or *állergy/ allérg-ic* different from verbal paradigms. Unlike the approach of McCarthy (2005), the schema in (32) does also not make any reference to whether the affixes involved are inflectional or derivational. This is a welcome omission, since the distinction is notoriously elusive (Anderson 1992, 77-82). Rather, the difference is correctly predictable under the REH (10) from the different degrees of productivity of the relevant morphological relations, as illustrated in (33).

- (33) a. i. $al \Rightarrow /N __ :$ parent-al, peripher-al, territori-al, trib-al, ...
 ii. $*N \Rightarrow / __ -al :$ *student-al, *surger(i)-al, *inventor(i)-al, *brib-al
 b. i. $-ic \Rightarrow /N __ :$ dynast-ic, allegor-ic, German-ic, ...
 ii. $*N \Rightarrow / __ -ic :$ *amnest-ic, *industr-ic, *dormitor-ic, *Norman-ic

The entailments in (i) of (33a, b) hold with a high degree of consistency: it is most often true that when adjectival *-al* occurs it is preceded by a noun, give or take allomorphic variation (e.g. change of stress) and a certain percentage of bound stems (e.g. *arbore-al*, *electr-ic*, etc.). The entailments in (ii), however, are most often false: given a randomly chosen noun, its chances of appearing before *-al* or *-ic* are rather slim. While I return below to the issue of how such limited productivity could be approached formally, the mere fact is sufficient for present purposes: the entailments in (i) acquire incomparably greater force through cross-lexical summation than their counterparts in (ii). If correspondence effects such as these play a role in modulating attraction as expected in the present perspective, then the material preceding *-al* will be attracted to its ‘base’, but there will be considerably less attraction in the opposite direction. Inflectional paradigms such as those in (31) are thus only special in that all relations within them are typically productive, in all directions (there is always a *V-ing*, given any *V*). Whatever lies behind this property of inflection (see Carstairs 1988 for some discussion), the property itself will be sufficient to draw the needed distinction in the present context. We then predict that, should multidirectional productivity obtain in any case derivation, then multidirectional PU rather than unidirectional consistency with a base should obtain as well. One case in point is that of *-ic/ -ical* alternations discussed above. Unlike the more general statement in (33a ii), the statement ‘...ic $\Rightarrow / __ -al$ ’ (if a structure ends in *-ic*, it also occurs before *-al*: *academic/ academical*, etc.) holds with some degree of systematicity (*-al* thus attaches not only to nouns but also to a certain class of adjectives). The transfer of the regular stress from the *-ical* variant: *académical* to the truncated variant: *académic* is thus consistent with expectations, and thus just like the PU effect of *pervért/ pervérting* (Burzio 1994a, Sect. 8.2.6). Recall also that identity in lexical category plays a role in FAITH effects as well. Such identity holds over *-ic/ -ical* pairs (both adjectives) as it does over inflectionally related pairs, reinforcing the expectation of PU effects. In contrast, both lexical category and productivity predict weaker FAITH effects over *V/ N* pairs like *pervért/ pèrvert* of (31c), whence the frequently different stresses. Indeed, the morphological relation within such pairs is rather unproductive in both directions: *indént/ indènt*, but *invént/ *invent* (V only) and **garmént/ gárment* (N only). Hence, the expectation

that productive derivational relations will result in PU effects on a par with inflectional ones seems correct.

The expectation in the opposite direction that, should some inflectional relations be unproductive, they will result in an asymmetry on a par with derivational ones, also seems correct. Albright (2005) notes asymmetrical relations in Latin such as: [populus]-NOMINATIVE/ [populi:] -GENITIVE ‘people’ versus [manus]-NOMINATIVE/ [manu:s]-GENITIVE ‘hand’. In such a case, the respective entailments from genitive to nominative will be different but not contradictory: given a genitive in *-i:*, there must be nominative in *-us*’; given a genitive in *-u:s*, there must be a nominative in *-us*’. In contrast, the respective entailments in the opposite direction will be contradictory: given a nominative in *-us*’ there must be a genitive in *-i:* ; given a nominative in *-us* there must be a genitive in *-u:s*. The relation from nominative to genitive is in this case ‘unproductive’, in the same sense as each of the relations in (ii) of (33): the corresponding entailment is often false. We would then predict that, in this kind of situation, the genitive should be able to influence the form of the nominative more than the other way around. Indeed, this is consistent with Albright’s (2005) discussion of paradigm leveling in Latin, where certain nominatives inherited the form of the genitive rather than the other way around, as if the genitive were ‘the base’, e.g. *hono:s* becoming *honor* ‘honor-NOMINATIVE’ to conform with *hono:ris* ‘honor-GENITIVE’.

The cases in (34) further illustrate the irrelevance of the inflection/ derivation distinction.

(34)	Gloss	Participle	‘-er’ Noun	‘-ion’ Noun	‘-ive’ Adject.	Allomorph
a.	<i>sent</i>	sped-ít-o	sped-it-óre	sped-iz-ióne	sped-it-ívo	it
b.	<i>attacked</i>	aggred-ít-o	aggres-s-óre	aggres-s-ióne	aggres-s-ívo	ss
c.	<i>adhered</i>	ader-ít-o	ade-s-óre	ade-s-ióne	ade-s-ívo	s
d.	<i>asserted</i>	asser-ít-o	asser-t-óre	asser-z-ióne	asser-t-ívo	t

As argued in Burzio (1998, 2003) de-participial derivatives in Italian avail themselves of several different allomorphs of the participial morpheme as listed in the rightmost column in (34): *-it-*, *-s-* sometimes resulting in geminate *ss*, and *-t-*, which results in affricate [ts] orthographically *z*, before the sequence *iV* of *-ióne*. The variation between syllabic *-it-* and the asyllabic allomorphs *-s-* and *-t-* can be understood in terms of the competing needs for segmental and metrical consistency with the primary allomorph *-ít-* instantiated in the participles in (34). In the presence of the derivational suffixes *-óre*, *-ióne*, *-ívo*, which bear their own stress, the stress of *-ít-* is excluded by a stress clash. Simple removal of the stress as in *-it-* of (34a) violates metrical consistency: same segment, different stress. Recourse to suppletives *-s-*, *-t-* violates segmental consistency, but satisfies metrical consistency instead, just as in the case of suppletive *and-* compared with *vád-* of (24) above. The point of relevance is that the choice between these two options is idiosyncratic, i.e. lexically controlled. To a considerable degree, so are the choice between *-t-* and *-s-* as well as the gemination effect: (34b) versus (34c). Despite the several degrees of idiosyncratic variation, all derivatives from the same base have consistent outcomes

as shown in (34). This is a PU effect over derivation: all derived stems in each of (34a, b, c, d) are identical ($t \Rightarrow ts$ aside), despite the fact that they are all different (accentually or segmentally) from their respective participial bases, thus excluding a ‘base-identity’ account. This effect follows in the present framework from the fact that the morphological relations across the derivatives are fairly productive (if there is an *X-óre*, there is likely also an *X-ivo*, etc.).⁶

To conclude, combinatorial properties of morphemes are characterizable in terms of selectional entailments of the type: $X \Rightarrow / _ Y$. These are presumed to arise from the self-organizing properties of the lexicon under the REH. They differ from traditional morphological means (Word Formation Rules or Subcategorization frames) in several important ways. First, they are violable surface constraints. As such, they cross-generalize over both morphological and phonological domains, correctly predicting co-variation of properties. Specifically, they will tolerate morphological variation (=irregularity/ suppletion) if and only if they also tolerate phonological variation (= regular/ ‘normal’ application of phonology). Secondly, because they impose types of partial identity across surface forms, their effects are transitive, yielding a larger set of relations than would traditional derivational means. I have argued that the difference between relations that hold symmetrically, allowing bidirectional phonological transfers (PU) and those that hold asymmetrically (Base Identity) is only incidentally rather than directly related to the inflection/ derivation distinction, contra McCarthy (2005), the direct source of the difference being rather productivity.

⁶ A further challenge to a simple inflection/ derivation distinction à la McCarthy (2005) is posed by the facts discussed in Jarosz (2005). She notes that several alternations of Polish are leveled within an inflectional paradigm only in the context of a derivational affix such as the diminutive. This situation is illustrated by the following paradigms.

	“pit/hole” (masc.)		“cow” (fem.)		“little pit/hole” (masc.)		“little cow” (fem.)	
	SING	PLUR	SING	PLUR	SING	PLUR	SING	PLUR
N	d[u]ł	d[o]ły	kr[o]wa	kr[o]wy	d[o]łek	<u>d[o]łki</u>	kr[u]wka	kr[u]wki
G	d[o]łu	d[o]łów	kr[o]wy	kr[u]w	<u>d[o]łka</u>	<u>d[o]łkuw</u>	kr[u]wki	<u>kr[u]wek</u>
D	d[o]łowi	d[o]łom	kr[o]wie	kr[o]wom	<u>d[o]łkowi</u>	<u>d[o]łkom</u>	kr[u]wce	kr[u]wkom
A	d[u]ł	d[o]ły	kr[o]wę	kr[o]wy	d[o]łek	<u>d[o]łki</u>	kr[u]wkę	kr[u]wki
I	d[o]łem	d[o]łami	kr[o]wą	kr[o]wami	<u>d[o]łkiem</u>	<u>d[o]łkami</u>	kr[u]wką	kr[u]wkami
L	d[o]le	d[o]łach	kr[o]wie	kr[o]wach	<u>d[o]łku</u>	<u>d[o]łkach</u>	kr[u]wce	kr[u]wkach

In the non-diminutivized paradigms on the left, Polish raising of *o* to *u* applies regularly: in closed syllables. In contrast, in the presence of the diminutive affix, the paradigms level in one or the other direction (under- and over-applications of raising underscoring). See Kenstowicz (1996) for further discussion. Since both sets of paradigms are inflectional, such distinctions go unexpressed within McCarthy’s (2005) ‘Optimal Paradigms’ approach. Jarosz (2005) argues for a solution consistent with the present approach in which the entailments contributed by the derivational relation are able to combine with those due to the inflection yielding a stronger overall effect.

The present proposal can be seen as straddling two competing tendencies of recent work, hopefully combining only their respective virtues. One of these is represented by Benua (1997), McCarthy (2003, 2005). That line of work postulates special types of Correspondence constraints: Base-Identity and Paradigm Uniformity/ ‘Optimal Paradigms’, as part of the phonology. While important for establishing the typology of Correspondence constraints, such an approach skirts the issue of how such constraints may reduce to independent properties of the morphology. By dealing with just those two types of effects parochially, it also fails to account for the full range of Correspondence effects that includes Affixal Correspondence: (15) above, and Multiple Correspondence/ Lexical Conservatism: (19) above. The alternative approach of Kiparsky (2000), Rubach (2000) on the other hand, addresses that issue head-on, insisting that all Correspondence relations be reducible to morphological relations. By maintaining a traditional, derivational-type morphology, however, that approach also fails to yield the full range of effects, accounting only for those that are consistent with cyclic derivations. The present approach has the conceptual leanness of Kiparsky’s/ Rubach’s (Correspondence is a by-product of morphology), but by recasting morphology into a parallel system it derives the full range of effects, including Benua’s/ McCarthy’s Base-Identity and Optimal Paradigms.

While the present system thus continues to postulate only surface forms and no URs, there continues to be no ‘redundancy’ to it. Forms like *parental* or *Americanist* are members of the lexicon, but this continues to be a lexicon which is grammar-checked. The grammar in this case contains the morphological constraints that relate these items to *parent* and *American* respectively (as well as to others by transitivity). In the present UR-less system, there is therefore no ‘redundant’ lexicon in the sense of Vaux 2003 –only a lexicon which is parallel to the grammar, such that the two combined sets of effects: properly lexical; properly grammatical, are inseparable, except rather indirectly by consultation of the constraint hierarchy.

3.5 Whence Suppletion?



The assumption that surface allomorphs have a common input of (8) above, is refuted by the phenomenon of suppletion, illustrated in (35).

- (35) a. go/ went,
 b. compel/ compuls-ive, crime/ crimin-al
 c. *arbore/ arbore-al

In each of the cases in (35), the morphologically or semantically more complex item exhibits some independence from its base. If surface allomorphs are ordinarily related to one-another vial a common UR, then the effects of that UR must somehow be overridden in these cases by alternative input information which is *not* consistent across the two allomorphs. The tradition features various types of overrides: alternative Word-Formation-Rules for cases like (a); readjustment rules for cases like (b); and lexical diacritics forcing certain stems to undergo affixation for cases like (c). In each case, the proposed device holds little explanatory force, however, as an alternative grammar without that device always seems unquestionably simpler. As already noted, any approach to (35) within a traditional architecture would also fail to shed

light on the correlation between suppletion and phonological regularity. That correlation is in that the same affixes that allow suppletive stems, such as *-ive*, *-al* of (35) (in general, the ‘Linate’ affixes) also allow for regular phonological processes such as re-stressing and vowel shortening: *parént-al*, *nátur-al*, *générat-ive*, etc. Regular phonology is not detectable in the case of *went* (35a), but it is in other ‘irregular’ past tenses, like *kept*, which has a regular syllable structure, in contrast to a morphologically ‘regular’ counterpart like *beeped*, which has an exceptional syllable CV:CC.

By contrast, in the present perspective that has no UR, derived forms and their bases *always* have independent inputs, hence suppletion is fully expected. The relative distribution of suppletive and regular morphology is in this case determined by constraint ranking, in the manner of (36).

(36)a. Suppletive Morphology	Input: /compUls-ive/ Base: /compel/	IO-F	OO-F
	a. compell-ive	*	
	b.  compuls-ive		*
b. Regular Morphology	Input: /compUls-ed/ Base: /compel/	OO-F	IO-F
	a.  compell-ed		*
	b. compuls-ed	*	

In (36), the availability of idiosyncratic input is assumed to be same in both cases, consistently with the ‘Richness of the Base’. What varies in the two cases is the rank of OO-FAITH, in particular the rank of the selectional entailment triggered by each affix, respectively ‘*-ive* \Rightarrow /V__’ and ‘*-ed* \Rightarrow /V__’. In this perspective, the lower rank of OO-FAITH in (36a) and with Linate affixes in general is in a sense both the cause and the result of the rampant idiosyncrasy. The latter idiosyncrasy yields more modest entailment summation in the sense of (25) above, and this in turn is a weaker suppressor of the idiosyncrasy. Ultimately, the difference between the Linate and the Germanic vocabularies relates to the fact that the former came into the language already rich with gaps and alternations.

Etymology does not help account for the phonological differences between ‘regular’ and ‘irregular’ expressions of the past tense, however. Rather, I take those differences to stem from class size. Irregulars can be thought of as forming separate conjugations. Conjugation membership appears to function like a ‘major class’ feature similarly to lexical category, and plays a major role in conditioning entailment summation. Specifically, in the large regular class, the selectional entailment *-(e)d* \Rightarrow /V__ that yields the past tense attains a very high rank under summation, resulting in virtually no stem allomorphy. In contrast, the corresponding *-t* \Rightarrow /V__ entailment in the smaller *keep* conjugation will attain only a weaker rank, yielding stem allomorphy more freely: *kep-t*. Hence for past tense forms which are ‘irregular’ simply by being phonologically regular, the input information needed reduces to some diacritic that sets them apart from the main conjugation.


The statistical basis for such OO-FAITH effects or lack thereof is confirmed by evidence from the Romance languages. For instance, one finds French *je par(t)/ nous partons* [ʒə paʁ] / [nu paʁtɔ̃] ‘I leave/ we leave’, with a ‘floating’ *t* in the smaller *-ir* conjugation, but correspondingly only *je porte/ nous portons* [ʒə poʁt] / [nu poʁtɔ̃] ‘I carry/ we carry’, with no alternation, in the far larger *-er* conjugation. Similar restrictions on stem alternations hold in other Romance languages. The assumption that PU effects are a by-product of inflectional as opposed to derivational morphology (McCarthy 2005) thus appears insufficient, statistics also being necessary, given the correlation with class size. Since I argued in the previous section that statistics (productivity) was sufficient to capture the rough correlation between inflection and PU effects, statistical factors thus appear both necessary and sufficient. The noted further correlation between suppletive morphology and regular phonology now follows from the fact that both IO-FAITH (controlling idiosyncrasy) and MARKEDNESS (controlling regular phonology) are competing with OO-FAITH, the enforcer of surface-identity relations, whence **compuls-ed*, **arbore-less* (no suppletion or bound stems), along with *beep-ed* (exceptional syllable) *éffort-less* (exceptional stress), *crime-less*, *genera:t-ing* (no vowel shortening).

Beside correlating with phonological regularity, morphological idiosyncrasy is also well known to correlate with limited productivity. That correlation is captured in the present analysis by considering that selectional entailments are the current equivalent of word-formation rules. When they are low-ranked, they will function as weak word-formation rules. Specifically, what I take it to mean for an entailment like ‘*al* ⇒ / N __’ to be low-ranked is that -revising slightly the discussion of (26) above- the generalization it represents has not fully ‘emerged’ from the individual cases, due to the many inconsistencies between each stem and the corresponding noun in the lexicon. The correct intuitive interpretation of this state of affairs would be that the entailment-based characterization of the distribution of *-al* is intermediate between the contextual generalization ‘/N__’ and a contextual list: {/parent__ ; /natur__ ; ...}: a ‘weak schema in Bybee’s (2001: 27) sense, and a point in what must be recognized to be a ‘rule-list’ continuum rather than just a binary choice, in agreement with Bybee (2001: 20), McClelland and Sidenberg (2000).⁷ In this regard, both *parent* and *student* would fit the contextual generalization, but only *parent* is in the contextual list, whence the existence of *parental*, but not of **studental*. The ‘listing’ of *parental* is a form of input, hence the often suppletive character of English ‘Level 1 affixation and its limited productivity are closely related phenomena, a relation that can be roughly captured as in (37).⁸


⁷ Bybee (2001, 195) points out that, while type frequency contributes positively to the strength of a schema, token frequency contributes to it negatively. In the present framework this is because type frequency summationally enhances entailments like (25III) above (*-al* attaches to nouns) that constitute the schema, while token frequency enhances item-specific entailments like those of (25I) above (*-al*, attaches to *parent*) which yield a list.

⁸ The present deployment of IO-FAITH in accounting for suppletion, illustrated in (36a), (37a) is analogous to Zuraw’s (2000, 50) appeal to USE LISTED constraints, given the shared assumption that surface forms can be ‘listed’. As I will note below, this parallelism extends to the account of lexical control of phonological variation (the present IO-FAITH, or her USE LISTED providing the control, equally). However, USE LISTED does not account for the non-productivity

(37)a. **Suppletive Morphology**

Input:	/ARBORE-al/	IO-F	OO-F
Base:	/Ø/		
a.	Ø	*	
b. 	arbore-al		*

b. **Limited Productivity**

Input:	/Ø/	IO-F	OO-F
Base:	/student/		
a. 	Ø		*
b.	student-al	*	

In (37a) there is an output without a base, while in (37b) there is a base without an output. In both cases, it is the ‘listing’ of the derivative in the form of an input that determines the outcome. In (37a) there is such an input and yet no base, and that proves sufficient, while in (37b) it is the other way round: there is a base but no input for the derivative, and that base proves *insufficient*. The output conforms with the input in both cases as demanded by the ranking. Hence, the assumption of (8) above that bases and their derivatives share a common input is a major roadblock not only to an account of each of suppletion (37a), but also of limited productivity (37b).

The twin accounts in (37) must be qualified in important ways, however. As with other phenomena discussed earlier (e.g. NDEB), the strict ranking of constraints proves inadequate here as well. Under that ranking, Level 1 affixation should be totally irregular: (37a), and fully listed: (37b). The ‘grammar’, in the form of OO-FAITH, should play no role, since it is fully dominated. What is needed instead is the present assumption that the different types of resources: MARKEDNESS (Phonology); IO-FAITH (Lexicon); OO-FAITH (Morphology) interact by summation. The hybrid character of Level 1 affixation: partly listed/ partly grammatical can then be accounted for as discussed next.

Under Richness of the Base, the input is taken to be unconstrained. In the present interpretation, this property extends to dimensionality, so that an input will freely range from the full structure of a word with its associated semantics, to just a single segment and even just some features. Under the REH, the dimensionality of an input matters, playing a direct role in the IO-FAITH effect. Specifically, a low-dimensional input will correspond to few entailments of type ‘ $\Rightarrow x$ ’ (there must be an x), for any component x of that input, and thus to a low ranked IO-FAITH effect. Hence, in general, a low-dimensional input will tend to have no effect, leaving matters to other constraints, which may well then produce a null output. There is a specific class of cases, however, in which even a low-dimensional or fragmentary input will have an effect. These are cases in which the rest of the constraint hierarchy would yield an indeterminate or a near-

shown in (37b): without a listed form, the latter constraint would be vacuously satisfied. What (37b) thus shows is that USE LISTED must be recast as regular FAITH: the output must be whatever the input is, including zero.

indeterminate output, for instance by way of two candidates that are equally or near-equally optimal. Then, even a small factor such as the hypothetical input fragment may play a critical role in breaking the tie. I will argue below that this is the correct formal model of lexically controlled phonological variation. For instance, English vowel-shortening is indeterminate in the context of penultimate syllables, whence *blasphemē*/ *blasphemous* (shortening) versus *desirē*/ *desirous* (no shortening), but the outcome is fixed for each item. This is attributable to the respective inputs: /*blasphemous*/, /*desirous*/. However, such inputs only need to be minimally specified to be able to resolve the indeterminacy: just some fragment of the representation specifying vowel length, the rest of the representation being fully determined by the grammar. Now, the phenomenon of (37b): non existence of **student-al* alongside of *parent-al* is a case of lexically controlled *morphological* rather than phonological variation, and is amenable to the same type of account. The variation is in that affixation of *-al* to any noun may either yield an output or not, indeterminately by some small margin. The surface lexicon will then control the variation as in the case of shortening. Our weak *-al* schema can then be thought of as a system with a less- than-full ability to do pattern completion: to complete the pattern *N-al* given any *N*. For the completion to succeed, a certain number of bits from the completed pattern must also be provided to help it along: the partial listing.

Lexical and grammatical resources thus need to be thought of as homologous or of the same type, so that they can be integrated together in this fashion. The common type provided by the present framework is the entailment, and the integration consists of summation. The present conception accounts for the variation by assuming that the input is stochastically variable in dimensionality. A low-dimensional input will have an effect only if concurrent with some grammatical process: *parent-al*. If non concurrent, it will have either no effect or an inhibitory effect: **student-al*. In contrast, a high- dimensional input will have the ability to fully override the effects of the grammatical process, resulting in suppletion: *arbore-al*, *crimin-al*. The fact that such suppletion occurs only in a fraction of the Latinate vocabulary will now follow from the stochastic property of the input: dimensionality controls FAITH, and high-dimensionality, resulting in high-ranked IO-FAITH as in (37a), obtains only some of the time. Whatever its dimensionality, the input continues not to be a specific level of representation in this system, but rather just a partition of the surface form as discussed earlier. Once again, if ranking was ‘strict’ as in (37), there should be no variation. On the given ranking, an output should always just correspond to the input (the listing), whatever it is.

The present view is similar to well-known approaches to variation that introduce a stochastic component into the constraint ranking: Boersma (1998), Boersma and Hayes (2001), but differs from those in that here the stochastic ranking of IO-FAITH is not a primitive property, but rather one that follows from the conjunction of OT’s Richness of the Base (random properties of input, including dimensionality) and the REH (dimensionality of a representation modulates FAITH).

Like dimensionality, frequency of occurrence is also expected to contribute to IO-FAITH through entailment summation. It is well known that ‘token’ frequency indeed correlates with morphological irregularity (Bybee 1985, 2001, Pinker 1991), as all of the English irregular verbs are highly frequent. IO-FAITH thus corresponds here to Bybee’s (2001, 38) notion of ‘lexical strength’. While it is not clear that items like *arboreal* of (37a) are particularly frequent, the

situation characterized in (37a) is special in that here the competing grammatical schema is only a weak one, making the conditions for morphological irregularity less stringent than those for the past tense. Nonetheless, frequency also plays a role in Level 1 irregularity, as many irregular patterns are highly recurrent: *comPULS-ive*, *rePULS-ive*, *rePULS-ion*, ...; *proBLEMAT-ic*, *emBLEMAT-ic*, ... The multiplicity of such concurrent representations constitutes a kind of ‘type’ frequency which will contribute to entailment summation similarly to token frequency, also aiding in the subversion of the regular pattern. Hence, an irregular but recurrent pattern like PULS will constitute an alternative attractor to the pattern ...*pel* instantiated by the relevant verb (*compel*, *repel*, ...). Irregular past tenses of course also instantiate minor types in this sense, consistently with the above claim that they constitute minor conjugations: *sank*, *sang*, *rang*, ..., etc.

In sum, both suppletion and limited morphological productivity reveal a critical role for the lexicon in morphologically complex forms, which are otherwise grammatical objects. Both effects are consistent with the present framework in which lexicon and grammar can simultaneously contribute to any surface form, either concurrently, resulting in lexically controlled morphology: *parent-al* vs. **student-al*, or discordantly, resulting in lexical overrides of the morphology: *compuls-ive*, *arbore-al*. In contrast, the traditional assumption that allomorphs have a common UR is directly contradicted by suppletion: at least for such cases that assumption is false. Similarly, limited morphological productivity is inconsistent with the traditional notion that there is a lexicon of morphemes that feeds into the grammar, here the grammar of morphology. At least in these cases the lexicon has a presence downstream of the grammar, controlling the morphology. Lexically controlled phonology, to be discussed below, will lead to the same conclusion.

3.6 Base Neutralization

There are many cases in which the structure of a morphologically complex form is not fully recoverable from its ‘base’ and which -however- do not instantiate suppletion –a situation illustrated in (38).

(38)	Base	Derivative
a.	[dæm]	[dæmn̩]-ation
b.	[pærənt]	[pərént̩]-al

In (38a), the underscored n in the derivative is not present in the base, while in (38b) it is the quality of the underscored vowel that is absent in the base. These alternations do not instantiate suppletion because they are phonologically predictable: there is a neutralization process that regularly applies in the base. In (38a) this process simplifies a word-final clusters of nasals, while in (38b) neutralization affects vowel quality in unstressed position. Neither process applies in the derivative simply because its environment is not met: in (38a) because the cluster is not word-final, and in (38b) because the underscored vowel is stressed.

McCarthy (2003) concludes on the basis of facts similar to those in (38) in Arabic that derivatives cannot be calculated solely via OO-FAITH, but must rather also be related to an input (contributing the underscored material in (38a, b)), which he takes to be the UR. McCarthy's conclusion is correct, except for the UR. This class of cases is explicitly addressed in Burzio (2000a, 62-64). The following brief discussion largely recaps the contents of that earlier work.

The underscored material in (38) must unquestionably come from an input. However, since the rejection of UR makes it possible for derivatives to have their own input (discussion of suppletion), facts such as (38) cannot show that there is a UR, other than by circularity (if there is a UR, then there is presumably no input other than UR). At the same time, assuming that the underscored material in (38) is part of the derivative's input without being part of a UR does not -incorrectly- reduce these cases to suppletion. The reason is that in truly suppletive cases like *go/ went* or Italian *and-/ vad-* there must be two fully independent inputs. In each of these cases, two different segmental structures are associated with the same basic meaning 'go'. In the present system, intersecting representations such as these are under pressure to neutralize under attraction (OO-FAITH/ Paradigm Uniformity) and thus become identical. In order to prevail over such pressure, IO-FAITH relative to each of the independent inputs must be sufficiently high-ranked. This will in turn require the conspiracy of statistical factors discussed in the previous section, accounting for the relative infrequency of suppletion: the input for each of the allomorphs must be sufficiently high-dimensional, indeed as if it were a totally independent form, and of sufficiently high frequency. In contrast, only a single input is needed in the cases in (38) rather than two conflicting ones. That input will call for the presence of the underscored material in each case, in the form of the entailments 'the environment: [dæm__] must be filled by [n]' and 'the environment [pər__nt] must be filled by [ɛ]', respectively. Under the REH (10), these entailments, constituting a form of IO-FAITH in OT, are inherent in the representation of each derivative in (38). This point parallels the discussion of suppletion in part: an input is associated with morphologically derivable forms, but with the noted crucial difference: there is no separate input for each of the bases in (38). Instead, the latter bases instantiate just the same entailments as their derivatives except for the underscored material. The reason that the latter material is absent in the bases is not due to an overriding input for the base, but rather to markedness constraints that are part of the phonology. If it were not for those, the derivative's entailments would condition the base, imposing the underscored material under the expected attraction, given that the two representations intersect substantially. We have seen that transfer effects from derivatives to their bases are weak in such cases (never overriding regular assignment of stress: discussion of (27)). Nonetheless, in the absence of any specific obstacle, such transfer would be expected. Once the base undergoes the neutralization process, however (*n* deletion/ vowel reduction), one might expect its form to be copied onto the derivative. Copying in this direction was shown to be stronger (stress transfers: (27bi)), and yet we have reason to believe that they would still not be strong enough. We know from the discussion of suppletion: (36a) that the ranking 'IO-FAITH >> OO-FAITH' must hold to some degree over Latinate affixation, and this suffices to account for the cases in (38): the derivatives maintain the underscored material faithfully to their inputs rather than leveling their forms in conformity with the base. Hence, while the present analysis does not treat cases like (38) as suppletion, it does predict that these kinds of alternations, involving a neutralization effect in a base which is not transferred over to a derivative, should show some overall correlation with suppletion, since the

same ranking: ‘IO-FAITH >> OO-FAITH’ would be involved in both cases. This is correct, as the Germanic/ Level 2 affixes, which do not tolerate suppletion: (36b), also generally do not tolerate alternations like (38), witness cases like *[dæm]/[dæm]-ing* and others, where all properties of the bare verb are transferred (Benua 1997). Since suppletion is a morphological phenomenon and alternations like (38) are phonological, there will be no account of their correlation short of the present approach in which OO-FAITH constraints interact simultaneously with both IO-FAITH (suppletion) and MARKEDNESS (Phonology).

As for the OO-FAITH effects that are attested within the Latinate vocabulary in contrast to the violations in (38), we note that these essentially only concern the stress patterns. This restriction can be accounted for by considering that stress transfers always obtain under a high degree of segmental identity between base and derivative, a situation that will result in a specially high-ranked OO-FAITH/ attraction in the present system. This is the ‘Metrical Consistency’ of Burzio (1994a, b). The latter must dominate some of the constraints that make up the grammar of stress in order to yield the transfers. The latter constraints must in turn dominate IO-FAITH given the generally regular character of English stress.

In sum, derivatives often contain information that is lost via regular neutralization processes in the base form. This fact implies that FAITH to a base is insufficient to predict the form of the derivative, and that FAITH to some input is also necessary. There is no further implication that such an input must be a UR, however. The same notion of input that is required for suppletion will be sufficient for these cases as well. Yet this will not incorrectly treat them as suppletion.

3.7 Conclusion

This section has provided the argument of (2)above, restated in (39).

- (39) a. UR is unnecessary because OO-FAITH can play an equivalent role.
 b. UR is insufficient because suppletion requires independent inputs.

We have seen that OO-FAITH relations are a necessary part of the theory of morpho-phonology because of the transfer of phonological properties between allomorphs, thus yielding (39a). The principle of cyclic application –the only alternative to OO-FAITH, is on the one hand a concession that surface representations (rather than UR) matter, while on the other is still sharply inadequate empirically, as each of: affixal uniformity, multiple correspondence and paradigm uniformity proves beyond its reach. In contrast, the REH (10) was shown to derive the full range of needed OO-FAITH relations, while at the same time also recasting the morphology into a system of violable constraints, dispensing with the need to see the morphology as feeding the phonology serially, via the UR. On this conception, the same OO-FAITH relations that are necessary given the transfer effects, also become sufficient to characterize the morphology. For instance, in *Américan/ Américan-ist*, the transfer of phonological properties such as stress occurs for the same reasons as the transfer of input properties such as the segmental structure. The common reason is the selectional constraint or morphological schema ‘-ist \Rightarrow /N ___’ stating that the suffixal structure *-ist* must be preceded by a sequence that corresponds to a noun in the

lexicon. When the OO-FAITH mandated by such morphological schemas is low ranked, it will sometimes be outranked by IO-FAITH, resulting in morphological irregularity/ suppletion without any special machinery other than just ranking, thus yielding (39b) in full force.

The surface approach to morphology delivers further advantages, in the form of a triple correlation among: i) phonological regularity; ii) morphological irregularity/ suppletion; and iii) lack of morphological productivity. Low-ranked schemas are violable by both markedness constraints of the phonology and by IO-FAITH, yielding the correlation between the first two members of the triple. In addition, low-ranked schemas are not fully productive because the same stem-base mismatches that result in low-rank, also result in ‘fuzzy’ subcategorization. For instance, the mismatch between [pærənt] and [pərənt] of *parental*, due jointly to the phonology of stress and of vowel reduction, will contribute to a low rank for the entailment ‘-al ⇒ / N __’, by interfering with the transitivity effect of (25) above. Here, the derivative yields the entailment ‘-al ⇒ / [pərənt] __’ while the base entails the category noun only for the sound structure [pærənt], not [pərənt]. We presume that, in terms of the overall entailment structure, this will result in a subcategorization ‘-al ⇒ / X __’ in which X is not a pure category ‘N’, but rather a hybrid object intermediate between a category and a list. For this reason, *-al* will then not only tend to attach exclusively to nouns, but also to attach exclusively to the members of the list, and hence be ‘unproductive’. The input /parental/ puts *parent* in the list. This captures the difference in productivity between English Level 1 and Level 2 formations, the latter instantiating stronger schemas by properties i) and ii), while being notoriously more productive: property iii). However, productivity appears to be also partially controlled by the derivation-versus-inflection difference, the latter being inherently more productive for reasons that I will not attempt to address (see Carstairs 1988 for some discussion). For instance, Level 2 derivational *-ful* does not appear to be fully productive: *graceful, peaceful*, vs. ??*choiceful, ?? warful*, in contrast to Level 2 inflectional *-ing*, which attaches to all verbs.

None of the above correlations follow from traditional alternatives. For Word Formation Rules, it would have to be the case that they can either underapply: **studental*, or overapply: *arbore-al*, with no particular reason why either syndrome should obtain, and consequently with no reason why the two syndromes should be coextensive. In addition, there would also be no reason why the output of the very same rules should be more accommodating to the demands of the phonology. It is only the notion of ranking and parallel interaction that can explain such conspiracies. Specifically the parallel interaction by ranking must implicate all three components of the system: OO-FAITH = Morphology; MARKEDNESS = Phonology; IO-FAITH = Lexicon.

4. Phonologically Controlled Morphology

4.1 Types of Cases

In the preceding section, we have seen that morphology can be lexically controlled (*parent-al/ *student-al*) –an indication that the lexicon is not in a feeding relation with the morphology. It is well known that the morphology can also be controlled by the phonology. This phenomenon provides a similar indication that the morphology does not feed the phonology. Some cases of

phonologically controlled morphology were reviewed in (24) above, the ‘Metrically Controlled Suppletion’. This section provides a more systematic inventory.

Several cases of phonologically controlled morphology need to be distinguished for our purposes. I begin with the case in (40).

- (40) a. *remóv-al*, *dismiss-al*, *conférr-al* b. **inhérit-al*, **prómis-al*, **éter-al*

English nominalizing *-al* attaches only to verbal stems that have final stress. In the present framework, this property is straightforwardly expressible as a selectional entailment like (41).

- (41) $-al_N \Rightarrow / \acute{\sigma}]_V ___$

Since all such entailments are surface constraints, there is nothing extraordinary to the fact that they can refer to such surface properties as stress. In the traditional perspective, such cases will require at least a cyclic provision: the phonological structure of the stem must be calculated first, *before* affixation can occur. Roca and Johnson (1999, 453) assume just such an analysis. The cases listed in (42) all seem to instantiate this type of interaction.

- (42) **Like (40):** selection of stem/ root based on some of its specific prosodic properties, like number of syllables/ position of stress/ tonal structure.

Carstairs (1988) and refs.:

- a. Turkana deverbal abstract noun suffixes *-isi*; *-u*; $-V_iC_i$ (subject to vowel harmony)
- b. Hausa number suffixes *-ai*; *-una*, *-ye*
- c. Turkish verbal causative suffixes: *-t-*; *-dir-*
- d. Warlpiri ergative suffixes *-ngku*; *-rlu*

Hargus (1993) and refs. (Also citing further languages and references):

- e. German deverbal nominalizing suffixes *-ei*; *-erei*

Booij and Lieber (1993):

- f. Dutch adjectival suffixes *-isch*; *-ief*

Kiparsky (1994):

- g. German participial prefix *ge-*
- h. Finnish illative sg. *-seen*; $-(h)Vn$

- i. English comparative *-er*

Harris (1989):

- j. Spanish singular definite article *el* with feminine nouns

Anttila (2002, fn. 4) (Also citing further languages and references):

- k. Finnish lexicalized suffixes *-kka_n*, *-kka_a*

Vaux 2003 (Also citing further languages and references):

- l. Turkish present suffixes *-Ir*; *-Er* (subject to vowel harmony)

There are other cases, however, in which the prosodic/ phonological structure of the whole word needs to be calculated for morphological selection to operate correctly. The familiar *vád-/ and-* case repeated in (43) is of this type.

- (43) a. *vád-o* ‘I go’ b. *and-iámo* ‘we go’

Cyclicity is of no help to these cases, because, while the choice of stem allomorphs is controlled by presence versus absence of stress, the latter in turn depends on the structure of the whole word including the affix. Hence phonology must first apply to the word before morphology is able to select the stem –an apparent contradiction of the traditional sequential order. Regular OT makes available a potential solution to this type of case. It consists of allowing an input to be a disjunctive set of allomorphs rather than just a singleton, here the set in (44).

- (44) **Multiple Input:** {*vád-*, *and-*}

It is easy to see that the first allomorph *vád-* will be optimal in all and only the stressed positions by virtue of satisfying IO-FAITH (stress), while the second will be optimal in the unstressed positions, for the same reason. No such solution is available in the pre-OT framework based on re-write operations, since those can only handle one-to-one relations, and thus not the one between each output in (43) and the two members of the input set in (44). I will argue below that the Multiple Input (MI) approach of (44), proposed in Mascaró (1996a, b), Lapointe (2001), and hinted at in Mester (1994) (see also Tranel 1998, Perlmutter 1998, Yip 2003 for similar proposals) is correct except that the ‘inputs’ are in fact outputs, so that ‘MI’ is to be properly understood as the multiple correspondence of (9b), (19) above, as already argued in connection with (24) above, which subsumes (43). The cases in (45) are all of the same type as the one in (43).

- (45) **Like (43):** allomorph selection based on satisfaction of accentual faithfulness.

Carstairs (1988), DiFabio (1990): (24c) above:

- a. Italian *-isc-* (only stressed)

Kiparsky (1994)

- b. Modern Greek diminutive *-áki* (only stressed)
- c. Spanish *abol-* stem of verb ‘abolish’ (only unstressed)

Note in passing that Italian *abol-* has exactly the same property as its Spanish counterpart in (45c). However, unlike Spanish that has a defective paradigm in this case: **aból-o/ *abuél-o* ‘I abolish’, Italian has a full paradigm because of the availability of (45a): *abol-isc-o* ‘I abolish’ (see DiFabio 1990 for a comparative discussion of Romance languages in this connection). This confirms that suppletion in these cases is partly driven by consistency of output properties – a fact not obviously captured by ascribing them solely to the input as in (44).

Other cases that can also be characterized along the lines of (44) involve selection by some form of prosodic markedness as in (46), rather than by prosodic faithfulness as in (45).

- (46) a. a h́istory b. an (h)istórical event

The English facts in (46), which hold at least in some dialects, show that the selection of the indefinite article must follow the phonological calculation of the following word since such selection is affected by deletion of the initial *h* in (46b), which in turn depends on the position of stress (McCarthy 2002, 155, 184, citing Skousen 1975). Most plausibly, though, allomorph selection must follow phonological calculation of the whole phrase, since it can be directly attributed to familiar syllable structure constraints such as ONSET: **a.is.to.ri.cal* and NO CODA: **an.his.tory*. The cases in (47) are all similar to the one in (46) in this respect.

- (47) **Like (46):** allomorph selection based on satisfaction of markedness: ONSET/ NO CODA/
*COMPLEX (a-i); harmony/ agreement between stem and affix vowels (j-k)

Carstairs (1988) and refs.:

- Fang noun class prefix *dz-*/ *a-*
- Fulfulde (Southern Zaria) General future active suffixes: *-V_it-* (with V harmony)/ *-ay-*
- Turkish 3rd sg possessive *-i-*/ *-si* , and genitive *-in-*/ *-nin* (both with V harmony)
- Sanskrit *asthan-*/ *asthi-* ‘bone’

Booij and Lieber (1993) and refs.:

- e. Polish comparative *-sz/ -ejsz*, and imperative *-E/ -ijE* (E= a ‘yer’)

Mascaró (1996a, b) and refs.:

- f. Catalan definite personal article *∂n/ l*
 g. Moroccan Arabic 3rd masc. sg. clitic *-h/ -u* and 1st sg. clitic *-i/ ja*

Lapointe (2001):

- h. Korean TOP/ FOC marker *-un/ -nun* and ACC marker *-ul/ -lul*
 i. Welsh *na/ nac* ‘nor’ (and other similar alternations)

Kiparsky (1994):

- j. Hungarian 3rd sg. inflection: *-ja/ -i* (selection by V harmony in backness)

- k. **Rubach (2003):**

Polish plurals of masculine nouns *-y/ -e* ([ɨ]/ [ɛ]) (selection by agreement in backness)

What makes the MI approach to such cases plausible is the idiosyncratic/ suppletive relation between allomorphs, as in {*vád-*, *and-*}, which makes such sets compliant with Richness of the Base. However, this is not completely true of some of the above cases, like *a/ an*, *-un/-nun*, *na/ nac*, where the allomorphs bear considerable similarity. More significantly, there are yet other cases where the allomorphy is clearly just regular rather than suppletive, making the MI approach altogether implausible. This situation is exemplified by the case in (48), from Spencer (1991, 77-78).

- (48) a. quick-en, redd-en, fatt-en, rough-en, short-en, sharp-en (/ [+son.][-son.] ____)
 b. *slow-en, *green-en,
 c. *apt-en, *lax-en, *strict-en
 d. moist-en, fast-en, soft-en, hast-en, chast-en

The verbal affix *-en*: [ɪ], attaches to adjectives that end in a single obstruent, as shown and indicated in parentheses in (48a) contrasting with (48b, c). Such conditions are met in (48d) as well since the stem-final *t*’s are deleted. In the present framework, the properties of *-en* are expressible by the entailment in (49).

- (49) SINGLE OBSTRUENT: $-en_v \Rightarrow / [+sonor][-sonorant]]_A _$


The entailment in (49) is perfectly comparable to the one in (41) above for *-al_N*, but there is a crucial empirical difference between the two cases. In the case of *-al_N*, the phonological properties to which the affix refers: stem stress, are not affected by the presence of the affix

itself, since $-al_N$ is not a stem-re-stressing affix.⁹ Hence the phonological structure of the stem seems sufficient. In contrast, the stem properties in (49) are indeed affected by the affix. In (48d), the affix is applicable under (49) only because the final t of *soft*, etc. has been deleted, but that deletion is in turn due to the presence of the suffix $[n]$, evidently as a result of constraints along the lines of (50).

(50) NO GEMINATES: $*[-\text{sonorant}, +\text{contin.}] C_x C_x$; $x: [+coronal], [-continuant]$

(A sequence of coronal stops is excluded after a fricative)

Because of this, the MI solution of (43)-(47) cannot be extended to this case. Since the stem allomorphs are in a phonologically regular rather than suppletive relation, one cannot postulate an input pair {soft-, sof-} from which *-en* would select the second member. Rather, only a fully parallel account is available in this case, as in (51).

(51)	/soft- η /	NO GEMINATES	MAX	SINGLE OBSTRUENT
a.	soft- η	*		*
b.	 sof- η		*	

Candidate (b) in (51) is optimal because it satisfies simultaneously both the morphological constraint SINGLE OBSTRUENT of (49) and the phonological constraint NO GEMINATES of (50). The analysis in (51) abstracts away from the question of why this particular repair is chosen, as opposed to some other form of deletion or epenthesis. This is likely related to the fact that the medial consonant in the cluster $f\eta$ would be the weakest perceptually (Steriade 1994, 2001). The repair in (51) can also be regarded as a form of assimilation under attraction, as the two final segments would share the features ‘ x ’ in (50). Attraction merges them into a single segment. As in the case of **cartoonistic* of (19) above, I also put aside here a formal account of the absence of an output form for cases like (48b, c) **slowen*, **laxen*. This is again intuitively related to the limited productivity of the morphological relations in question. However, precisely by not being fully productive, this process does not place *-en* in complementary distribution with some alternative affix *-x* as noted in Carstairs (1988), not even zero: cf. *slow- \emptyset_V* , but **tall- \emptyset_V* ; and *wet- \emptyset_V* , despite the well-formedness of hypothetical **wett-en*. This means that in addition to the absence of an MI solution featuring the set {soft-, sof-} there is also no MI solution featuring a set {-en, x }.

A case similar to (51) is provided by Armenian plural affixation, discussed in Vaux (2003) and illustrated in (52).

⁹ The minimal contrast between nominalizing *-al*: stress neutral and adjectival *-al*: re-stressing, follows from the systematic metrical difference between the respective stems: verbs and nouns, respectively, as in *re(móiva)l \emptyset* (non re-stressed), *pa(rénta)l \emptyset* (re-stressed). See Burzio (1994a, 8.4).

(52) **Armenian Plurals** (Vaux 2003)

- a. k^hɑr-er ‘stones’ ts^hi-er ‘horses’ dak^hr-er ‘brothers-in-law’
b. t^husdr-er ‘daughters’ mɑnr-er ‘small things’
c. moruk^h-ner ‘beards’ jereχɑ-ner ‘children’ k^hɔluχ-ner ‘heads’

As shown in (52), Armenian employs the allomorph *-er* after monosyllables: (a, b), and *-ner* after plurisyllables: (c). These distributions are in themselves unremarkable and expressible in the present system as in (53a, b) partly similar to Vaux’ (2003) corresponding notations.

- (53) a. -er ⇒ / #σ ____ b. -ner ⇒ / σσ ____

The fact of interest is that, as discussed by Vaux, in Standard Western Armenian some monosyllabic stems taking *-er* such as those in (52b) have bisyllabic singulars due to epenthesis, as shown in (54).

- (54) t^husdɔr ‘daughter’ mɑndɔr ‘small thing’

The epenthesis is in itself also unremarkable. It occurs in this particular dialect to break up certain complex codas as in (54) or complex onsets as in *k^hɔluχ-* of (52c) (see Vaux 2003 for further details). It does not occur in (52b) simply because the relevant cluster is in that case heterosyllabic, rather than forming a complex coda. Such heterosyllabicity, though, is due to the presence of the plural morpheme itself – a situation of mutual dependency describable as in (55).

(55) **Mutual dependency** (Standard Western Armenian plurals):

- a. Correct selection of the plural allomorph *-er* in cases like (52b) depends on the absence of epenthesis in the stem (cf. (54)).
b. Absence of epenthesis in the stem depends on the presence of vowel-initial *-er*.

This situation is parallel to that of English *-en*, where the mutual dependency is as in (56).

(56) **Mutual dependency** (English *-en*):

- a. Correct selection of stems like *sof-* in (48d) depends on deletion of the stem-final *t*.
b. Deletion of stem-final *t* depends on the presence of affixal [ɪ].

As argued above, such double dependencies are the gold standard of parallelism arguments, in this case the argument for parallel morpho-phonology and a further demonstration that statements of morphological selection like (49) and (53) are surface constraints applying simultaneously with those of the phonology, not part of some sequentially prior system that only

feeds the phonology via UR. The parallel account of the double dependency in (56) was given in (51). The one of (55) is given in (57), (58).

(57)	/t ^h usdɔr-PL. /	#σ-er (53)	*COMPLEX	*ɔ	MAX
a.	t ^h usdɔr-ner			*	
b.	☞ t ^h usdr-er				*

(58)	/t ^h usdr/	#σ-er (53)	*COMPLEX	*ɔ	MAX
a.	t ^h usdr		*		
b.	☞ t ^h usdɔr			*	

In (57), we can take the input form of the stem to be the output form of the singular, consistently with the present surface-to-surface approach. This approach makes it possible for surface properties such as the epenthetic schwa to ‘transfer’ under morphological relatedness (as would -in this case- cyclic application). It does not, however, make this transfer necessary, leaving the matter to the constraint hierarchy. Assuming that a constraint banning schwa dominates MAX as in (57), such a transfer as in candidate (57a) will be excluded, making the correct output (57b) optimal. Further candidates transparently excluded by the two top-ranked constraints in (23) are omitted in the tableau for clarity. Note that the existence of a prohibition on schwas as well as of a ranking ‘*ɔ >> MAX’ seems independently motivated by the fact that schwa is excluded from the segmental inventory of Armenian and is inserted only epenthetically (Vaux 1998: 12, 66-67).¹⁰ It is true that exclusion from the inventory depends on the ranking of INPUT-OUTPUT MAX, while the MAX of (58) would be a member of the OUTPUT-OUTPUT family, but the ranking in (57) remains nonetheless plausible and unproblematic. In the case of the singular (58), the schwa candidate will be optimal because the conditions for epenthesis are met –the potential violation of *COMPLEX. The input in (58) can be taken to subsume the influence of the plural, that has no schwa –an expected PU effect, without affecting the argument.

The analyses in (57)-(58) make no pretense of providing full alternatives to the careful and extensive discussion of Armenian phonology in Vaux (1998), (2003), but seem nonetheless sufficient to show that the facts under consideration: (55), lend support to the parallel approach.¹¹ It is then interesting in this regard that Vaux (2003) would take the same facts to

¹⁰ As Steriade (2001) notes, this correlation between epenthetic function and absence from the inventory of schwa is common and is relatable to schwa’s perceptual proximity to zero. This makes it both marked in a Dispersion Theoretic sense, and yet the optimal epenthetic repair if all repairs are constrained by minimal perceptual distance as Steriade argues.

¹¹ Standard Western Armenian (SWA) resorts to epenthesis to break up final clusters Cr and Cn, but tolerates other clusters, in which case the final C is an extrasyllabic appendix as

lead to just the opposite conclusion: that there must be a UR (p.118). Vaux compares singular *tʰusdər* of (58), whose schwa is not counted for plural selection, with cases like *kʰəluχ* whose schwa is counted as shown in (52c), and proposes the analyses in (59) (slightly adapted. See fn.12 below) to account for the difference.

(59)		SING.	PL.	SING.	PL.
a.	UR	/kʰluχ/		/tʰusdr/	
b.	Epenthesis 1	kʰəluχ		tʰusd<ɾ>	
c.	Plural selection		kʰəluχ-ner		tʰusdr̥-er
d.	Epenthesis 2			tʰusdər̥	
e.	SR	kʰəluχ	kʰəluχ-ner	tʰusdər̥	tʰusdr̥-er

The derivations in (59) assume that plural selection occurs at some level that already contains some syllabification and yet is crucially different from surface structure in that -at that level- ‘consonants at morpheme edges are left unsyllabified under certain very specific conditions’ (Vaux 2003, 116). The latter level is (59c), where epenthesis has occurred in *kʰəluχ*, making the stem bisyllabic, but not in *tʰusd<ɾ>* where the final consonant is extrasyllabic and thus invisible to syllabification. Selection of the plural allomorph will under these circumstances operate correctly in each case. Full syllabification occurs only at stage (d) where extrasyllabicity is revoked, resulting in epenthesis in the singular *manər̥*, but not in the plural *mant-er*, where the plural affix makes it unnecessary.¹²

Not surprisingly from the present point of view, such an analysis rests on both a conspiracy and

Vaux argues. Unlike in SWA discussed in the text and in Istanbul WA, in Standard Eastern Armenian appendixes count as syllables for purposes of plural allomorph selection, as in *skiz-ner* ‘beginnings’ (Vaux 2003, 108), where is the appendix. Evidently, such appendixes constitute ‘weak’ syllables in the sense of Burzio (1994a), and for this reason may or may not be counted as syllables subject to dialectal variation.

¹² The derivation in (59) is the one that would be consistent with “Lexical Phonology’: phonology first applies to the stem, then the plural affix is added; after which phonology applies again. Vaux’s assumptions are slightly different, though in ways that do not affect the text point, except perhaps reinforce it. He assumes that ‘morphemes ... are run through the basic syllabification procedure... [and that] the syllable structure assigned in this way is then registered as part of the lexical entry...’ (p. 117-118). On this view, the forms in (59b) would then be lexical entries appearing in underlying representations, while the forms in (59a) would be their ‘once-upon-a-time’ inputs, not lexically stored. Such lexicalization of outputs is in fact a fragmentary version of the present view, which maintains that *all* lexicalized forms are outputs. As such, it is inconsistent with Vaux’s own claim (p. 92-93) that the lexicon should not be ‘redundant’ in that way.

a duplication. The conspiracy is in that two unrelated properties are taken to have the same effect by coincidence: both the extrasyllabicity of $t^h usd\langle r \rangle$ in (59b) and the presence of *-er* in (59c) $t^h usd\zeta\text{-er}$ have the effect of avoiding epenthesis. While the latter presence is factual, the former extrasyllabicity is a contingency of the analysis. Vaux cites several references as providing independent evidence for such ‘Final Consonant Extraprosodicity’ but all the work cited presupposes the derivational framework and therefore does not provide a valid basis for his critique of the parallel, UR-less, approach. The duplication is in the two epenthesis processes in (59), one which precedes plural formation, the other which follows it (though one might see this as just a general effect of the cycle: fn. 12).

Contrary to the analysis in (59), I have shown above that there is no need for ordering, since plural morphemes are selected consistently with the surface form of their stems in all cases. The only challenge and potential motivation for a UR is in the failed transfer of epenthetic $[\partial]$ from the singular to the plural, as in $t^h usd\partial\zeta / t^h usd\zeta\text{-er}$. We have seen, however, that such difference can be straightforwardly ascribed to the constraints ‘*COMPLEX, * ∂ ’, hence defusing any arguments for UR or derivations. Vaux’s claim that there must be a UR seems to hinge on the following reasoning: i) Plural formation cannot be based on a ‘pure’ UR like (59a), since it appears to rely on syllabification. ii) At the same time, it cannot be based on surface forms either, or else all epenthetic schwas of the singulars should transfer to their plurals incorrectly, yielding incorrect plural selections as well. iii) Hence plural formation must access some representation crucially different from the surface –some enriched UR like (59b). What leads to the incorrect conclusion is the incorrectness of the second step, which overlooks the possibility that the phonology might eliminate the epenthetic $[\partial]$ in the presence plural affix. Derivationally, it would indeed make no sense to suppose that an epenthetic schwa is first introduced in the singular and then removed in the plural. Schwa insertion followed by deletion would –coincidentally– have the same effect as simple non-insertion: a conspiracy. But, as in other cases, parallelism will be the conspiracy buster here as well: the same * ∂ constraint of (57), (58) ensures that $t^h usd\zeta\text{-er}$ (59e) undergoes schwa deletion just as it would ensure that it did not undergo schwa insertion. Hence Vaux’s reasoning is circular, the derivational conclusion resting on derivational premises.

In sum, the facts of Armenian provide no evidence for UR. Rather, they provide a clear argument against it and for parallel morpho-phonology, in the form of the double dependency of (55). Any attempt to extend the analysis in (59) to the *sof(t)-en* case would only underscore its problems. In that case, some special provision would have to make the stem-final *t* of *soft-*, invisible prior to *-en* attachment, only to find that the same stem-final *t* deletes once *-en* is attached –the conspiracy.

The case in (60) also instantiates the same type of mutual dependency and is also unlikely to benefit from an extension of (59).

- (60) **Like (55), (56):** Correct allomorph selection contingent on (non) application of a phonological process that in turn depends on the allomorph itself.

Spencer (1991, 123-124):

- a. In Czech, correct selection between allomorphs *-ích*, *-ech* in the Prepositional Case, Plural of nominal inflection depends on whether or not the stem ends in a palatal/ palatalized consonant: ‘soft’ (palatal) stems, selecting *-ích*, ‘hard’ stems, selecting *-ech*.
- b. The soft stems include those that undergo ‘2nd Velar Palatalization’ triggered by the high front vowel of *-ích*, as in *zvuk/ zvuc-ích* ‘sound NOM. SG./ PREP. PL.’

The mutual dependency in (60): *-ích* depends on a palatal; the palatal depends on *-ích*, is again inexpressible within a serial relation between morphology and phonology.

The typology of phonologically controlled morphology reviewed above can now be summed up as in (61).

(61)	Types of Phonologically controlled Morphology	Alternatives to full parallelism
a.	Phonological structure of stem required: <i>remóv-al</i> (40)	Cyclic application
b.	Phonological structure of full word including affix required:	
i.	Allomorphy is suppletive: <i>vád-/ and-</i> (43)	Multiple Inputs
ii.	Allomorphy is phonological: <i>sof(t)-en</i> (48)	Conspiracies/ duplication

As (61) shows, there is no single alternative to the full parallelism of the present approach. Neither cyclic application nor ‘Multiple Inputs’ extends to any of the other cases in (61), and combining them together would still leave case (61bii) unresolved. In addition, the MI approach suffers from its own limitations, as I discuss in the next subsection.

4.2 Why the Multiple ‘Inputs’ are Outputs

A case like Italian *vád-/ and-* of (43) which can receive a MI analysis can alternatively also be analyzed in terms of Multiple Correspondence or Lexical Conservatism –the ‘conservatism’ here being in the absence of unstressed **vad-* and of stressed **ánd-*: (24a) above. The opposite, however, is not always true, as the now familiar case in (62) will show.

- (62) a. beau garçon / bel ami ‘nice boy (MASC.)/ nice friend (MASC.)’
 - b. Multiple Input analysis: {[bɔ], [bɛ]}

While MI analyses within OT provide significant breakthroughs compared with derivational alternatives as I noted above, the one in (62b), given in Mascaró (1996b), nonetheless fails the Richness-of-the-Base (ROTB) criterion in a couple of ways. One is in that the special allomorph [bɛl] is accidentally identical to the feminine allomorph. Mascaró is careful to point out that

such full identity does not always hold: [sə] *garçon* ‘this boy’/ [sət] *ami* ‘this friend (MASC.)’ versus [sɛt] *femme* ‘this woman’, but the generalization still remains robust despite such deviations. Demonstratives may indeed have partly suppletive forms, like other high frequency items. This does not imply that other forms must also be suppletive. This ROTB violation is removed if we take the first form in (62b) [bɔ] to be indeed the input (though, as a surface form it is also an output), while the second form [bɛl] is just the feminine allomorph to which the target output of the calculation is attracted as argued above. This makes the latter also an input in a functional sense, and the disjunction in (62b) a list of the two main attractors in the calculation.

The second aspect of (62b) that runs afoul of ROTB is the relation between the two allomorphs themselves, which is not random. Rather, the latter are identical except for the alternation [ɔ]/[ɛl] as is even clearer in cases like *nouv[ɔ]/nouv[ɛl]*. In the case of (62b), this second point is a corollary to the first: the reason [bɔ] and [bɛl] are not unrelated is that the latter is identical to the feminine allomorph, which is in turn related to the masculine in fairly systematic ways. The issue is more general, though. As I noted, it is also true of several of the cases listed in (46)-(47) above as potential candidates for a MI analysis that the allomorphs are not in a purely suppletive relation, in particular: English *a/ an* ; Turkish *-in/ -nin* ; Sanskrit *asthan-/ asthi-* ; Polish *-sz/ -ejsz*; Korean *-un/ -nun* and *-ul/ -lul*; Welsh *na/ nac*. All of these cases consist of an alternating portion cooccurring with an invariant portion, and yet here there is no lexical conservatism in the sense of (62): the special allomorph is not identical to some independently existing form.¹³ If these pairs are regarded as outputs, their partially suppletive/ partially invariant character can be analyzed as in (63b), contrasting with the purely suppletive cases in (63a).

(63)	Phonologically Controlled suppletion	IO-FAITH	OO-FAITH
a.	Total: Italian <i>vád-/ and-</i> (43); Catalan <i>ən/ l</i> (47f)	✓	
b.	Partial: English <i>a/ an</i> (46); Korean <i>-un/ -nun</i> (47h)	✓	✓

In (63), the contributions from the input are underscored. Where input information for the special allomorph is absent as in (63b), OO-FAITH will fill in, resulting in partial identity of the two allomorphs. The MI approach has no way to characterize such partial identities, because there is no ‘Input-Input’ FAITH analog to the present OO-FAITH.

The typology in (63) is in fact parallel to that in (64) discussed earlier (Sect. 3.5).

(64)	Morphologically Controlled suppletion	IO-FAITH	OO-FAITH
a.	Total: <i>go/ went</i>	✓	
b.	Partial: <i>compel/ compul_s-ive, crime/ crimin₋al</i>	✓	✓

¹³ The same considerations apply to the MI analysis of allomorph selection in Zahao of Yip (2003): the allomorphs bear a greater than casual resemblance to one another.

Here again, where input information provides only a partial divergence between forms as in (64b), OO-FAITH will complement it with a partial identity. The phenomena of (63), (64) differ only by the type of information that bears on the selection of allomorphs: phonological in the case of (63) as discussed above (stress, syllabification), and morphological in (64) as discussed in sect. 3.5 (environment of certain derivational suffixes, or environment of PAST TENSE). Hence the machinery developed in sect. 3.5 above to handle suppletion in general: interaction of IO-FAITH and OO-FAITH, will handle phonologically controlled suppletion in particular just by adding phonology to the mix, e.g. ONSET, in the case of English *a/ an*. In contrast, beside not accounting for (63b), the MI approach will also be of no help with (64), since an input set {go [-PAST], went [-PAST]} has no advantage over just separate inputs for each surface form: the present account of suppletion in all cases.

In sum, the multiple inputs of the MI approach need to be construed as outputs, both because the members of the set are sometimes partially faithful to each other: (63b), and because sometimes the special allomorph exists independently as an output: lexical conservatism (62). The latter case: [bɔ]/ [bɛl] was not tabulated in (63) precisely because it does not instantiate suppletion proper, but rather only a merger of a special allomorph with an existing form which in turn may or may not hold a suppletive relation to the main allomorph.¹⁴

Similar conclusions to the ones just reached for (62b) are also entailed by the Italian cases of multiple correspondence discussed earlier and further illustrated in (65).

¹⁴ Note incidentally that this fact also cuts across the two types of phenomena in (63) and (64), as shown in (i).

(i)	Conservative allomorphy	Special allomorph	Independent allomorph
a.	Phonologically induced: [bɔ]/ [bɛl]	[bɛl]	[bɛl]-FEM.
b.	Morphologically induced: <i>inhibit-ion/ elicit-at-ion</i>	-at-	agit-at-ion, ...

The morpheme *-at-* of *elicit-at-ion* in (ib) is inserted under morphological control in the sense that it occurs only between specific roots and *-ion*: **inhibition*. At the same time, this morpheme occurs independently before *-ion* in cases like *agitation*, where it is just part of the stem *agitate*. Hence its occurrence in *elicit-at-ion* is analogical on the regular pattern, or ‘lexically conservative’, like occurrence of [bɛl] in the French case in (ia), (62).

(65)	<i>Gloss</i>	Infinitive	Participle	Agentive noun
a.	<i>possess</i>	possed-ére	possed-út-o	
b.	<i>beat</i>	bátt-ere	batt-út-o	
c.	<i>win</i>	vínc-ere	vín-t-o	vínc-it-óre
d.	<i>dye</i>	tíng-ere	tín-t-o	tin-t-óre
e.	<i>descend</i>	scénd-ere	scé-s-o	

As argued for (24b) above, the alternation between regular *-út-* and suppletive forms *-t-*, *-s-* in the participles in (65) is a case of metrically controlled suppletion. The suppletive forms *-t-*, *-s-* enable the stem to maintain the stress of the infinitive: (c, d, e). This is why such suppletive options are never resorted to in the conjugations that have unstressed infinitival stems as in the case in (65a). Even when there is stem stress, though, *-út-* is still a possible choice: (b). What this means is that, in an MI approach, *-út-* would have to be assigned preference over *-t-*, *-s-*, as in (66).

(66) Multiple Inputs, participles: {*-út-* >> *-t-*, *s-*}

The outcome in (65b) will satisfy the preference in (66), while those in (65c-e) satisfy metrical consistency –two evenly-valued alternatives, apparently. Such variation, as well as the variation between the two suppletives *-t-*, *s-* is lexically controlled, each individual participle making a specific choice. I put aside this issue for the time being, which will be the topic of the next section. With regard to the analysis in (66), however, such ranking cannot plausibly be part of an input. First, it is transparently just a piece of grammar, since it includes ranking. Secondly, that ranking is predictable from statistical properties of the outputs, as *-út-* is the most frequent allomorph of the three, because beside occurring in the stem stressed conjugation of (65b-e) where it competes with the other two, it is also the exclusive allomorph of *-ére* conjugation of (65a) for the reasons just noted. Hence the ranking in (66) seems only interpretable in terms of entailment summation over output forms, not as a type of input.

If we now turn to the derived agentive nouns given in (65c, d), similar considerations will emerge. The one in (65d) *tin-t-óre* is segmentally consistent with its participle *tín-t-o*, while the one in (65c) *vínc-it-óre* is rather *metrically* consistent with its own participle *vín-t-o*. This variation is similar to the one observed for the participles in (65) –a type of ranking indeterminacy. Since the participial allomorphs are again in a suppletive relation to one-another, the MI approach will call for an input disjunction as in (67) similar to the one in (66).

(67) Multiple Inputs, participial affixes for derived nouns: {*-it-*, *-t-*, *s-*}

Putting aside the issue of why unstressed *-it-* was not available in (66) for a moment: **vínc-it-o*, we note that these formations also exhibit multiple choices over stem allomorphs, calling for disjunctions such as those in (68) as well.

(68) Multiple Inputs, stems of derived nouns: {vínc-, vín-}; {tíng-, tín-}; ...

But the members of each set in (68) can again not be ‘input’ material, since they are plainly calculated outputs. In each case, the first member is the infinitival stem, whose stress reflects the unstressed character of its affix *-ere* in the output. The second member in (68) is the participial stem, whose stress is transferred from the infinitive as a PU effect, as argued just above and earlier for (24), hence again exhibiting output properties. The specific segmental make-up of the participial stems is also output-predictable –just cluster simplification from *vin(c)-t-o*, etc. However, given this simple relation, one might suggest instead that the infinitival stem in (68) is sufficient for calculating the nouns: *vínc-it-óre*/ *tin(c)-t-óre*, making the multiplicity of inputs in (68) unnecessary. This is true, but the infinitival stem would in any event have to be an output form since its stress is critical, and at that point there will be little reason why nouns such as those in (65) should be related to the output form of the infinitive but not that of the participle when they in fact feature participial morphology, hence reasserting (68). The conclusion that the nouns in (65) must involve multiple correspondence of output forms just like the participles thus seems inescapable.

The issue of the availability of unstressed *-it-* in the noun in (65c) but not in the participles which was temporarily set aside, also bears on the present conclusion. This difference was analyzed above (discussion of (29)) as a faithfulness/ attraction effect. Taking *-it-* to be inherently stressed, loss of stress was attributed to a concomitant loss of lexical category, here from participle to noun. This was compared to the change from verb to noun in English *organ-ize*/ *organ-iz-ation*, which similarly facilitates loss of vowel length. On this view, the correct move for the MI approach would then be to place stressed participial *-ít-* in the input both to the nouns and to the participles and let the chips fall where they may: if its lexical category is overridden by nominal *-óre*, then stress may also be removed, yielding *vínc-it-óre* (65c). If this is not the case, as in the participles, then unstressed *-it-* would not be available. The problem is that adding stressed *-ít-* to the input in (66) would make it compete with *-út-*, incorrectly. Only *-út-* is the correct participial affix for the *-ere* and *-ére* conjugations, while *-ít-* goes with verbs in *-íre*. It is only when the stress is lost that *-út-*, *-ít-* merge into *-it-*. But such merger is just a neutralization effect under attraction like many others and a type of lexical conservatism: when stress is removed from the contrasting allomorphs *-út-*, *-ít-*, their overall distance is narrowed as the distance between their two respective vowels is narrowed. Hence the merger of unstressed *-ut-*, *-it-* into just *-it-* is a combination of lexical conservatism: avoid unstressed *-ut-*, and segmental neutralization: independently existing *-it-* is close enough to the desired output. Since availability of unstressed *-it-* is then derivable along these lines by comparing outputs, it would again be incorrect to postulate it in the input of (67), confirming once again that all previous MI analyses must be converted wholesale into ones based on the Multiple (output-to-output) Correspondence of (19) above.

4.3 Conclusion


If phonology and morphology were interfaced via a level of UR, morphology would have to precede phonology and the latter should not be able to have an effect on the former. Therefore,

the phenomenon of phonologically controlled morphology contradicts such a view –the argument of (3a) above. We have seen that, while cyclic application of phonology could handle some subcases of this phenomenon and that postulating multiple inputs could handle some of the others, neither approach nor the conjunction of both can successfully deal with all subcases: (61). In particular, cases where morphological selection depends on the phonological contribution of the very item which is doing the selection manifest a mutual dependency which is intractable by serial means, except under loss of generalization. In contrast, the present framework that assumes full parallelism accounts for all of the cases, and subsumes under its more general resources those of the more parochial attempts: the effects of cyclicity are reduced to OO-FAITH, and the effects of multiple inputs are more properly accounted for under the multiple correspondence of outputs.

5. Lexically Controlled Variation

5.1 IO-FAITH over Partial Orders

In some of the earlier discussion, we have seen that OT has adequate capabilities for characterizing certain lexical-grammatical hybrids. One case in point was Italian stress. When a penultimate syllable is open, Italian allows the stress to be either on that syllable, in which case the vowel lengthens: *ancó:ra* ‘still (adverb)’, or on the preceding syllable: *áncora* ‘anchor’. Hence stress is to that extent lexical. It is not purely lexical, however, as a number of other possibilities (pre-antepenultimate, etc.) never materialize. We can thus think of the grammar as establishing a window within which the lexicon can make choices. That window is defined by the constraint ranking, in this case the ranking in (69) repeated from (5) above.

(69)	/ancóra /	FOOT: (σLσ) / (Hσ)	IO-FAITH (stress)	*V:	IO-FAITH (V-length)
a.	 an(có:ra)			*	*
b.	(áncora)		*		

The specific role of the lexicon in controlling stress is defined here by the rank of IO-FAITH (stress). The constraints that dominate it will delimit that role, in this case the constraint that defines the set of acceptable foot types. At the same time, the constraints that IO-FAITH (stress) itself dominates will allow IO-FAITH (stress) to have an effect in contributing lexical information, providing the noted ‘window’. When the penultimate syllable is open, either penultimate or antepenultimate stress will be optimal depending on which is stressed in the input. Penultimate stress is optimal in (69) despite the violation of both *V: and IO-FAITH (V-length). Had a long vowel been present in the input (a possibility allowed by ROTB) the outcome would have been the same, except for saving a violation of bottom-ranked IO-FAITH (V-length). The bottom ranked status of the latter constraint is determined by the fact that vowel length is not contrastive in Italian. Hence all vowels will surface as short except for the specific circumstances instantiated in (69). It is easy to see that had the input in (69) been /áncora/ ‘anchor’, then (69b) would have been the winner instead. Hence the fact that stress is lexically controlled within specific limits is accounted for in this system. In contrast, we have seen that a

system in which the organization was serial would be incapable of characterizing such hybrid character of Italian stress: discussion of (4) above. A similar situation exists with certain cases of vowel reduction in English. Unstressed syllables closed by sonorants feature variable vowel reduction, as shown in (70).

(70) a. **Word-final sonorants**

Vowel reduced: ápron, Wiscónsin, bálsam, amálgam, cústom, bósom, búxom, cóndom, phántom, ránsom, slálom, tránsom, bácon, uténsil, enámel, decórum

Vowel unreduced: Agamémnon, márathon támpon, péon, sámpan, Ígor, wígwam, ágar, cháos, cáravan, méteor

b. **Word-medial sonorants**

Vowel reduced: cárpenter, còmpensátion, còntemplátion, sèrendípity, cóncentrated, àffirmátion, cònfirmátion, cònservátion, cònsultátion, cònversátion, informátion, làmentátion, prèservátion, trànsportátion, ùsurpátion

Vowel unreduced: òstentátion, défalcáted, incantátion, hàlicarnássus, incarnátion, éxorcise, ínculpáted, còmplementátion, èxhortátion, còmpartmental, dispensátion, dèpartmental, dèportátion, èlongátion, èmbarkátion, èmendátion, èxaltátion, fèrmentátion, fràgmentátion, còntemplàte, incrustátion, infestátion


This contrasts with the fact that obstruents, except coronals (and except *s*, which behaves more like sonorants) inhibit vowel reduction rather systematically, as shown in (71) (see also fn. 16).

(71) a. **Word-final velar and labial obstruents (vowel unreduced):** Adiróndack, áztec, báobab, cárnap, sátrap, bébop, pársnip, túrnip, kídnap, ketchup, Mamáronec, hándicap, hémlock, kópeck, Lákoff, shérlock, shýlock, tármac, álmanac, lílac, slóvak, kódak, káyak, bédrock, féedback, dráwback, gímcrack, nítpick, sétback, wédlock, múskeg, húmbug, shíndig, zígzag, éggnog, nútmeg

b. **Word-medial velar and labial obstruents (vowel unreduced):** èxpectátion, áutopsy, mácropsy, mícropsy, hýdropsy, gàstrocnémius, àrchitectónic, òlfactómeter, àdjectíval, èlectrólysis, èlectrómeter, àffectátion, hýperactívity, ínspectórial, mìcrobacterial, rèflectívity, rèfractómeter, cònductívity, còllectívity, cònnectívity, sýnecdochic, dèlectátion, désignàte, insigníficant, àstigmátic, ènigmátic, ímpregnátion, phýsiognómic

Arguing against a long tradition that had taken the failed vowel reductions of (70) and (71) as indicative of stress, Burzio (1994a, Sect. 4.4) attributed them rather to the specific dependency that consonants have on the energy level of a neighboring vowel. Burzio (2007) recasts the earlier analysis into the licensing-by-cue perspective of Steriade (1994, 1997, 2001). Within that perspective, vowel reduction occurs because unstressed positions entail a reduced energy level,

compromising perceptibility of vowel quality. The common repair to compromised cues is neutralization: the articulatory activity responsible for the compromised cues is canceled (see also Boersma 1998). In the case of English, neutralization in unstressed position is particularly radical, yielding the mid-central vowel schwa for most short vowels in the input. It seems obvious from this perspective, however, that the reduction of energy on a vowel would compromise not only the cues to the quality of the vowel itself, but also the cues to the quality of the flanking consonants, codas being notoriously vulnerable. This consideration straightforwardly leads to the expectation that in unstressed closed syllables one might face twin neutralization processes: one affecting the vowel itself, and one affecting the coda.¹⁵ The tableau in (72) illustrates how this kind of V-C interaction, crudely anticipated in Burzio (1994a), can inhibit reduction in the cases in (71). I return to the cases in (70) and the issue of lexical control shortly below.¹⁶

(72)	‘Adirondack’ /ædirondæk/	*WEAK PLACE (-son.)	Δ-ENERGY
a.	 ædðrónd[æ]k		*
b.	ædðrónd[ə]k	*	

In (72), candidate (b) satisfies the general demand that unstressed syllables be de-energized compared with stressed ones: Δ-ENERGY. The low level of energy on the bracketed vowel has two simultaneous effects, however: i) it yields weak cues to vowel quality (formant structure), resulting in neutralization to schwa as in the Steriade model; ii) it yields weak place cues for the following obstruent (formant transitions). The latter results in a violation of *WEAK PLACE (-son.), a type of markedness constraint. Under the ranking given, candidate (a) will be more harmonic. In this candidate, the bracketed vowel retains sufficient energy to supply adequate place cues for the coda, which at the same time will also provide adequate cues to the quality of the vowel, making neutralization to schwa no longer necessary. The cost will be a smaller stressed-unstressed energy differential, violating Δ-ENERGY.

The ranking in (72) is deliberately simplified for ease of exposition. Some of the omitted details

¹⁵ Although onsets are relatively more resilient than codas, they are nonetheless also expected to be affected by reduced energy levels on the vowel. Harris (2003) in fact identifies a number of neutralization, or ‘lenition’ effects affecting onsets of unstressed syllables which seem interpretable along the lines of the text.

¹⁶ The generalization instantiated by (72) is overruled by a more specific one, represented by the word *Arab*: [æ̀rəðb]. When the syllable targeted by reduction is preceded by a stressed but *light* syllable, reduction in unstressed position occurs despite the presence of the non-coronal obstruent coda. I argue in Burzio (2007) that light syllables instantiate lower energy levels and that reduction under these circumstances would correspond to a more severe violation of Δ-ENERGY than in æ̀dðrónd[æ]k of (72) (i.e. a violation of a higher-ranked member of the Δ-ENERGY family) and that for this reason *WEAK PLACE (-son.) of (72) is violated instead in these cases.

entail further consequences. An alternative way to satisfy *WEAK PLACE (-son.) in (72) would be to neutralize place distinctions, in synchrony with the neutralization of vowel quality distinctions of (72b). I naturally assume that place neutralization would result in the least marked place, namely coronal, as in the hypothetical candidate *[ædəróndət], parallel to neutralization of vowel quality to the unmarked -least effortful- quality: schwa. To yield the correct result (72a) an additional constraint: IO-FAITH (place) must therefore also be ranked above Δ -ENERGY. This fuller model will now correctly predict that, should the obstruent be a coronal in the input, vowel reduction should apply regularly, since IO-FAITH (place) would be satisfied in such cases, place neutralization applying vacuously. This is indeed the case, witness *Connectic*[ə]t, *idi*[ə]t, etc.– (see Burzio 2007). The specific constraints controlling vowel reduction: *WEAK QUALITY; IO-FAITH(quality), would also have to be added to (72) for a full analysis, but this will have no further consequences.

Turning now to the variation on (70), it would seem to indicate, when compared with the lack of variation in (71), that sonorant consonants are less dependent on the energy of an adjacent vowel than obstruents. This conclusion is consistent with the fact that, almost by definition, sonorants benefit from inherent perceptual cues. One can therefore postulate for sonorants a constraint parallel to *WEAK PLACE (-son.) of (72), but of lower rank. Putting aside the issue of exactly which cues would be compromised by a reduction in vowel energy in this case, we may give this constraint the generic label *WEAK N, as in (73), (74) below. The noted variation will then follow from assuming that the latter constraint is un-ranked relative to its competitor Δ -ENERGY, making either the reduced or the unreduced candidate potentially optimal, leaving the choice to bottom-ranked IO-FAITH(quality), as shown in (73), (74).


(73)	/Agamemnon/	*WEAK N	Δ -ENERGY	IO-FAITH(quality)
a.	☞ Agamémn[o]n		*	
b.	Agamémn[ə]n	*		*

(74)	/aprən/	*WEAK N	Δ -ENERGY	IO-FAITH(quality)
a.	ápr[o]n		*	*
b.	☞ ápr[ə]n	*		

The lexical control of the variation in (73), (74) is executed directly by way of IO-FAITH much as in the case of Italian stress in (69). Here, whichever vowel is in the input: reduced or unreduced, will be optimal in the output. In contrast, it is easy to see that a reduced vowel in the input would not affect the outcome in (72) above. The reason is that a reduced vowel in the output always presupposes reduced energy, witness the absence of schwas in stressed position (see Burzio 2007 for specifics). Reduces energy will then yield the same violation of *WEAK PLACE (-son.) of (72b).

The general schema for lexical control of phonological variation thus developed is then as in (75).

(75) **Lexical control of variation:**

/b/	C1	C2	IO-FAITH
a		*	*
 b	*		

In (75), IO-FAITH resolves the conflict between some C1 and some C2 in favor of the input, here (b) for illustration. The schema in (75) is instantiated by (73), (74), as well as by the case of Italian stress in (69) albeit slightly indirectly. In (69) above, the leftmost constraint: FOOT: ($\acute{\sigma}L\sigma$)/($\acute{H}\sigma$) represents two equally valued alternatives that can play the role of C1 and C2 in (75): ‘a foot must have the structure ($\acute{\sigma}L\sigma$)’ and ‘a foot must have the structure ($\acute{H}\sigma$)’. In themselves, these two alternatives apply to disjoint sets of environments: light penultimate, and heavy penultimate syllables respectively, and would therefore by themselves not compete. What makes them compete is the fact that IO-FAITH(stress) of (69), while playing the role of IO-FAITH in (75), also dominates *V_L, making it possible for a syllable L to change to H. Any input sequences syllabifiable as ‘ $\sigma L\sigma$ ’ can therefore yield either an output ($\acute{\sigma}L\sigma$) or -through lengthening- an output ($\acute{H}\sigma$). Hence, the two parts of FOOT: ($\acute{\sigma}L\sigma$)/($\acute{H}\sigma$) in (69) do indeed compete in the manner of C1 and C2 of (75).

Ranking indeterminacies such as those of (73)-(75), and by extension that of (69), are commonly referred to in the OT literature as ‘Partial Orders’ (Anttila 2002), a term that I will adopt. Note, however, that the present approach does not subscribe to the ‘strict ranking’ hypothesis of standard OT, since entailment summation is critical in the present context to characterizing both attraction effects and the hybrid character of various phenomena, from limited morphological productivity to partial suppletion. In this respect, it concurs with the approach of Boersma (1998), although the respective motivations are a bit different. Hence it would not see the schema in (75) literally as a ‘Partial Order’, that is absence of strict ranking, but rather as a ranking gap whose numerical value is small enough that it can be overridden by the rank of IO-FAITH, e.g.: C1= 3.5; C2 =3.0; IO-FAITH = 1.0. For ease of exposition, in the remainder of this discussion, I will continue to refer to the situation under consideration as a ‘Partial Order’ and characterize it in the standard OT fashion of (75), even though the present framework would contemplate narrow numerical gaps instead. The point of direct significance is that OT -either in its strict ranking, or in its numerical ranking version- has adequate resources to deal with lexically controlled variation: the control is exerted by IO-FAITH over other constraints that would individually dominate it, but whose effects counterbalance each other.

As in the case of Italian stress, so in the case of English vowel reduction, there will be no viable serial account: vowel reduction is partly dependent on its own effects –the curse of mutual dependency. That is, while the primary cause of vowel reduction is lack of stress, the latter is not sufficient as we have seen. Coda consonants must also not be adversely affected: (72), (73). A step-by-step attempt would then go as follows: (i) tentatively reduce an unstressed vowel; (ii)

observe the consequences on coda consonants if any; (iii) decide whether reduction is viable, and either confirm or disconfirm the reduction accordingly. Such trial-and error procedure can only be implemented in the OT analysis, however, where the different candidates represent the different alternative possibilities. It cannot be implemented in a serial analysis, where each step is an irreversible structural change. Instead, one would have to postulate reduction rules that are highly context specific: one for open syllables and syllables closed by coronal obstruents, which applies systematically; another for syllables closed by sonorants, which applies variably. The heterogeneity of the contexts would constitute a kind of ‘conspiracy’: different contexts with the same effects for reasons that the rules do not make apparent. In addition, the lexical control in syllables closed by sonorants could not be captured in any non-stipulatory way. Similarly to the case of Italian stress (discussion of (4) above), an attempt to attain the vowel reduction by rule would require incorporating a lexical list of targets into the rule: *apr[ə]n* is in the list, but *Agamemn[o]n* is not. This would be a form of duplication, since the lexicon would be partially repeated in the grammar. The alternative would be to introduce underlying distinctions: there is an underlying schwa in *apron*, but not in *Agamemnon*. This would also result in duplication, as the lexicon would now have to take on grammatical properties in the form of just the right distribution of underlying schwas: never in stressed syllables or in syllables closed by non-coronal obstruents.

In sum, lexical control of phonological variation provides an important argument for parallelism. In parallel OT, IO-FAITH constraints representing the lexicon can determine the outcome of the grammar even when they are low ranked, so long as the grammar features a degree of indeterminacy. In a serially organized system, the lexicon would have to precede the grammar and should for this reason be unable to make choices over alternative outputs of the grammar.

This breakthrough for parallelism is seriously compromised by the usual suspect in (76), however.

(76) Surface allomorphs have a common input (= Underlying Representation)

Consider in this regard the variation in (77), which was encountered in (6) above.

(77) **Shortening in penultimate syllables**

a. Shortened:

admir-able, vagin-al, resid-ent,
impedi-ment, excrete-ory, orat-or,
blaspheme-ous, satir-ist, appetiti-ive,
bii-cycle, univ-alent, univ-ocal

b. Not shortened:

oppos-able, himicid-al, adher-ent,
cajole-ment, advis-ory, divis-or,
desir-ous, extrem-ist, divis-i-ve,
bi-polar, uni-cycle

Descriptively, this variation seems perfectly comparable to the one in (70): vowels shorten in one case and reduce in the other variably and under lexical control. The present account is indeed parallel, as in (78), (79).

(78)	Input: /blasphemous/ Base: [blasphé:me]	*V:	OO-FAITH (stress)	IO-FAITH(length)
a.	blasphé:mous	*		*
b.	☞ blásphe:mous		*	

(79)	Input: /desi:r-ous/ Base: [desi:re]	*V:	OO-FAITH (stress)	IO-FAITH(length)
a.	☞ desí:r-ous	*		*
b.	dési:r-ous		*	

The analysis of (78), (79) is that of (6) above with the lexical control added, thereby instantiating the schema in (75). Undominated constraints that forbid stress on a light penultimate (much as in Italian) preclude simultaneous satisfaction of both *V: and OO-FAITH (stress). Hence these two constraints will compete. In (78), (79), the role of IO-FAITH is strictly that of the arbitrator in the competition, just as it was in (73), (74). It does not have the override function it was attributed in cases of suppletion: (36a). Hence these cases are correctly characterized as holding regular relations to their bases rather than as morphological irregularities.

In contrast, the widespread adoption of UR (76) into OT will make the simple solution of (73), (74) based on the schema in (75) unavailable to morphologically complex cases like (78), (79). From that perspective, the stem in *blasphem-ous* will need to have the same input as its base *blasphe:me*, and that input will presumably have a long vowel, surely just like the input for *desi:r-ous*, leaving no account of the different outcomes. One option within the UR-based approach would be to postulate two different co-grammars: one with the rank ‘*V: >>OO-FAITH (stress)’ and one with the opposite rank. There would then have to be two lexical lists: one containing the roots in (77a), the other with the roots in (77b). Then either each co-grammar will have to contain the list of items to which it applies, or each list will have to cite which co-grammar applies to it. Unsurprisingly, this is just the same predicament that was identified above for the serial approach, since UR (76) introduces serialism into OT.

Summing up, the adverse effect that UR has on OT’s ability to deal with lexically controlled variation is yet another -and our final- argument against it: (3b) above. The phenomenon of lexically controlled variation shows -like others- that the lexicon cannot be segregated to work upstream of the grammar. With morphologically simple items, OT imposes no such segregation and proves successful as a result. With morphologically complex items, the adoption of UR reintroduces the segregation and OT just inherits the old problems.

In the next section, I will review the main attempts to deal with lexically controlled variation in the OT literature that assumes UR, arguing that they indeed suffer from critical limitations,

proving the present point.

6. Prespecification versus Co-phonologies

The two main extant proposals on lexically controlled variation in OT are based, respectively, on differentiating the inputs by way of ‘pre-specification’ and on differentiating the grammatical systems by postulating coexisting phonologies that apply selectively to different inputs. I discuss these in turn below, where I consider the variant of the co(existing) phonologies approach that relies on the notion of ‘Partial Order’ introduced above. The latter, developed in Anttila (2002), concurs substantially with the present proposal, differing only over the consequences of UR.

6.1 The limits of Pre-specification: ROTB

Inkelas, Orgun and Zoll (1997) consider Turkish data such as those in (80), where I also report some elements of their analysis.

(80)	Turkish coda devoicing		Pre-specification solution
a.	kanat/ kanad-u	‘wing NOM./ ACC.’	[ø voice]
b.	etyd/ etyd-y	‘study NOM./ ACC.’	[+voice]
c.	devlet / devlet-i	‘state NOM./ ACC.’	[-voice]

The variation in (80) is in that a /d/ appears to devoice to [t] when in coda position in (a), but not in (b), while the case in (c) may be presumed to have an underlying /t/. Inkelas et al. propose to replace the binary [\pm voice] distinction with the ternary distinction shown on the right hand side, where (80a) features a segment that is unspecified for [voice]. The latter input will undergo voicing in onset position, and be realized as unvoiced in a coda, whence the alternation in (80a). The fully specified inputs of both (80b) and (80c) will surface faithfully, whence the absence of alternation in each of those cases. OT implementation of this account is straightforward, and may run along the lines of (81) (though Inkelas et al.’s implementation is -inconsequentially- slightly different and given only partially in their article).

(81) FAITH(\pm voice) >> VOICED ONSET, NO VOICED CODA >> FAITH(ø voice)

On this ranking, the markedness constraints in the middle are able to override [ø voice] specifications yielding the alternation in (80a), but not the full specifications, resulting in no alternations elsewhere: (80b, c).

The relative strength of this approach is that it directly handles the lexical control of the variation. This can be seen by comparing it with the Partial Order (PO) approach, which would yield the analysis in (82) if one assumes the existence of UR.

(82)	Turkish coda devoicing: PO with UR		NO VOICED CODA	IO-FAITH
a.	kanat/ kanad-u	(input: /d/)		*
b.	etyd/ etyd-y	(input: /d/)	*	
c.	devlet / devlet-i	(input: /t/)		

The two constraints in (82) constitute a PO. Hence the two cases in (82a, b), violating either constraint, are equally possible. In (82), the input is the traditional UR. It features /d/ in (a, b), but /t/ in (c). This analysis will fail to express the lexical control (**etyt/ etyd-y* would be equally optimal), and would thus be better suited for cases of free variation. This inability is the present arguments against UR. Without a UR, the PO analysis would be as in (83), and the lexical control would be correctly expressed in the way argued for earlier.

(83)	PO without UR	NO VOICED CODA	OO-FAITH	IO-FAITH
a.	kanat/ kanad-u		*	
b.	etyd/ etyd-y	*		
c.	devlet / devlet-i			

The analysis in (83) instantiates the variation schema of (75) above. The inputs are, in each case, just the surface forms. It is easy then to see that any alternative output in each case would be suboptimal by violating IO-FAITH relative to such surface forms. At the same time, postulating independent inputs for both forms in each row of (83) does *not* incorrectly reduce these cases to suppletion, since IO-FAITH is -again- bottom ranked in this analysis, as with all fully regular morphology. A fourth logical possibility alongside of the three in (83), represented by a hypothetical *d/t* case like **devled / devlet-i* is correctly excluded in this analysis, as it would in those of (82) or (80). In this case both NO VOICED CODA and OO-FAITH would be violated simultaneously, forcing a repair. Any repair would then violate IO-FAITH to the input *d/t*, but the repair yielding *t/t* would satisfy both top-ranked constraints, thus producing the optimal candidate just as in (83c). Four logically possible types of input pairs: *t/d*, *d/d*, *t/t*, *d/t* thus correctly reduce to the three attested outputs in (83) as desired.

What the comparison of (80) with (82), (83) aims to show is that prespecification analyses of variation can generally be converted into PO analyses. In the framework that insists on UR: (82), the conversion will lose the lexical control (which will thus require additional machinery as we see below), but in the present framework there will be no loss: (83).

The opposite type of convertibility does not appear to hold, however. As discussed below, the reason for this is essentially that, at least typically, variation is contextually restricted, e.g. vowel reduction *in syllables closed by sonorants*, or vowel shortening *in penultimate syllables* (contexts italicized). Such contextual restrictions may well reflect properties of the constraints implicated by the PO, but may not reflect properties of a prespecified input, given ROTB.

Consider on this connection the vowel-reduction case again, which has the distribution in (84).

(84) **Vowel reduction in unstressed syllables:**

- a. Always in open syllables: *p[ə]rental*
- b. Never in syllables closed by non-coronal stops: ¹⁷ *Adirond[æ]k, exp[ɛ]ctation*
- c. Variably in syllables closed by sonorants: *apr[ə]n/ Agamemn[o]n*

The variation here concerns the context in (84c). This distribution was captured as in (74) above, repeated as (85).

(85)	/aprən/	*WEAK N	Δ-ENERGY	IO-FAITH(quality)
a.	ápr[o]n		*	*
b.	↘ ápr[ə]n	*		

The analysis in (85) features a kind of prespecification as well: *apron* has an input /ə/, but *Agamemnon* has an input /o/. However, this prespecification only plays a role within the limits set by the PO in (85). Imagine removing *WEAK N from the picture, and the reduced candidate (b) will always win no matter what the input: schwa or full V. This is the case of the open syllables in (84a): with no coda to deal with, *WEAK N is vacuously satisfied. Now imagine re-ranking *WEAK N so that it fully dominates Δ-ENERGY. Then the full vowel candidate (a) will always win. This is essentially the case of closed syllables in (84b), where higher-ranked *WEAK PLACE (-son.) replaces *WEAK N: the analysis of (72) above.

In contrast to this, prespecification without the partial order will not be able to adequately handle such contextual restrictions. In order to attribute the variation in (84c) to the input without either violating ROTB or resorting to a partial order, IO-FAITH(quality) will have to dominate Δ-ENERGY, else all input vowels will just output as schwas. Without further intervention, however, this will just make vowel reduction in unstressed position lexical, incorrectly predicting variation in (84a, b) as well. Instead, the general IO-FAITH(quality) should remain as in (85), but a second ‘positional’ IO-FAITH(quality) relative to syllables closed by sonorants, ‘IO-F(quality)/ __N’ should be introduced with a rank higher than Δ-ENERGY. It is easy to see that, aside from the duplication of resources (IO-FAITH(quality) twice), this approach would attribute to a specific constraint: IO-F(quality)/ __N properties that are more plausibly attributed to interaction: the fact that codas depend on their nuclei. As a result, it will fail to directly relate non reduction in *Agamemn[o]n* (due to high-ranked IO-F(quality)/ __N) to that of *Adirond[æ]k* (due to high-ranked *WEAK PLACE). In the present approach, the two accounts are parallel, in so far as *WEAK N of (85) and *WEAK PLACE of (72) are in the same family of constraints, differing only in rank, all codas requiring strong nuclei though to differing degrees.

¹⁷ Except as noted in fn.16: the *Arab* case

The prespecification attempt will also will also similarly fail to relate the reduction of *apr[ə]n* (also due to high-ranked IO-F(quality)/ __N) to that of *p[ə]rental* (due to unhindered application of Δ-ENERGY). In the present approach, those accounts are also parallel, in that a low-ranked *WEAK N applying to a coda approximates the absence of any coda. Other accommodations to the prespecification approach may be conceivable, e.g. multiple versions of Δ-ENERGY rather than multiple versions of FAITH, but they will lead to the same conspiratorial conclusions.

This syndrome is quite general and is in fact apparent even in the prespecification analysis of Turkish coda devoicing above. In order to ensure that the effects of an unspecified input [ø voice] are properly limited to just codas, it is necessary to assume that there exists not only a NO VOICED CODA constraint, but also a VOICED ONSET constraint, otherwise redundant. In what follows I examine three more cases to confirm the diagnosis: the English vowel shortening case described in (86), the Finnish alternations analyzed in Anttila (2002), and the Italian participial allomorphy cases of (24b) and (65) above.

(86) **English vowel shortening with Latinate affixes:**

- a. Always in foot-final position: (dèfə)(má:tìon)
- b. Always in foot-antepenultimate position: di(vínity)
- c. Variably in foot-penultimate position: (blásphəmous)/ de(sí:rous)

The variation here only concerns the context in (86c). This distribution was captured above as in (87), which repeats (79).

(87)	Input: /desi:rous/ Base: [desi:re]	*V:	OO-FAITH (stress)	IO-FAITH(length)
a.	☞ de(sí:rous)	*		*
b.	(désirous)		*	

The analysis in (87) was argued to parallel the one of reduction in (85), both instantiating the variation schema in (75). The variation comes from the fact that had the input (for the derived form) featured a short vowel, candidate (b) would have been the winner: *blásphəmous*. The variation is limited to the context of (86c) because only in this context do the constraints in the PO compete. Imagine OO-FAITH (stress) being taken out of the picture, and the shortening candidate in (b) will always win. This is true of both (86a) and (86b), though for different reasons. In the foot final position (86a) OO-FAITH (stress) is violated regardless of vowel length due to the stress clash: **de(fə)(má:tìon)/ *de(fə)(má:tìon). In the foot antepenultimate position (86b) OO-FAITH (stress) is satisfied regardless of vowel length: *di(vínity)*, stressed light antepenultimates being well formed, witness *a(mérica)*, unlike penultimates. Such contextual restrictions on the effects of the PO come from higher-ranked constraints that define possible feet: (6) above.*

In contrast, an attempt to apply the prespecification model without a PO would presumably have to feature two types of long vowels underlyingly. For the sake of discussion, let us say that these would have two moras, and one-and-a half moras, respectively.¹⁸ In general, all vowels with more than one mora would normalize to two, yielding comparable *desi:re/ blasphe:me*, but in the context of Latinate affixes, the constraint ranking in (88) would have a discriminatory effect analogously to the one in (81) at work in the Turkish case.

(88) IO-FAITH-2 >> *V: (Lat. Affix) >> IO-FAITH

Here, the two-mora vowels would be left alone given the higher-ranked FAITH, whence *desi:rous*, while other vowels will shorten, whence *blasphemous*. Aside from the reference to Latinate affixation not necessary in this specific form (it is rather the OO-FAITH for level 1 that is low-ranked: (28) above), it is clear that the ranking in (88) will now just predict failed shortenings across the board, including (86a, b). The only recourse will -again- be to build contextual restrictions -that would have followed independently in the PO analysis- into the formulation of specific constraints, with consequent loss of generality. This would be either in the form of a further, context-specific and higher-ranked, ‘*V: in foot final or antepenult. syllables’ covering (86a, b) dominating IO-FAITH-2, or in the form of contextual restrictions on IO-FAITH-2 itself, now limited to foot penultimate position, thus covering exactly (86c). As in the vowel reduction case, these accommodations are possible in a narrow technical sense, but are patently artificial at the conceptual level.

The Finnish case is described in (89) (with some simplifications; see Anttila 2002 for full discussion).

(89) **Finnish stem-final *a* before *i*-initial affixes**

a. Mutation to <i>o</i> after [+high] segments (underscored):	/ap <u>i</u> na/	ap <u>i</u> no-i-ssa	‘money-PL-INE’
	/melak <u>a</u> /	melak <u>o</u> -i-ssa	‘riot-PL-INE’
b. Deletion after [+round] segments (underscored):	/o <u>s</u> a/	o <u>s</u> -i-ssa	‘part-PL-INE’
	/pi <u>s</u> am <u>a</u> /	pi <u>s</u> am-i-ssa	‘freckle-PL-INE’
c. Variation elsewhere:	/tavara/	tavaro-i-ssa	‘thing-PL-INE’
	/avara/	avar-i-ssa	‘vast-PL-INE’
d. Variation when both conditions of (89a, b) obtain simultaneously	/Fatima/	Fatimo-i-ssa	‘Fatima-PL-INE’
	/hekuma/	hekum-i-ssa	‘lust PL-INE’

As Anttila shows, the main players in the distribution in (89) are two types of dissimilatory

¹⁸ Just this type of analysis is implemented autosegmentally in Harris’ (1985) for Spanish diphthongization. In that analysis non-alternating diphthongs are associated with two skeletal units; non-diphthongizing short vowels feature a single unit; while short vowels that diphthongize under stress have two skeletal units in their representation, but are lexically associated with just one: a three-way distinction.

effects. Specifically, deletion in (89a) would yield a violation of the OCP on the feature [+high], given the initial *i*, of the suffix, while mutation to *o* in (89b) would violate the OCP relative to [+round] given the preceding [+round] segment in the stem. Variation occurs either in the absence of OCP effects: (89c), or when both types of OCP effects are present: (89d). The situation is in fact more complex, but inconsequentially so for the present point (See Anttila 2002 for full discussion).

To handle the variation in (89c), a prespecification approach might propose two different types of underlying /a/, one with some affinity with [o], let us say /a_o/, resulting in surface [o], the other without such affinity, resulting in deletion. To begin, such degree of abstraction would seem rather implausible in its own right, as was also the case above for the vowels of intermediate length. In the same vein, Yip (2003) points out as well that in some cases there simply aren't enough representational resources available to implement a prespecification analysis. The more serious challenge for a prespecification account, however, comes from the variation in (89d), accounted for by Anttila by a PO along the lines of (90).

(90)		OCP [+ROUND]	OCP [+HIGH]
a.	<i>Fatimo-i-ssa</i>	*	
b.	<i>Fatim-i-ssa</i>		*

Given the facts in (89a, b), it is clear that minimally- the two constraints in (90) exist. If there is no PO, then they must be strictly ranked. Suppose that they are in fact ranked in the order of (90). Then, (90a) must be optimal not because (90b) would violate OCP [+HIGH] (it is now dominated), but because of the effects of the prespecification, like the propensity of underlying /a_o/ for mutating to [o] rather than deleting. The ranking in (91), where MAX_o forces the covert subscript 'o' of /a_o/ to surface, would correctly yield (90a).

(91) MAX_o >> OCP [+ROUND] >> OCP [+HIGH]

The present version of the usual question is now why MAX_o only has an effect when a [+high] segment precedes as in (90) and never otherwise, as in (89b). As before, there is no satisfactory answer to this puzzle, the only recourse being to build the context of OCP [+HIGH] into the MAX_o of (91) to yield a high-ranked 'MAX_o / [+high] ____' alongside of a lower-ranked, non positional MAX_o –the familiar conspiracy. The cases in (89b) will now only violate the lower ranked version, dominated by OCP [+ROUND]. Hence any underlying /a_o/ will be deleted just like regular /a/ in those cases.

Reversing the dominance relation of the two constraints in (90) simply turns all assumptions into their mirror images, making the analysis equally contrived. Specifically, the case *hekum-i-ssa* will violate OCP [+HIGH] of (90), now the higher-ranked of the two. This will require a yet higher-ranked constraint, say IDENT-*a* (don't mutate regular /a/). The question will then be why this constraint never has any effect when no [+round] segment precedes, /a/'s always deleting in those cases: (89a). The only recourse in this case would be to build the context of the OCP

[+ROUND] into this constraint, revising it to: ‘IDENT-*a*/ [+ROUND] ____’.

The above examples have shown that the prespecification approach runs afoul of ROTB because the property targeted by the variation has a contextual distribution not expressible in the input. There also exist cases, however, where the property itself is not representable in the input simply because it is grammar-induced, posing an even more serious problem. Consider (92).

(92)	infinitive/ participle		-út- >> -s-/ -t-	PU/ OO-F(stress)	IO-FAITH
a.	‘sell’	vénd-ere / vend-út-o		*	
b.	‘win’	vínc-ere/ vín-t-o	*		
c.	‘descend’	scénd-ere/ scé-s-o	*		

The cases in (92b, c) were analyzed in (31) above as instances of PU(stress) across infinitive-participle pairs. The competing constraint in the PO is the morphological preference for regular allomorph -*út*- over the two suppletive allomorphs -*s*- and -*t*- . It was argued that such preference has a statistical basis: -*út*- occurs in more conjugations (discussion of (66) above). - Since -*út*- is inherently stressed (and FAITH-affix dominates FAITH-stem over this class of cases: Burzio1998, 2003 and below) it will force deletion of the stem stress under clash and hence a violation of PU(stress), as in (92a). The PO of the two leftmost constraints in (92) will account for the variation between (92a) and (92b, c), and the PO of the two suppletive choices -*s*-, -*t*- will account for the variation between (92b) and (92c). The lexical control is done by bottom-ranked IO-FAITH referring directly to the surface forms as usual.

A prespecification approach modeled on the Turkish case in (82) above might attempt to postulate an underlying weaker form of stress for the infinitive in (92a) than for those in (92b, c), such that the former but not the latter will be lost in the corresponding participles. But such attempt would be incorrect a-priori, because the stem stress of the infinitives in (92) is *not* a property of the UR or input, but rather only of the output, as the following considerations show.

In all conjugations other than the one in (92): -*áre*-, -*ére*-, -*íre*-, infinitival stress falls only on the affix, revealing that FAITH-affix must dominate FAITH-stem (some stems might in principle have input stress under ROTB). Then, all stem-stressed infinitives in -*ere* such as those in (92) must come from the fact that, alongside of the stressed -*ére*-, there indeed also exists an unstressed -*ere* infinitival affix –a fourth conjugation. The grammar will then force the infinitival stem to be stressed in these cases regardless of its input form, given ‘FAITH-affix >> FAITH-stem’.

Prespecification for some level of stress is thus not an option. This is the same consideration that excluded the ‘Multiple Inputs’ approach to (92b, c): discussion of (65) above: the stress properties of stems in these cases are calculated by the grammar given the properties of the infinitival affixes, hence they cannot be attributed to the stem’s input form. The only remaining alternative will be to prespecify the roots in (92b, c) for a propensity towards one of the suppletive participial allomorphs, but this attempt will just meet with the now familiar critique

head on: there is no variation in any of the other three conjugations. These only take regular and stressed participial allomorphs *-át-*, *-út-*, *-ít-*, respectively. In the present analysis, this is because the stresses allomorph here satisfies rather than violate PU(stress), since the respective infinitives are equally affix-stressed. Hence, prespecification of morphological propensities would have to be excluded in these conjugations, calling for a contextually restricted type of prespecification which blatantly just duplicates the effects of PU: a root can be prespecified for one of the (unstressed) suppletive participial allomorphs *-t-* or *-s-*, just in case it is also prespecified to select unstressed infinitival affix *-ere*.

Matters get even worse when one considers the facts in (93), showing that a variation similar to that of (92) also obtains in the relation between participles and participial derivatives.

(93)	participle/ agentive noun	OO-F (segments)	OO-F (stress)	IO-FAITH
a.	‘possessed’ pòssed-út-o/ pòsses-s-óre	*		
b.	‘attacked’ àggred-ít-o/ àggres-s-óre	*		
c.	‘won’ vín-t-o/ vînc-it-óre	*		
d.	‘dyed’ tín-t-o/ tin-t-óre		*	

In (93a, b, d) the derivatives take a-syllabic participial allomorphs *-t-* or *-s-*. This is consistent with the form of the participle in (d), but not in (a, b). In (93c), the derivative takes syllabic allomorph *-it-*, unlike its participle. The present account of this variation is essentially the same as that of (92): OO-FAITH (stress) is here in a PO with OO-FAITH (segments). The cases in (93a, b, c) violate the latter for switching to a different participial allomorph, but the loss is made up by satisfying OO-FAITH (stress). The cases in (93a, b) achieve this by avoiding unstressed variants of *-út-*, *-ít-* of their participles. Recall that stress is a relation between certain prosodic properties and certain segments. When segments are changed, FAITH (stress) is vacuously satisfied (only FAITH (segments) is violated, as with *and-/ vâd-*).¹⁹ The case in (93c) satisfies OO-FAITH (stress) by maintaining the stem stress of the participle in the derivative. Segmental consistency with the participle would incur the loss of such stress under clash, as shown by the case in (93d). Bottom-ranked IO-FAITH relative to the given surface forms ensures the correct outcome in each case as before. The point of significance is that, unlike the variation in (92), that of (93) is no longer restricted to any specific conjugation. The reason is that, unlike the infinitival affixes, canonical participial affixes are stressed in all conjugations: *-át-*, *-út-*, *-ít-*, with the same potential for a stress clash when *-óre* of (93) or other stressed derivational affix is added. For instance, the case in (93b) is from the *-íre* conjugation. Such analyses were alluded to above (see respective discussions of (19), (24), (24), (31), (65). For further details and discussion, see also Burzio (1998), (1999), (2003)). The consequences of this for the prespecification analysis are that the once problematic but possible root marking for participial morphology is now outright impossible, as in each of the cases in (93a, b, c) the same root

¹⁹ The derivatives in (93a, b) also succeed in preserving the stresses on their initial syllables, though irrelevantly, since alternatives like **àggred-it-óre* would presumably also do so.



makes different choices in the derivative than in the participle. The formerly needed restriction of root marking to one specific conjugation is also falsified, as all conjugations now require some diacritic to handle their derivatives: (93b).

In sum, the Partial Order approach to variation cannot be dispensed with by resorting to prespecification since, in general, the effects of a constraint C2 which is in a partial order with a constraint C1 cannot be replicated by some input prespecification. The reason for this is that the effects of any such C2 are in general subject to contextual restrictions, as either C2 or other constraints with which it interacts make reference to context. The input, on the other hand, cannot contain such reference, given ROTB. Prespecification solutions are thus forced to introduce ad-hoc contextual restrictions on specific constraints that effectively duplicate independent parts of the grammar. In addition, the property that is targeted by variation is sometimes a grammar-given property like stress, and is thus not even a candidate for representation in the input. In contrast to this predicament, any prespecification analysis can be straightforwardly converted into a PO analysis, aside -again- from the issue of lexical control. The present framework resolves that issue as well. Note too that the present rejection of UR independently precludes prespecification analyses. Without a UR, all stored ‘inputs’ are necessarily also outputs. Since outputs never feature [ø voice], vowels of intermediate length, or /a_o/’s, neither will inputs in the present system. Hence the inadequacies of the prespecification approach simply corroborate the present claim that there is no UR.

6.2 Co-phonologies and Lexical control

Turning to the Partial Order approach to variation, this is articulated most explicitly in the literature in Anttila (2002), where it is applied to the Finnish phenomena of (89) above. Aside from not maintaining the strict ranking of constraints, the present approach is consistent with Anttila’s on how to express the variation. The remaining burning question is only how to express the lexical control.

In many of the cases that Anttila discusses, the variation is free, as in (94).

(94)	/omena-i-ssa/ ‘apple-PL-INE’	* DEL	*MUT	IO-FAITH
a.	 omeno-i-ssa		*	
b.	 omen-i-ssa	*		

In such cases, the PO will be sufficient. In the present approach, free variation in the case of morphologically complex forms will arise from the absence of any input information for those forms. While the present system allows associating an input with a morphologically complex form like that in (94), such input can straightforwardly also be null –a possibility consistent with ROTB. In that case, the conflict between C1 and C2 of (75) above will remain unarbitrated, allowing for co-optimal forms, just as in Anttila’s system. The conflicting constraints in (94) are not the OCP-based ones of (90) above, both of which are satisfied in this case, but simply the

general ones that ban deletion and mutation, respectively, perhaps MAX and ONSET, but given in (94) in Anttila's more descriptive format.

When the variation is lexically controlled, however (see Anttila's (18)-(20) for relevant statistical data), Anttila's UR-based approach requires postulating separate declensional classes, with cross-referencing of lexicon and grammar. Specifically, a PO of some C1, C2 is taken in Anttila's system to be a disjunction of two total orders: $TO_I = C1 \gg C2$, and $TO_{II} = C2 \gg C1$. The two total orders constitute co-phonologies, and specific lexical items need to be associated with a specific co-phonology, resulting in lexical classes. Any member of some class I will be indexed to utilize a specific TO_I , while members of class II will utilize a TO_{II} and so forth (there are multiple POs and hence numerous TOs in Anttila's fully articulated grammar). As argued above (discussion of (73)-(74), (78)-(79)), this type of duplication of information: grammar in the lexicon, is a syndrome of serialism. In the case of morphologically simple items, the syndrome is vanquished by OT's parallelism: there is no need to claim that *Agamemn[o]n* and *apr[ə]n* belong to two different declensions since postulating /o/, /ə/ in their respective inputs is sufficient: (73), (74). With morphologically complex items, the assumption that there is a UR reintroduces serialism, and the syndrome reappears.

Anttila notes that the different lexical classes thus defined by the different co-phonologies are often also independently definable in purely morphological terms. For instance, nouns tend towards mutation and adjectives towards deletion, as in *tavaro-i-ssa* 'thing-PL-INE', and *avar-i-ssa* 'vast-PL-INE' of (89c) above, respectively. This may seem to alleviate the severity of the conceptual problem, but it does not remove it. For one thing, there remains a residue of unpredictable variation. Secondly, the assumption that the phonology has access to morphological information such as lexical category -though commonplace- is not very natural in a theory in which morphology and phonology are discretely separable modules. The most natural assumption in that perspective would be that phonology only sees phonological substance. The observation that phonology appears to also 'read' some morphological diacritics should prompt the conclusion that the two modules are not discretely separable, so that Anttila's observation that there is 'emergence of morphology' (p. 14) is in fact more consistent with the present framework. Specifically, under the REH (10) above, any noun undergoing mutation in the Plural Inessive will generate among others a cluster of entailments summarizable as in (95).

(95) $N \Rightarrow o-i-ssa$ (if an item is a noun, then it mutates)

Other nouns will then be conditioned by (95) to follow the same pattern. This type of mechanism is in fact the one that the present framework postulates for the 'emergence of morphology' under all circumstances (discussion of (25)). Hence emergence under specific circumstances is not surprising.

In addition to these general though perhaps subtle conceptual reasons against lexical-grammatical cross-classification, there are also empirical ones, having to do with the fact that it incorrectly predicts uniform behavior of roots. One type of counterexample to this prediction is given by Inkelas et al. (1997). They note based on Harris (1985) that, while Spanish diphthongization of mid vowels is variable, the choice is not uniform within roots. For instance,

the first vowel of $r[\acute{e}]pr[o]bo_N$ ‘reprobate’ does not diphthongize under stress ($*r[y\acute{e}]pr[o]bo_N$), but the second one does, as in $r[e]pr[w\acute{e}]bo_V$ ‘I reprove’, showing that one cannot simply partition roots into diphthongizing and not. The present approach faces no difficulty in this connection, as the value of each vowel in the input –here each surface form, is independent. The pre-specification approach would also not be challenged by this case, for similar reasons. Yip (2003, 10) also finds similar counterexamples to the predicted uniformity of roots, noting that: ‘In Zahao a high tone H in the primary verb stem maps into H, L, or ? in a secondary stem, variably. In *huatHsuakH/ huatLsuak?* ‘be naughty, childish’ and other cases, however, the same morpheme exhibits two different mappings.’ Again, neither the present approach nor prespecification are challenged by this type of case, but Anttila’s (2002) style cross-referencing would be.

A second type of counterexample is brought up in Zuraw (2000, 23), who notes that, while Tagalog nasal-obstruent clusters exhibit variation between simple place assimilation and nasal substitution, derivatives of the same root often differ with respect to such variation, as shown in (96).

(96) **Tagalog nasal assimilation/ substitution**

a.	Assimilation	/paŋ-bigaj/	pam-bigaj	‘gifts to be distributed’
a’.	Substitution	/maŋ-bigaj/	ma-migaj	‘to distribute (actor focus)’
b.	Substitution	/paŋ-bugbóg/	pa-mugbóg	‘wooden club to pound clothes’
b’.	Assimilation	/maŋ-bugbóg/	mam-bugbóg	‘to wallop’

In (96), the same prefix *paŋ* can undergo either nasal assimilation or nasal substitution: (a, b). Similarly for the prefix *maŋ*: (b’, a’). At the same time, the same root *bigaj* can also undergo either: (a, a’), as does the root *bugbóg*: (b, b’). Hence neither roots nor prefixes can be underlyingly marked for which repair they will undergo. The point made by (96) is the same as the one made by the Italian data in (93): choice of participial allomorph cannot be pinned on a root.²⁰ Like (93), (96) is thus also an argument against the prespecification approach, so that

²⁰ The data in (96) may seem to violate OO-FAITH/ Lexical Conservatism, however –an issue that I must leave open. The Italian data in (93) are not problematic in this regard, since the variation is due to competition between two types of OO-FAITH/ Lexical Conservatism: metrical and segmental, a derivative being unable to satisfy both simultaneous compared with its participle. Recall that OO-FAITH/ Lexical Conservatism was shown to correctly apply *across* derivatives, where metrical and segmental aspects are *not* in competition: (34) above.

English provides a small scale replica of the Tagalog data in the set: *bi-cycle, tri-cycle, uni-cycle, uni-valent*.. The first three items show that shortening cannot be encoded into the root, while the last two show that it cannot be encoded into the prefix either.

this kind of data is inconsistent with both prespecification and co-phonologies.²¹

In sum, while ranking indeterminacies or Partial Orders provide the correct account of variation within OT, it is only the ability to associate some input information with morphologically complex forms directly, and not any prespecification or indexing of individual morphemes that can provide a general account of how variation can be lexically controlled. This conclusion concurs in fact with Zuraw (2000) and Hayes (2004), who also postulate ‘listing’ of surface forms. They, however, do not pursue the negative implications that this has for the notion of UR (76) that I have addressed here.

To conclude this section, lexical control of variation in morphologically complex items is co-symptomatic with both suppletion and unproductive morphology: each of these three phenomena shows in different ways that there are ‘lexical’, i.e. unpredictable, properties to morphologically complex items, and that therefore the notion of ‘lexicon’ cannot be exhausted by the notion of ‘morpheme’. The present framework has ascribed all three phenomena to the same ability to associate an input with a full-fledged word, while leaving it to surface-to-surface relations to characterize morphology and allomorphy in a fully parallel system, with no UR.

7. Conclusions

This work has laid out two related claims pertaining, respectively, to the macro- and the micro-architecture of a theory of morpho-phonology.

The first claim, concerning the macro-architecture, is that lexicon and grammar are part of a single parallel organization. This claim contains the more specific one that the phonology and the morphology are both systems of violable constraints working in parallel without a ‘UR’. The latter was supported by the observation that the same types of arguments that have heralded the introduction of parallel Optimality Theory into phonology can be constructed for the relation between morphology and phonology. Specifically, while the phonology must apply to morphological formations, the morphology is often also conditioned by the output of the phonology itself –the phenomenon of phonologically controlled morphology. At the same time, the morphology, being partly lexicon and partly grammar, does not itself feature a discrete segregation of the two resources. Both the phenomenon of suppletion and the unproductive character of certain morphological relations show that the lexicon can control the output of the morphology itself and is thus not just a passive supplier. In this regard, we saw that the lexicon can veto legal morphological outputs: *student/ *student-al* (unproductive morphology), as well as bypass regular morphology altogether: **arbore/ arbore-al* (suppletion). Analogous to the surface lexicon’s ability to control the morphology is its ability to control the phonology --the

²¹ Both arguments against co-phonologies: different resolutions of the variation in different loci within the same morpheme: Spanish and Zuhao cases; and different resolution of the variation in the same locus within a morpheme but in different words: Tagalog and Italian cases, also apply to the version of the co-phonologies approach that has morpheme-specific constraints (rather than morpheme specific Total Orders), as in Pater (2000).

phenomenon of lexically controlled phonological variation. Hence lexicon, morphology and phonology must all interact in parallel. In the ontology of Optimality Theory, these three components correspond closely to the IO-FAITH, OO-FAITH, and MARKEDNESS classes of constraints, respectively.

The second claim, pertaining to the micro-architecture of the system, is that OT constraints, at least those of the FAITH family, are by-products of more elementary-type constraints that I have labeled ‘entailments’. The reason for this interpretation is that the rank of FAITH constraints does not appear to hold in a fixed or ‘strict’, way, but rather to depend on properties that can be quantified in terms of number of concurring entailments under the ‘Representational Entailments Hypothesis’. Two classes of cases in particular were argued to instantiate summation of concurring entailments. One involves the phenomenon of ‘attraction’ between allomorphs. In this case, an allomorphic variant A' of some attractor A , where A' lacks a property y of A , will be subject to a number of entailments of type ‘ $x \Rightarrow y$ ’ equal to the number of properties x that A' shares with A . Hence the pressure on A' to inherit y –the ‘attraction’ to A relative to y , will be proportional to the overall similarity or proximity of A' to A . We have seen that two formerly unrelated phenomena: Non-Derived Environment Blocking, and Lexical Conservatism, both instantiate this attraction-over-distance, only differing incidentally in the morphological status of the attractor A : the input to A' in one case (NDEB); a neighboring output in the other (LC).

The second type of case where summation of entailments was shown to be relevant is in defining the strength of morphological correspondences or ‘schemas’. A schema is an entailment of type ‘ $w \Rightarrow z$ ’, where each of w and z is either a property or a set of properties, either inherent or contextual, like ‘-al \Rightarrow / N__’: the sound structure [æɪ] with the meaning ‘pertaining to’ entails a noun in its left-hand context. Such an entailment will attain a strength proportional to the number of times that it holds true (roughly analogous to the psycholinguistic notion of ‘type frequency’). While at first this may seem just a post-hoc way to encode some lexical generalization, it was shown to correctly predict that phonological alternations should correlate with morphological idiosyncrasy/ suppletion, both instantiating weakness of the schema. It was also argued that weak schemas are properly interpretable as fuzzy generalizations, intermediate between a categorical generalization and a list, and for this very reason not fully productive. In turn, unproductive schemas were then argued to yield directionality in OO-FAITH relations: from a base to a derivative but not vice versa, while productive ones lead to adirectional effects: Paradigm Uniformity.

Hence both summation of entailments, analogous to summation of activation in a neural net, and parallel architecture were found critical to characterizing the fined-grained interaction of lexicon and grammar.

References

- Albright, Adam (2005) 'The morphological basis of paradigm leveling', in Laura J. Downing, T. A. Hall, Renate Raffelsiefen, eds. *Paradigms in Phonological Theory*. Oxford: Oxford University Press: 17-43.
- Albright, Adam and Bruce Hayes (2002) 'Modeling English Past Tense Intuitions with Minimal Generalization', in M. Maxwell (ed.) *Proceedings of the 6th Meeting of the ACL Special Interest Group in Computational Phonology, Philadelphia, July 2002*. ACL, 58-69.
- Anderson, Stephen, R. (1992) *Amorphous Morphology*, Cambridge University Press.
- Anttila, Arto (2002) 'Morphologically Conditioned Phonological Alternations' *Natural Language and Linguistic Theory*. 20.1: 1-42
- Bat-El, Outi (2005) 'Principles of Paradigm Uniformity', in Laura J. Downing, T. A. Hall, Renate Raffelsiefen, eds. *Paradigms in Phonological Theory*. Oxford: Oxford University Press: 43-64.
- Benua, Laura (1997) *Transderivational Identity: Phonological Relations between Words*, Ph.D. Dissertation, U. Mass. Amherst.
- Boersma, Paul (1998) *Functional Phonology*, Holland Academic Graphics, The Hague.
- Boersma, Paul, and Bruce Hayes (2001) 'Empirical Tests of the Gradual Learning Algorithm', *Linguistic Inquiry* 32, 45-86.
- Booij, Geert and Rochelle Lieber. (1993) 'On the Simultaneity of Morphological and Prosodic Structure' in *Phonetics and Phonology 4: Studies in Lexical Phonology*, Sharon Hargus and Ellen Kaisse, eds. 23-44. San Diego: Academic Press.
- Bromberger, Sylvain, and Morris Halle (1989) 'Why Phonology Is Different,' *Linguistic Inquiry* 20,1, 51-70.
- Burzio, Luigi (1993) 'English Stress, Vowel Length and Modularity,' *Journal of Linguistics*, 29.2, 359-418.
- Burzio, Luigi (1994a) *Principles of English Stress*, Cambridge University Press.
- Burzio, Luigi (1994b) 'Metrical Consistency,' in E.S. Ristad, ed., *Language Computations*, American Mathematical Society, Providence RI, 93-125.
- Burzio, Luigi (1995) 'On the Metrical Unity of Latinate Affixes,' in H. Campos and P.M. Kempchinsky *Evolution and Revolution in Linguistic Theory: Essays in Honor of Carlos Otero*, Georgetown University Press (revised version of 1991 article), 1-24.
- Burzio, Luigi (1996) 'Surface Constraints versus Underlying Representation,' in: Durand, Jacques & Bernard Laks (eds.) *Current Trends in Phonology: Models and Methods*. European Studies Research Institute, University of Salford Publications. (123-141)
- Burzio, Luigi (1998) 'Multiple Correspondence', *Lingua* 103, 79-109.
- Burzio, Luigi (1999) 'Italian Participial Morphology and Correspondence Theory,' in Geert Booij, Angela Ralli and Sergio Scalise, eds. *Proceedings of the First Mediterranean Conference of Morphology*. University of Patras.
- Burzio, Luigi (2000a) 'Cycles, Non-Derived-Environment Blocking, and Correspondence,' in Joost Dekkers, Frank van der Leeuw and Jeroen van de Weijer, eds. *Optimality Theory: Phonology, Syntax, and Acquisition*. Oxford University Press, 47-87.
- Burzio, Luigi (2000b) 'Segmental Contrast meets Output-to-Output Faithfulness', *The Linguistic Review* 17, 2-4, 368-384.
- Burzio, Luigi (2002a) 'Surface-to-Surface Morphology: when your Representations turn into Constraints' in P. Boucher (ed.) *Many Morphologies*, Cascadilla Press. 142-177.

- Burzio, Luigi (2002b) 'Missing Players: Phonology and the Past-tense Debate,' *Lingua* 112, 157-199.
- Burzio, Luigi (2003) 'Output-to-Output Faithfulness: the Italian Connection', *Lingue e Linguaggio* 1, 69-104.
- Burzio, Luigi. 2004. "Paradigmatic and Syntagmatic Relations in Italian Verbal Inflection". In *Contemporary Approaches to Romance Linguistics*, Auger, Julie, J. Clancy Clements and Barbara Vance (eds.), 17-44. John Benjamins, Amsterdam.
- Burzio, Luigi (2005) 'Sources of Paradigm Uniformity', in Laura J. Downing, T. A. Hall, Renate Raffelsiefen, eds. *Paradigms in Phonological Theory*. Oxford: Oxford University Press: 65-106.
- Burzio, Luigi (2007) 'Phonology and Phonetics of English Stress and Vowel Reduction' *Language Sciences* 29 154-176.
- Burzio, Luigi, and Elvira DiFabio (1994) 'Accentual Stability,' in M. Mazzola, ed. *Issues and Theory in Romance Linguistics (LSRL XXIII)*, Georgetown University Press, Washington, D.C.
- Bybee, Joan L. (1985) *Morphology: A Study of the Relation between Meaning and Form*, John Benjamins, Amsterdam.
- Bybee, Joan L. (2001) *Phonology and Language Use*, Cambridge University Press.
- Carstairs, Andrew (1988) 'Some Implications of Phonologically conditioned suppletion,' in *Yearbook of Morphology* 1, 67-94.
- Chomsky, Noam and Morris Halle (1968) *The Sound Pattern of English*, Harper and Row, New York.
- DiFabio, Elvira (1990) *The Morphology of the Verbal Infix /-isk-/ in Italian and in Romance.* Doctoral Dissertation, Harvard.
- Flemming, Edward (1995) *Auditory Representations in Phonology* Ph.D. Dissertation, UCLA.
- Frisch, Stefan, Janet B. Pierrehumbert, and Michael B. Broe (2004) 'Similarity Avoidance and the OCP': *Natural Language and Linguistic Theory* 22.1: 179-228.
- Goldsmith, John (1990) *Autosegmental and Metrical Phonology*, Basil Blackwell, Oxford.
- Hargus, Sharon (1993) 'Modeling the Phonology-Morphology interface,' in *Phonetics and Phonology 4: Studies in Lexical Phonology*, Sharon Hargus and Ellen Kaisse, eds. 45-74. San Diego: Academic Press.
- Harris, James (1973) 'On the ordering of certain phonological rules in Spanish,' in S.R. Anderson and P. Kiparsky eds. *A Festschrift for Morris Halle*, Holt Rinehart and Winston, New York.
- Harris, James (1985) 'Spanish Diphthongization and Stress', *Phonology Yearbook* 2: 31-45.
- Harris, James (1989) 'The Stress Erasure Convention and Cliticization in Spanish,' *Linguistic Inquiry* 20, 339-363.
- Harris, John (2003) 'Release the captive coda: the foot as a domain of phonetic interpretation', in J. Local, R. Ogden, and R. Temple (eds) *Papers in Laboratory Phonology VI*, Cambridge University Press: 103-129.
- Hayes, Bruce (1982) 'Extrametricity and English Stress,' *Linguistic Inquiry* 13, 227-276.
- Hayes, Bruce (2004) 'Stochastic Phonological Knowledge', paper presented at the 2004 IGERT workshop, Johns Hopkins University.
- Inkelas, Sharon, Cemil Orhan Orgun and Cheryl Zoll (1997) 'The Implications of Lexical Exceptions for the Nature of Grammar', in Iggy Roca (ed.) *Derivations and Constraints*

- in Phonology*, Oxford University Press, 396-418.
- Jarosz, Gaja (2005) 'Polish Yers and the Finer Structure of Output-Output Correspondence' talk presented at the Berkeley Linguistics Society. To appear in the Proceedings
- Kager, René (1999) *Optimality Theory*. Cambridge University Press.
- Kenstowicz, Michael (1996) 'Base Identity and Uniform exponence: Alternatives to Cyclicity,' in: Durand, Jacques & Bernard Laks(eds.) *Current Trends in Phonology: Models and Methods*. European Studies Research Institute, University of Salford Publications: 363-394.
- Kiparsky, Paul (1979) 'Metrical Structure Assignment is Cyclic,' *Linguistic Inquiry* 10, 421-442.
- Kiparsky, Paul (1994) 'Allomorphy or morphophonology?' In R. Singh with R. Desrochers (Eds.). *Trubetzkoy's Orphan. Proceedings of the Montréal Roundtable 'Morphonology: contemporary responses' (Montréal, September 30, October 2, 1994)*. (pp. 13-31). Amsterdam: John Benjamins.
- Kiparsky, Paul (2000) 'Opacity and Cyclicity', *The Linguistic Review* 17, 2-4, 351--365.
- Lapointe, Steven G. (2001) "Stem selection and OT" in *Yearbook of Morphology 1999*, Geert Booij and Jaap van Marle (eds.), Kluwer Academic Publishers, 263-297.
- Lindblom, Björn (1986) 'Phonetic Universals in Vowel Systems'. In John J. Ohala and Jeri J. Jaeger (Eds.), *Experimental Phonology* (pp. 13-44) New York: Academic.
- Łubowicz, Ania (1999) 'Derived Environment Effects in OT'. In the *Proceedings of the West Coast Conference on Formal Linguistics 17*. ed. Kimary N. Shahin, Susan J. Blake, and Eun-Sook Kim, pp. 451-65. Stanford, CA: CSLI. (Available online at: <http://roa.rutgers.edu/index.php3>).
- Mascaró, Joan (1996a) External Allomorphy as Emergence of the Unmarked. In Durand, Jacques & Bernard Laks(eds.) *Current Trends in Phonology: Models and Methods*. European Studies Research Institute, University of Salford Publications. (473-87).
- Mascaró, Joan (1996b) 'External Allomorphy and Contractions in Romance', *Probus*, 8: 181-205.
- McCarthy, John (2002) *A Thematic Guide to Optimality Theory*, New York: Cambridge University Press.
- McCarthy, John (2003) 'Richness of the Base and the Determination of Underlying Representations', ms., U. Mass. [<http://roa.rutgers.edu/index.php3>]
- McCarthy, John (2005) 'Optimal Paradigms', in Laura J. Downing, T. A. Hall, Renate Raffelsiefen, eds. *Paradigms in Phonological Theory*. Oxford: Oxford University Press: 170-210.
- McClelland, James L. and Mark S. Seidenberg (2000) 'Why do kids say goed and brang? Science 287', 47-48.
- Mester, Armin (1994) 'The quantitative trochee in Latin', *Natural Language and Linguistic Theory* 12, 1-62.
- Noyer, Rolf (1998) 'The Basis of Bases: Cyclic and Noncyclic Evaluation in Output-Output Correspondence,' talk presented at the University of Maryland, College Park, April 24, 1998.
- Pater, Joe 2000. Nonuniformity in English stress: the role of ranked and lexically specific constraints. *Phonology* 17:2, 237-274.
- Perlmutter, David (1998) 'Interfaces: Explanation of Allomorphy and the Architecture of

- Grammars' in Steven G. Lapointe, Diane K. Brentari and Patrick M. Farrell (eds.) *Morphology and its Relation to Phonology and Syntax*, CSLI Publications, Stanford, CA, 307-338.
- Pinker, Steven (1991) 'Rules of Language,' *Science*, 253 (5019), 530-535.
- Prince, Alan, and Paul Smolensky (1993) *Optimality Theory: Constraint Interaction in Generative Grammar*, Report no. RuCCS-TR-2. New Brunswick: Rutgers University Center for Cognitive Science. Published (2004): Blackwell.
- Rebrus, Péter, and Miklos Törkenczy (2005) 'Uniformity and Contrast in the Hungarian Verbal Paradigm', in Laura J. Downing, T. A. Hall, Renate Raffelsiefen, eds. *Paradigms in Phonological Theory*. Oxford: Oxford University Press: 263-295.
- Roca, Iggy, and Wyn Johnson (1999) *A Course in Phonology*. Blackwell.
- Rose, Sharon and Rachel Walker (2004) 'A Typology of Consonant Agreement as Correspondence', *Language* 80-3, 475-531.
- Rubach, Jerzy (2000) 'Glide and Glottal Stop Insertion in Slavic Languages: A DOT Analysis', *Linguistic Inquiry* 31.2, 271-317.
- Rubach, Jerzy (2003) 'Duke-of-York Derivations in Polish' *Linguistic Inquiry* 34. 4 601-629.
- Skousen, Royal (1975) *Substantive Evidence in Phonology: The Evidence from Finnish and French*. The Hague: Mouton.
- Spencer, Andrew (1991) *Morphological Theory*, Basil Blackwell.
- Steriade, Donca (1994) 'Positional Neutralization and the Expression of Contrast,' ms. UCLA.
- Steriade, Donca (1997) 'Phonetics in Phonology: The Case of Laryngeal Neutralization,' ms. UCLA.
- Steriade, Donca (1999) 'Lexical Conservatism in French Adjectival Liaison,' in B. Bullock, M. Authier and L. Reed (eds.) *Formal Perspectives in Romance Linguistics*, John Benjamins, pp. 243-270.
- Steriade, Donca (2000) 'Directional Asymmetries in Assimilation: A directional account' in Hume, E. and K. Johnson (eds.) *The Role of Speech Perception in Phonology*. New York, Academic Press.
- Steriade, Donca (2001) 'The Phonology of Perceptibility Effects: the P-map and its consequences for constraint organization', ms. UCLA
- Tantalou, Niki and Luigi Burzio (2003) 'Modern Greek Accent and Faithfulness Constraints in OT', ms. Johns Hopkins University.
- Tranel, Bernard (1998) 'Suppletion and OT: On the issue of the syntax/ phonology interaction', in E. Curtis, J. Lyle, and G. Webster, eds., *Proceedings of WCCFL*: 415-29.
- Vaux, Bert (1998) *The Phonology of Armenian*, Oxford University Press.
- Vaux, Bert (2003) 'Syllabification in Armenian, Universal Grammar and the Lexicon', *Linguistic Inquiry* 34.1, 91-125.
- Yip, Moira (2003) 'Phonological Markedness and Allomorph selection in Zahao', ms., UC, London [<http://roa.rutgers.edu/index.php31>].
- Zuraw, Kie (2000) *Exceptions and Regularities in Phonology*. Ph.D. dissertation, UCLA.