

Underlying Forms in Automatic Phonology

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0. Introduction

In choosing underlying or lexical representations (below, URs) for alternating morphemes, speakers are known to rely in one set of cases on principles, exemplified by those of (1) below, that identify URs with morpheme alternants that are “salient” in one or another sense.¹

- (1) a. URs are identified with isolation forms, when those exist.
- b. URs are identified with the most frequent alternants in inflectional paradigms.
- c. URs are drawn from a consistent morphological environment over a lexical class.

On the other hand, any case in which there is reason to believe that the UR of an alternating morpheme is distinct from all that morpheme’s surface alternants (see examples below) shows that criteria such as those of (1) cannot be fully general, since all of those principles assume that a UR will coincide with some actually occurring allomorph. In de Chene 2010, it was suggested that the existence both of cases for which UR choice is governed by criteria like those of (1) and cases for which such criteria are irrelevant is a consequence of the fact that there are two distinct modes of phonological analysis, corresponding, respectively, to the historical processes of phonologization and reanalysis. While UR choice in reanalysis is governed by criteria of salience, it was claimed, UR choice for newly phonologized alternations, and more generally for alternations governed by surface-true constraints, is governed instead by a criterion of faithfulness, reminiscent of the Optimality Theoretic criterion of Lexicon Optimization (Prince and Smolensky 2004: 225), that minimizes the distance between URs and surface forms.

The primary purpose of the present paper is to investigate the properties and consequences of the latter criterion, that based on faithfulness and claimed to govern UR choice in the domain of what, adapting a traditional term, I will call automatic phonology.² I will claim that the faithfulness-based criterion operates at the level of the feature (or minimal bundle of features that vary together) rather than at that of the morph and that this

property explains immediately why its application can result both in morpheme-sized URs that coincide with no surface alternant of the relevant morpheme and in segment-sized URs that coincide with no surface alternant of the relevant segment.

The paper is organized as follows. In section 1, I inventory the possible distributional patterns of the two values of a binary feature in a pair of environments, concluding that there are only two types of alternation that can be forced by such a distributional pattern, the neutralizing and the allophonic. In section 2, I propose a faithfulness-based criterion of UR choice and indicate how I take it to apply to those two types of alternations; in section 3, I provide two illustrations of its application, showing that in one case it dictates the adoption of a UR for an alternating morpheme that coincides with no surface alternant of that morpheme and that in the other it dictates the adoption of a UR for an alternating segment that coincides with no surface alternant of that segment. In section 4, I show that the faithfulness-based criterion is equivalent to a simpler principle that takes as basic, for a given instance of a feature, that value of the feature that appears in environments where the distribution of the feature is unconstrained. Section 5 summarizes the paper’s conclusions and suggests directions for future research.

1. Patterns of Feature Distribution and Resulting Alternation Types

Consider the distribution of the two values of a binary feature $[F]$ over a natural class characterized by a set of feature values $[X]$ --for example, the distribution of the two values of $[\text{voice}]$ over the class of obstruents. The distribution of $[+F]$ and $[-F]$ may be context-sensitive or context-free. If it is context-free, either both values of $[F]$ occur in all relevant environments or there is a single value of $[F]$ that does. These two possibilities are represented in Tables 1 and 2 below, where α ranges over $\{+, -\}$ and occurrence of a particular feature value is shown by a “o” in the column corresponding to that feature value.

	X αF	X $-\alpha F$
All environments	o	o

Table 1: Context-free Contrast in $[F]$

	X αF	X $-\alpha F$
All environments	o	

Table 2: Context-free Lack of Contrast in $[F]$

If the distribution of $[+F]$ and $[-F]$ is context-sensitive, on the other hand, either there are two types of environments, namely those in which both values are allowed and those in which only one is, or else all environments have in common that they allow only one of the two values. These two possibilities are represented, for the case in which there are precisely

two types of environments, in Tables 3 and 4, respectively.

	X α F	X $-\alpha$ F
Environment A		o
Environment B	o	o

Table 3: Contrast and Neutralization in [F]

	X α F	X $-\alpha$ F
Environment A		o
Environment B	o	

Table 4: Complementary Distribution in [F]

In the situation of Table 3, there is a contrast in [F] in Environment B that is neutralized in favor of $[-\alpha F]$ in Environment A; in the situation of Table 4, $[\alpha F]$ and $[-\alpha F]$ are in complementary distribution, with the former appearing in Environment B and the latter in Environment A.

Now consider the question of when an alternation in [F] will be forced by one of the patterns of distribution we have seen. In the situation shown in Table 4, to begin with, any instance of [F] that occurs both in Environment A and in Environment B will be forced to alternate by the fact that the values of [F] allowed in those two environments are distinct. In the situation shown in Table 3, similarly, any instance of $[\alpha F]$ in Environment B that also occurs in Environment A will be forced to alternate by the fact that only $[-\alpha F]$ is allowed in the latter environment. In contrast, alternations in the value of [F] will be impossible in the situation shown in Table 2, since in that situation, only one value of [F] is allowed anywhere. In the situation shown in Table 1, finally, an alternation in the value of [F] will not be impossible, but no such alternation is forced by the distribution of [F]’s values. Equating “automatic alternations” with “alternations forced by constraints on featural distribution”, we see that there are two types of automatic alternation, neutralizing and allophonic, for the choice of URs in which we will need to account.³

2. A Faithfulness-Based Criterion for UR Choice

Within Optimality Theory (OT, Prince and Smolensky 2004), a widespread intuition about URs, embodied in the principle of Lexicon Optimization (LO, Prince and Smolensky 2004: §9.3) is they are as close as possible to surface phonetic representations. While LO was originally proposed only for nonalternating morphemes, and while its applicability to alternations is unsettled,⁴ its general import is clear:

- (2) Faithfulness is the only criterion for UR choice.

One notable characteristic of (2) is that nowhere does it make reference to the notion of morpheme or suggest that morpheme-level URs must correspond with actually occurring

morpheme alternants. Indeed, given that the OT concept of faithfulness is typically taken to be relative to individual features, (2) can be seen as suggesting the possibility that UR choice is made at the level of the feature. This proposal, as we will see, provides a natural way to understand cases in which morpheme-level and/or segment-level URs appear to diverge from all of their surface realizations.

The basic intuition underlying the criterion for UR choice to be proposed here is that for automatic alternations, URs are chosen so that they surface unchanged apart from the need to satisfy exceptionless constraints.⁵ To implement this idea, I divide deviations between underlying and surface forms into two types depending on whether or not they are motivated by such a constraint: deviations that are will be called “motivated”, while those that are not will be called “unmotivated”. I further assume that, in evaluating a hypothesis concerning base forms, unmotivated deviations count against the hypothesis, but motivated deviations do not.⁶

(3) UR Choice for Automatic Alternations

- a. Definition: Divergences between underlying and surface forms that can be accounted for by the need to conform to exceptionless constraints are motivated; others are unmotivated.
- b. Unmotivated divergences between underlying and surface forms count against hypotheses concerning URs; motivated divergences do not.

It follows from (3) that:

- (4) Given feature F subject to an automatic alternation, the UR of morpheme M with respect to an alternating instance of F contains that value α of F that maximizes the degree to which deviations from $[\alpha F]$ can be motivated by the need to conform to exceptionless constraints.

In particular, if there is a (unique) choice of α for which all deviations from $[\alpha F]$ can be motivated by the need to conform to exceptionless constraints, that will be the underlying value for the instance of F in question.

3. Case Studies

We now turn to two examples illustrating the application of (3)–(4) above, the first involving two neutralizing alternations, the second one neutralizing and one allophonic alternation. We will see that while the application of (3)–(4) to neutralizing alternations is entirely straightforward, the application of those principles to allophonic alternations will require us to make one further assumption.

3.1. Russian

In Russian, as is well known, the contrast between voiced and voiceless obstruents is neutralized in favor of the latter word-finally, and the contrast between /o/ and /a/ is neutralized in favor the latter in stressless syllables. I will assume for Russian the six-vowel system and feature analysis of Halle 1994: 41, in which there is only a two-way height contrast and /o/ and /a/ thus differ only in rounding, and will for expository purposes treat stress as a binary feature. The two constraints in question may then be stated as in (5).

(5) a. Prohibition of word-final voiced obstruents

$$* \begin{array}{|l} \hline -\text{son} \\ \hline +\text{voi} \\ \hline \end{array} \#$$

b. Prohibition of stressless /o/

$$* \begin{array}{|l} \hline -\text{cns} \\ -\text{hi} \\ +\text{bk} \\ +\text{rnd} \\ -\text{str} \\ \hline \end{array}$$

Now consider the nominative and genitive singular of the Russian noun “pie”, given in (6).

(6) a. *pirók* “pie (nom.sg.)”

b. *piragá* “pie (gen.sg.)”

The final segment of the noun stem displays an alternation in the feature [voi]. In accordance with our assumption that URs are chosen at the level of the feature for automatic alternations, the two possibilities entertained by the child constructing a lexical entry for “pie” are that the final segment of the noun stem is specified [+voi] and that it is specified [−voi].⁷ If it is specified [+voi], the divergence from the underlying value in the nominative can be accounted for by the need to conform to constraint (5a); this is thus a motivated divergence and does not count against the hypothesis of [+voi] as the underlying voicing value. In contrast, if the last segment of the stem is specified [−voi], the divergence from the underlying voicing value in the genitive will not be explicable by the need to conform to an exceptionless constraint; this divergence will therefore be unmotivated and will count against the hypothesis of [−voi] as the underlying voicing value. Principles (3)–(4), then, dictate that the underlying voicing value of the last segment of the stem “pie” is [+voi].

The stem “pie” also displays an alternation between [o] and [a] (i.e. between [+rnd] and [−rnd]) in the vowel of its second syllable. If the vowel in question is lexically specified

[+rnd], the divergence from the underlying value in the genitive can be accounted for by the need to conform to constraint (2b); this is thus a motivated divergence and does not count against the hypothesis of [+rnd] as the underlying rounding value. In contrast, if the vowel in question is specified [−rnd], the divergence from the underlying rounding value in the nominative will not be explicable by the need to conform to an exceptionless constraint; this divergence will therefore be unmotivated and will count against the hypothesis of [−rnd] as the underlying voicing value. Principles (3)–(4), then, dictate that the underlying rounding value of the second vowel of the stem “pie” is [+rnd]. In conjunction with the conclusion that the underlying voicing value of the last segment of the stem is [+voi], and assuming that (with one exception to be noted below) nonalternating features of phonetic form appear unaltered in underlying forms, this means that the UR of the stem as a whole is /pirog/.

The conclusion that the stem of “pie” in Russian is /pirog/, and not */pirok/ or */pirag/, coinciding with one of the occurring alternants, could also be reached by comparing the number of motivated and unmotivated divergences between underlying and surface forms resulting from the postulation as basic of those three morpheme-sized UR candidates. For /pirog/, there are two such divergences, [−voi] in the stem-final consonant in the nominative and [−rnd] in the second vowel in the genitive, but both of these divergences are motivated in the sense defined above and thus do not count against the hypothesis that /pirog/ is the UR. For */pirok/ and */pirag/ as well there will be two divergences, but only one, in each case, will be motivated. Table 5 below makes it clear that the total number of divergences between underlying and surface form is irrelevant to the choice of the former; only the number of unmotivated divergences is relevant.

Proposal	Motivated Divergences	Unmotivated Divergences	Total Divergences
/pirog/	2	0	2
/pirok/	1	1	2
/pirag/	1	1	2

Table 5: Divergences between Underlying and Phonetic Form for Three Hypotheses Concerning the UR of Russian “pie”

While Table 5, as indicated, shows that our conclusion about the UR of “pie” could have been reached by considering morpheme-sized UR candidates, the hypothesis that UR choice is made at the level of the feature for automatic alternations is desirable in that it relieves the learner of the need to construct such UR candidates.

3.2. Catalan

In Catalan, as in Russian, the contrast between voiced and voiceless obstruents is neutralized in favor of the latter word-finally (and in favor of the voicing value of a following onset consonant in word-internal codas (see Wheeler 2005: 145–149)). Further, voiced stops [b d g] are in complementary distribution with the homorganic voiced fricatives [β ð γ], the latter appearing in syllable onsets after continuants and the former elsewhere (Wheeler 2005: 10). These two restrictions may be captured by the constraints of (7).

(7) a. Prohibition of word-final voiced obstruents

$$* \begin{array}{|c|} \hline -\text{son} \\ \hline +\text{voi} \\ \hline \end{array} \#$$

b. Prohibition of onset voiced stops after a continuant ($[\alpha \text{stp}] = [-\alpha \text{continuant}]$)

$$* [-\text{stp}]. \begin{array}{|c|} \hline -\text{son} \\ \hline +\text{stp} \\ \hline +\text{voi} \\ \hline \end{array}$$

We must note immediately about (7b) that the complementary distribution of [+stp] and [−stp] for Catalan voiced obstruents would appear to justify another constraint prohibiting voiced fricatives in the set of environments complementary to post-continuant position. More generally, complementary distribution, as in Table 4 above, might appear to automatically entail a pair of complementary constraints, with the result that divergences between underlying and surface forms could be motivated by the need to conform to such constraints regardless of which feature value was chosen as underlying. In fact, the situation is not this clear-cut. As shown by a case like the history of the distributional relationship between [Φ] and [h] in Japanese (Blevins 2004: 255), with the two originally in complementary distribution ([Φ] before /u/, [h] before /i e o a/), but with contrasts introduced subsequently by the importation of loanwords with [Φ] before /i e o a/, complementary distribution does not in fact automatically entail a bidirectional constraint.

In most cases of complementary distribution at the featural level, the two complementary feature values have an asymmetrical relationship at least in that one appears in a narrowly defined environment that provides phonetic motivation for the occurring feature value, while the other, the default or elsewhere case, appears in a heterogeneous set of environments at least some of which fail to provide such motivation. Other asymmetries may be observed as well; thus, in the case at hand, that the voiced obstruents of Catalan, Wheeler (2005: 327)

notes that post-continuant contexts display variation between stop and fricative realizations, while other contexts show invariable stops; he takes this to imply that the stops are basic, as their wider distribution would suggest. Here, in order to be able apply the principles (3)–(4) to allophonic as well as neutralizing alternations, we will assume, as we did in (7b), that a marked allophonic feature value appearing in a particular environment is associated with a constraint prohibiting the complement value in that environment, but that no such constraint is associated with an unmarked allophonic feature value.⁸

Consider now the masculine and feminine singular forms of the Catalan adjective “blind” (Hale and Reiss 2008: 7), given in (8).

- (8) a. sek “blind (masc.sg.)”
 b. seɣə “blind (fem.sg.)”

The final segment of the noun stem displays an alternation in the two features [voi] and [stp]. In accordance with our assumption that URs are chosen at the level of the feature for automatic alternations, the possibilities entertained by the child constructing a lexical entry for “blind” are (a) that the final segment of the adjective stem is specified [+voi] and that it is specified [–voi] and (b) that that segment is specified [+stp] and that it is specified [–stp]. If the stem-final consonant is specified [+voi], the divergence from the underlying value in the masculine can be accounted for by the need to conform to constraint (7a); this is thus a motivated divergence and does not count against the hypothesis of [+voi] as the underlying voicing value. In contrast, if the stem-final consonant is specified [–voi], the divergence from the underlying voicing value in the feminine will not be explicable by the need to conform to an exceptionless constraint; this divergence will therefore be unmotivated and will count against the hypothesis of [–voi] as the underlying voicing value. Principles (3)–(4), then, dictate that the underlying voicing value of the stem-final consonant of “blind” is [+voi].

In the same way, if the stem-final consonant is lexically specified [+stp], the divergence from the underlying value in the feminine can be accounted for by the need to conform to constraint (7b); this is thus a motivated divergence and does not count against the hypothesis of [+stp] as the underlying stopness (continuance) value. In contrast, if the consonant in question is specified [–stp], the divergence from the underlying stopness value in the masculine will not be explicable by the need to conform to an exceptionless constraint; this divergence will therefore be unmotivated and will count against the hypothesis of [–stp] as the underlying voicing value. (3)–(4), then, dictate that the underlying stopness value of the stem-final consonant of “blind” is [+stp]. In conjunction with the conclusion that the

underlying voicing value of that consonant is [+voi], and assuming that nonalternating features of phonetic form appear unaltered in underlying forms, this means that the UR of the stem as a whole is /seg/.

The conclusion that the stem of “blind” in Catalan is /seg/, and not */sek/ or */sey/, coinciding with one of the occurring alternants, could also be reached by comparing the number of motivated and unmotivated divergences between underlying and surface forms resulting from the postulation as basic of those three morpheme-sized UR candidates. For /seg/, there are two such divergences, [−voi] in the stem-final consonant in the masculine and [−stp] in the same consonant in the feminine, but both of these divergences are motivated in the sense defined above and thus do not count against the hypothesis that /seg/ is the UR. For */sek/ and */sey/ as well there will be two divergences in each case, but neither divergence will be motivated in the case of */sek/, and only one of the two (devoicing) will be motivated in the case of */sey/. Table 6 below again underlines the fact that what is important in UR choice is not the total number of divergences between underlying and surface form, but only the number of unmotivated divergences.

Proposal	Motivated Divergences	Unmotivated Divergences	Total Divergences
/seg/	2	0	2
/sey/	1	1	2
/sek/	0	2	2

Table 6: Divergences between Underlying and Phonetic Form for Three Hypotheses Concerning the UR of Catalan “blind”

In the Russian case of section 3.1, we saw that the hypothesis that UR choice for automatic alternations is made at the level of the feature had the consequence that the morpheme-sized UR need not coincide with any of its morpheme-sized surface alternants; in the Catalan case we see that that hypothesis has the consequence that a segment-sized UR (here, /g/) need not coincide with any of its segment-sized surface alternants either.

4. Unconstrained Environments: A Simpler Criterion for UR Choice

According to (3)–(4), speakers must compute, in order to choose URs, which divergences between underlying and surface forms are motivated and which are unmotivated for multiple hypotheses and then compare the results. In this section, we will see that, assuming that there is an environment E in which the distribution of the values of an alternating feature F is unconstrained, the faithfulness-based criterion of (3)–(4) is equivalent to a simpler

principle that takes as basic, for a given instance of F, the value of F that appears in E. In particular, we will argue that:

- (9) Given morpheme M displaying an alternation in the value of feature F in one of its segments, methods a. and b. of choosing the UR of M with respect to F are equivalent.
- a. The UR of M with respect to F contains that value of F that occurs in environments where the distribution of F's values is unconstrained.
 - b. The UR of M with respect to F contains that value all observed deviations from which can be motivated by the need to conform to exceptionless constraints.

In particular, we will argue that (9a) entails (9b) and that the negation of (9a) entails the negation of (9b).

Given feature F, classify an environment of F as “constrained” if the value of F is subject to an exceptionless constraint in that environment and as “unconstrained” otherwise. Consider the case in which there is precisely one environment of each type, and call the constrained environment E_c and the unconstrained environment E_u . Assume that the content of the constraint operative in E_c is that $[-\alpha F]$ is prohibited there ($*[-\alpha F] / E_c$). Then the distribution of values of F will be as in (10):

- (10) a. $[\pm F] / E_u$
 b. $[\alpha F] / E_c$

Now consider morphemes M_1 and M_2 containing instances of F that alternate as in (11), where failure to alternate, as in (11b), is considered one pattern of alternation (the “null alternation”).

- (11) a. $M_1: [-\alpha F] / E_u \sim [\alpha F] / E_c$
 b. $M_2: [\alpha F] / E_u \sim [\alpha F] / E_c$

Given the distribution of feature values in (10), M_1 and M_2 exhaust the possible patterns of alternation with respect to F. It is straightforward to show that if UR choice for M_1 and M_2 satisfies (9a) above it will satisfy (9b), and that if it fails to satisfy (9a), it will fail to satisfy (9b). This is argued in (12) and (13), respectively.

- (12) If, following (9a), the URs of M_1 and M_2 contain the value of F observed in E_u , they will contain $[-\alpha F]$ and $[\alpha F]$ respectively. In that case, deviation from the underlying value of F will be observed only for M_1 in environment E_c , where underlying $[-\alpha F]$ is realized as $[\alpha F]$. But this deviation can be motivated by the constraint $*[-\alpha F] / E_c$, and so this choice of underlying values satisfies (9b) as well as (9a).
- (13) If, in violation of (9a), the URs of M_1 and M_2 fail to contain the value of F observed

in E_u , they will both contain $[\alpha F]$. In that case, deviation from the underlying value of F will be observed only for M_i in environment E_u , where underlying $[\alpha F]$ is realized as $[-\alpha F]$. But this deviation can not be motivated by the constraint $*[-\alpha F] / E_c$, and so this choice of underlying values fails to satisfy (9b) as well as (9a).

The upshot is that speakers can achieve a faithfulness-based choice of URs with regard to a feature F displaying an automatic alternation simply by examining contexts in which F is not subject to any constraint and taking as underlying the value they find there.

5. Conclusion

The output-oriented nature of Optimality Theory has resulted in a de-emphasis, in recent phonological research, on underlying or lexical representations, a de-emphasis that applies both to the question of what URs speakers postulate in particular cases and to the question of the principles on the basis of which they do so. Taken to its logical conclusion, OT's output-orientation might be seen as implying that, as long as the constraint hierarchy guarantees the correct surface forms, the identity of the URs that underlie them is a matter of little concern.⁹ This, however, would amount to enshrining observational adequacy as the sole goal of phonological analysis--that is, to abandonment of the goals of descriptive and explanatory adequacy, and with them, of the generative project itself for the domain of phonological knowledge.

Above, we have assumed, in contrast, that the identity of speakers' URs in particular cases (the problem of descriptive adequacy for URs) and the identity of the principles according to which URs are chosen (the corresponding problem of explanatory adequacy) are central concerns of phonological analysis and theorizing. Starting from the observation that there appear to exist both cases in which URs are chosen on the basis of criteria of salience like those of (1) and as a result invariably coincide with surface allomorphs, on the one hand, and cases in which such principles appear to play no role in UR choice and URs may deviate from surface allomorphs, on the other, we have developed tentative proposals both about where the boundary between the two kinds of cases lies and about what criteria are used in those cases where salience is irrelevant. Specifically, we have suggested that salience is irrelevant for automatic alternations, characterized here as those that result from the demands of exceptionless constraints, and that URs for such alternations are (a) computed at the level of the individual feature and (b) chosen so as to minimize divergences between underlying and surface forms--equivalently, so as to maximize faithfulness. If this is the case,

there is a sharp contrast between the principles of UR choice operative in automatic phonology and the principles that govern UR choice in cases of reanalysis--that is, in the nonautomatic phonology of inflection. Much further investigation, however, will be needed to test and refine those proposals.

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Notes

- 1 For discussion of three cases taken to suggest (1a), see Hayes 1998; for the claim (1c) and a principle parallel to (1b), see Albright 2002; for the discussion of all three principles, see de Chene 2010.
- 2 For Bloomfield (1926: 160-161), an automatic alternation is a phonologically conditioned formal alternation, where the latter is an alternation of forms (in practice, morphemes) as opposed to an alternation of segments (phonemes).
- 3 The reader may verify that automatic alternations are limited to these two types by examining all sixteen of the possible patterns of o's and blanks in a table like that of Table 3 or 4.
- 4 For the claim that LO is inapplicable to alternations, see McCarthy 2002: 78; for attempts to adapt it to alternations, see Inkelas 1995 and Tesar and Smolensky 2000: 77-83.
- 5 I will assume that the UR of a nonalternating feature specification is identical with its surface value except in the case of a marked allophonic value, whose UR will be the corresponding unmarked value.
- 6 This line of reasoning is by no means original; in Fromkin et al. 2000 (610-611), for example, it is used to argue that in the alternation between [t] and [d] as the English past tense suffix, [d] is underlying. To my knowledge, however, it has not been proposed explicitly as a principle of base form choice. One reason for this is that for many phonologists, the line of reasoning in question is a way-station on the road to an OT in which exceptionless constraints have no privileged status, faithfulness violations are not divided into the benign and the pernicious, and the problem of base form choice is itself deemphasized. Non-OT phonologists have declined to make use of such a principle of base form choice as well, however; we will see directly how it provides an immediate solution to an elementary problem Hale and Reiss (2008: 7-9, 271-276) consider at some length--a solution distinct from the one at which they eventually arrive.
- 7 I will assume that any consideration of the hypothesis that the segment in question is unspecified for [voi] occurs subsequent to the initial choice of voicing value under consideration here, so that the issue of underspecification can be set aside for present purposes.

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- 8 It would be possible to take the position that since UR choice for an allophonically alternating feature is global--that is, morpheme-independent--application of (3)–(4) to allophonic alternations is superfluous. Here I emphasize instead the possibility of a unified treatment under (3)–(4) of neutralizing and allophonic alternations.
 - 9 This kind of claim has in fact been made; see Hale and Reiss 2008:18–22 for discussion.