Description and Explanation in Inflectional Morphophonology: The Case of the Japanese Verb*

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Outline

1 Introduction

Since the introduction of the concepts of descriptive and explanatory adequacy in Chomsky 1964b (see also Chomsky 1964a), the terms "description" and "explanation" have defined the twin projects of generative linguistic inquiry, the goal of description being the characterization of the steady-state endpoint of the language acquisition process and that of explanation being the characterization of the starting point of that process, the initial state or innate endowment. These two goals apply to all areas of linguistic competence and are independent of whether the transition from the initial state to the steady state is taken to be mediated by an evaluation procedure (Chomsky 1957:51), by parameter setting (Chomsky 1981:4), by constraint (re)ranking (McCarthy 2002:208), or by some other mechanism.

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1.1 Description and Explanation in Phonology: A Research Program

In the area of morphophonology, the existence of multiple observationally adequate analyses for many data sets (exemplified below) made it evident quite early that descriptive adequacy could not be attained merely on the basis of analyzing patterns of distribution and alternation. At the same time, the existence of cases in which speakers seemed to have arrived at analyses strikingly different from those predicted by the standard assumptions of phonologists (see e.g. Hale 1973) made it clear that explanatory adequacy could not be attained merely by adopting a priori a particular definition of simplicity--for example, the feature-counting evaluation metric of Chomsky and Halle 1968, taken to apply to the lexicon (see pp.381-382) as well as to rule schemata. Two representative quotations illustrating these realizations, the first focusing on the problem of description, the second on the problem of explanation, are given below.

> "Generative grammarians have ... claimed that a description of the phonological structure of a language is simultaneously a characterization of the linguistic knowledge of native speakers .... But in order for this implication to be valid, we must be able to corroborate it by corpus-external evidence .... (Kenstowicz and Kisseberth 1979:153-154)

> " ... [S]howing that introducing the alternation condition can lead to more complex analyses cannot by itself refute the alternation condition, since the point at issue is precisely whether simplicity is the correct evaluation measure. .... To avoid begging the question in investigations of this problem we must look for *external evidence* as to the correctness or incorrectness of specific analyses which are required or forbidden by the constraints at issue." (Kiparsky 1971/1982:59-60 (italics in original))

Both of the above quotations imply a research program, set forth explicitly in Kenstowicz and Kisseberth 1977:3, that would seek to determine the relevant explanatory principles through examination of a critical mass of cases for which the descriptively adequate analysis is known from external evidence. The principles thus discovered could then be used to predict the descriptively adequate analysis in cases for which no such evidence is available. The present paper, using evidence from morphophonological change, aims to advance that research program by showing that substantive results are obtainable within it. We begin in section 1.2 by developing a general model of the inferential relation between synchrony and diachrony in inflectional morphophonology, following the dictum of Kiparsky (1978/1982:217) "that structure can determine change, with the corollary that change can therefore be diagnostic of structure." Section 2 deals with the suffixal alternations of Japanese verb inflection, which have been analyzed in at least four distinct ways in the literature. Based on the synchrony-diachrony relationship as explicated in 1.2, predictions for potential change are computed for three observationally adequate analyses of the Japanese alternations. It is then shown that only one set of predictions is consistent with the facts of change in progress, as documented in a nationwide survey of inflection; we conclude that the analysis that correctly predicts the ongoing changes is the unique descriptively adequate analysis of the system of alternations under consideration.

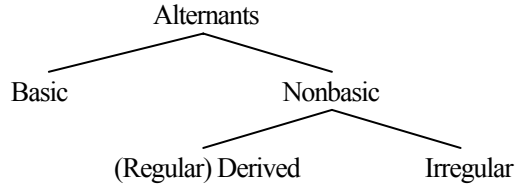
Before taking up the question of the explanatory principles that determine the choice of the descriptively adequate analysis, we deal, in section 3, with proposals in the literature that treat the ongoing changes of section 2 in isolation from an account of the synchronic system that is changing, notably those that take innovative inflectional suffixes to be direct transforms of the conservative counterparts they replace. Moving to questions of explanation in section 4, we begin by contrasting rules (or constraints) that directly reflect the phonologization of phonetic variation with rules resulting from reanalysis, suggesting that the phonology of phonologization and the phonology of reanalysis are sharply distinct in their respective principles of base form choice. Returning to the Japanese case, we first see that the choice of the descriptively adequate analysis over observationally adequate alternatives follows from proposals of Albright 2002, notably the principle that speakers attempt to maximize the predictability of inflected forms (IF predictability). I consider and reject, however, the position that speakers evaluate for IF predictability a unitary complex of base forms and rule(s), concluding on the basis of attested or ongoing reanalyses in Portuguese and Korean that base forms are chosen first and that only then do speakers deal with the question of whether the alternation is rule-governed. Section 5 summarizes the paper's conclusions and implications and suggests directions for future research.

1.2 The Relation between Synchrony and Diachrony in Morphophonology

But just how is it that synchronic structure limits the paths of possible change in morphophonology, so that change can be diagnostic of structure? I will maintain that the link between synchrony and diachrony in this area follows from the typology of morpheme alternants that results from the assumption of basic forms and rules combined with a model of how the alternant types in question are stored, retrieved, and generated.

Two of the claims of classical generative phonology that distinguished it most sharply from the post-Bloomfieldian phonology that preceded it were that, in analyzing alternations, speakers postulate (1) basic or underlying forms and (2) rules to derive nonbasic forms. Provisionally adopting these claims,[1] and assuming that basic forms coincide with surface alternants in the cases of interest (see section 4.4 below), postulation of basic forms divides the entire set of morpheme alternants for a given alternation into basic and nonbasic subsets. Further, the postulation of a rule governing that alternation divides nonbasic alternants into regular derived forms, which are predicted accurately by the rule postulated, and irregular forms, which are not. The result of these two binary divisions is the tripartition of alternants in (1).

(1)



The fundamental link between synchronic structure and diachronic change in morphophonology is, I claim, a consequence of this tripartition of alternants in that differential predictions concerning diachronic stability arise from the psychological interpretation of the three alternant types--in particular, from whether or not they must be stored in memory and whether or not they can be generated online (see Albright 2002:12 and Marcus et al. 1992:vi, 15-18). Before examining those questions, however, it is necessary to say something about the ways in which a morpheme alternant can be irregular.

I will take a single phonological matrix, in conjunction with a specification of meaning, to constitute the irreducible minimal form of a lexical entry and will count anything beyond that, from a diacritic feature to a suppletive alternant, as excess information, equating the latter concept with irregularity. At least four types of irregularity can be distinguished, depending first of all on whether the excess information is phonological or diacritic. In the most extreme case, that of suppletion, an irregular alternant (like a basic alternant) must be lexically listed in full; I will assume that, in contrast to a basic alternant, a suppletive alternant is listed with a specification of its environment. In the case of a morpholexical alternation, which shares with a suppletive alternation the property of being morpheme-specific but differs in that the alternants have phonological material in common, those features of the morpholexical alternant not shared with the basic alternant will have to be listed; I will assume in this case as well that the extra phonological material is associated with a statement of environment. Thus, for example, the Japanese Causative suffix is *-sase-* after a vowel and *-ase-* after a consonant, where the *s*-zero alternation is morpheme-specific; if the latter alternant is basic, as I will claim, the lexical representation of the suffix will be <s>ase/<V>__.

Following a widely adopted proposal of Lightner (1968), I will assume that an alternation that characterizes only a limited class of morphemes is to be captured by a "minor" rule that applies only to lexical items individually marked to undergo it. An irregular alternant that is the result of a minor rule will not need to be lexically listed; the excess information constituting the irregularity in question will take the form of a diacritic feature ("rule feature") that triggers the minor rule. The excess information associated with failure to undergo a general ("major") rule will be diacritic as well, consisting of an exception feature; in this case, the irregular alternant will typically be identical to the basic

[1] As is well known, Optimality Theory (OT), the dominant theory of phonology over the last fifteen years, rejects language-specific rules. OT is also consistent with a rejection of (unique) basic forms for alternating morphemes, as illustrated by Ito and Mester's (2004) suggestion that both post-vocalic and post-consonantal alternants of Japanese verbal suffixes are lexically listed. Below, however, we will see ample evidence that speakers postulate both basic forms and language-specific rules in analyzing the nonautomatic alternations of inflection; we will also see that the criteria on the basis of which they do so appear to be distinct from any presently contemplated in OT.

alternant, contrary to the prediction of the rule. In the context of such proposals, it is widely assumed (see e.g. Kenstowicz and Kisseberth 1977:61,122-123) that there is a general tendency for speakers to eliminate diacritic information from lexical entries over time. I will assume that this tendency applies to all four types of irregularity we have just surveyed (rule feature, exception feature, suppletive alternant, morpholexical alternant)--that is, to any information in excess of a single phonological matrix, whether it be diacritic or phonological in content. Where an irregular alternant is any alternant whose generation requires reference to such excess information, then, we expect irregular alternants, other things being equal, to be eliminated over time.

Let us now return to the question of whether the three alternant types we identified above (a) must be stored in memory and (b) can be generated online, with an eye to the further question of whether they can be expected to display stability or instability across time. Basic alternants, to begin with, must be stored in memory--that is, lexically listed. If lexical retrieval should for any reason fail for a basic alternant, there will be no way to generate a substitute, so there is no way for a basic alternant to show instability. Regular derived alternants, in contrast, may be stored in memory, but they need not be, because they may also be generated online by rule. The result of retrieval from memory and the result of online generation will be identical, though, so there is no way for a regular derived alternant to exhibit instability either.

Irregular alternants, finally, are similar to basic alternants in that they require lexical listing. More precisely, the excess information required by an irregular alternant, whether phonological or diacritic, must be noted in the lexical entry of the corresponding morpheme. We have hypothesized that this excess information tends to be eliminated from lexical entries over time. When lexical retrieval fails for the excess information required by an irregular alternant, however, the speaker is free to derive a substitute from the corresponding basic alternant by application of the relevant rule. This substitute, of course, will be an "overregularized" form, distinct from the result of retrieval from memory. As a result, if failure of retrieval occurs with sufficient frequency for the excess information required by an irregular alternant, we will observe variation or fluctuation between that alternant and an innovative regular substitute, typically progressing over time to a state in which the innovative alternant has been generalized and the irregular alternant eliminated.

Of the three alternant types of (1), then, it is only the irregular alternants that are potentially unstable, and there is a single type of change that is predicted to occur if that instability is realized, namely the replacement of irregular nonbasic forms by regular derivatives.[2] It is in this way that synchronic structure, in the form of basic forms and rules, restricts the pathways of change. Further, any hypothesis about synchronic structure, in the form of an analysis that induces the tripartition of forms seen in (1), makes falsifiable predictions about what changes in the system are possible, predictions which may then be confronted with the facts of change in progress. Conversely, change in progress can illuminate synchronic structure. In the change scenario just envisioned, basic forms and regular derivatives will be stable, while irregular forms will be subject to replacement by regularly derived substitutes. If we can assume that this state of affairs arises only in the way we have envisioned, then, given a situation where, for a given class of morphemes, alternant type A is stable, but alternant type C is subject to replacement by alternant type B, where type B bears a constant relationship to type A, it will follow that type A is basic, type C is irregular, and type B is generated by rule from type A. These inferential relations between synchrony and diachrony are summarized in Table 1 below.[3]

Postulated Analysis	Basic A Rule A → B Irregular C	Inferred Analysis
⇓		⇑
Predicted Change	Replacement of A ～ C with A ～ B (Extension of A ～ B)	Observed Change

Table 1 Inferential Relations between Analysis and Change in Morphophonology

The change scenario of Table 1 can also be characterized as extension of the rule-governed alternation A ～ B: as

[2] Cf. Bloomfield 1933:509: "... analogic change replaces irregular derivatives by regular."

[3] In the generative tradition, early examples of such reasoning can be found in works such as Vennemann 1972, 1974 and Skousen 1975.

a result of the elimination of irregular alternants, that alternation comes to be applicable to forms to which it previously failed to apply. In terms of our typology of alternants, then, "analogical" extension of an alternation is triggered by the loss of irregular alternants in the presence of a rule which is then free to derive regular substitutes. Leveling of an alternation, on the other hand, is naturally understood as loss of irregular alternants in the absence of a (major) rule: if speakers postulate a basic (unmarked/default) vs. nonbasic (marked) distinction but no general rule to derive nonbasic forms, all nonbasic alternants will be irregular, and loss of irregular alternants will automatically result in leveling in favor of basic alternants. Leveling as well as extension of an alternation, then, can be interpreted as the consequence of loss of irregularity.

Extension and leveling--expansion and contraction of range of application--are the two basic externally observable changes that an alternation can undergo. If both extension and leveling are the result of loss of lexical irregularity, the possibility arises that, once a given analysis of an alternation is in force, the elimination of irregularity is the only reason for that alternation to display instability. And if that is true, any description of an alternation that postulates zero irregularity can be said to predict diachronic stability for that alternation. In closing this section, we look at two devices that make it possible to avoid postulating irregularity in the treatment of an alternation and suggest that descriptions that avail themselves of those devices should indeed be seen as predicting diachronic stability.

The extension and leveling scenarios identified above, with extension triggered by loss of irregular alternants in the presence of a rule and leveling by the loss of irregular alternants in the absence of a rule, have in common the postulation of a distinction between basic and irregular alternants, where the latter, but not the former, are associated with a statement of environment. A further possibility, however, is that no such distinction is postulated, all alternants being accorded the same status in the lexicon. In this case, there are two sub-possibilities, namely that all alternants are accompanied by environmental specification and that none are (for examples of published analyses of these two kinds in the context of Japanese verb inflection, see note 6 below). Let us refer to such analyses, which postulate neither rules nor (unique) basic forms, as "symmetric" treatments of alternations. Under a symmetric treatment of an alternation, while there will of course be lexical information for each morpheme in excess of a single phonological matrix, no alternant can be said to be irregular to the exclusion of any another. If nothing is irregular, however, there will be no reason for the alternation to display instability or change; in particular, neither extension nor leveling will be predicted. Symmetric analyses, then, can be taken to predict diachronic stability.

It is of course possible that a prediction of diachronic stability is justified by the facts; in such a case, symmetric listing of alternants could be seen as a device that appropriately allows an analysis to avoid unwanted predictions of instability. In order to motivate a second analytical device that can be seen as having this effect, consider the relatively common situation in which a recurrent alternation of A with B coexists with both nonalternating A and nonalternating B. Across time the alternation will be either stable or unstable; if it is unstable, the logically possible changes are leveling in favor of A, leveling in favor of B, extension of the alternation to previously nonalternating A, and extension to previously nonalternating B.[4] Each of these possible changes, of course, is naturally seen as the result of the elimination of lexical irregularity: leveling in favor of A will be expected if speakers postulate a minor rule A → B, so that alternating A are irregular, and similarly for leveling in favor of B; extension of the alternation to previously nonalternating A will be expected if speakers postulate a major rule A → B, so that nonalternating A are irregular, and similarly for extension to previously nonalternating B. The postulation of irregularity for such an alternation, however, can be avoided by treating it as the surface reflex of an abstract segment X distinct from both A and B, where X may be either fully specified or underspecified. I suggest that such abstract segment analyses, like fully symmetric treatments, can be taken as predicting diachronic stability and can thus be falsified by a demonstration of ongoing leveling or extension. While this assumption will play no significant role in the argumentation below (but see note 41), it makes explicit one important implication of the view, proposed above, that all "analogical" change in the range of application of an alternation, both extension and leveling, results from the elimination of lexical irregularity.

[4] Many actual historical situations are of course "messy" in that over time, more than one of these possibilities are attested, with none clearly predominant. This phenomenon suggests that there are (perhaps substantial) subregions of the space of alternations for which the relevant explanatory principles do not yield a unique analysis.

2 Description

We are now ready to turn to the inflectional suffix alternations of the Japanese verb. In the present section, we will examine three observationally adequate analyses of those alternations, computing the predictions regarding potential instability and change for each and comparing the results with the facts of change in progress.

2.1 Introduction: The Alternating Suffixes of Japanese Verbal Inflection

The inflectional suffixes of the Japanese verb can be divided into two sets depending on the alternations they display and whether or not they induce alternations in the stems they attach to. The members of the larger set of suffixes alternate between a vowel-initial form after consonant-final stems and a consonant-initial form after vowel-final stems; in combination with such suffixes, stems are nonalternating. The members of the smaller set of suffixes are consonant-initial after all stems and undergo only a voicing alternation (*t* ～ *d*), but they trigger a relatively complex set of stem alternations ("onbin"). Here we will be concerned only with the former set of suffixes, which will be seen to constitute a well-defined morphophonological subsystem. As an introduction to those suffixes and their alternations, Table 2 displays two representative examples, the first showing a consonant-zero alternation, the second a vowel-zero alternation (the stems are *mat-* "wait" and *mi-* "see"; the Negative suffix is given for convenience in its Western Japanese form).

	C-Stem	V-stem
Indicative	mat-u	mi-ru
Negative	mat-an	mi-n

Table 2 Sample Alternations (Indicative, Negative)

Concerning the lexical representations of the suffixes of Table 2, there are at least the following possibilities: (a) C-stem alternants (*-u, -an*) are basic; (b) V-stem alternants (*-ru, -n*) are basic; (c) longer alternants (*-ru, -an*) are basic; (d) there are no unique basic forms; all alternants are lexically listed. Because the segment-zero alternations are not fully predictable given the shorter alternants, choice (c) is the one that maximizes phonological predictability of morpheme alternants, as we will see in more detail below.

For Tokyo and many other localities, the full set of suffixes that show V-initial forms after C-stems and C-initial forms after V-stems consists of the nine items of Table 3 (the Passive, Causative, and Potential suffixes create verb stems; the Eastern Japanese variant *-ana-* of the Negative suffix creates adjective stems).[5] There are also many localities that lack certain of the suffixes of Table 3 or display additional suffixes with parallel alternations.

	Suffix	C-stem	V-stem	Alternation
1	Indicative	mat-u	mi-ru	ϕ ～ r
2	Provisional	mat-eba	mi-reba	ϕ ～ r
3	Passive	mat-are-	mi-rare-	ϕ ～ r
4	Hortative	mat-oo	mi-yoo	ϕ ～ y
5	Causative	mat-ase-	mi-sase-	ϕ ～ s
6	Infinitive	mat-i	mi-ϕ	i ～ ϕ
7	Negative	mat-an(a-)	mi-n(a-)	a ～ ϕ
8	Imperative	mat-e	mi-ro	e ～ ro
9	Potential	mat-e-	mi-rare-	e ～ rare

Table 3 Full Set of Alternating Suffixes (Tokyo and other localities)

[5] A number of the suffixes of Table 3 are like the Negative in displaying regional variation; for example, as we will see below, the V-stem Imperative suffix is *-yo* or *-i* in most of Western Japan. Variation in the Negative suffix is recorded in this and subsequent tables because the Western Japanese variant *-an* will figure prominently in the story of change in progress to be recounted below.

As indicated in the last column of Table 3, suffixes 1-3 show the *r*-zero alternation that we saw in Table 2, suffixes 4-5 show alternations of other consonants with zero, suffixes 6-7 show vowel-zero alternations (including the *a*-zero alternation seen in Table 2), and suffixes 8-9 show alternations that are apparently suppletive. Published analyses of these alternations illustrate all four of the proposals for lexical representations that we considered above for the two suffixes of Table 2: C-stem alternants, V-stem alternants, and longer alternants as basic, and symmetrical listing of all alternants.[6] It is clear, then, even before considering the question of what phonological rule (if any) speakers postulate to relate basic and nonbasic alternants, that this is a system of alternations with multiple observationally adequate analyses. In section 2.2, we will examine three such analyses, based respectively on the postulation as basic of C-stem alternants, V-stem alternants, and longer alternants.

2.2 Three Observationally Adequate Analyses and their Predictions

Below, the three analyses to be compared in this section will first be introduced, each defined by a set of basic forms and a phonological rule. We will then compare the partition of suffix alternants into basic, regular derived, and irregular types induced by the three analyses and note, using one of the analyses as an example, how that partition determines the lexical representations of the alternating suffixes that are associated with each analysis. Finally, we will examine the predictions of each analysis regarding what changes in the system are to be expected if regularization occurs, setting the stage for the confrontation of those predictions with the facts of ongoing change in section 2.3.

If the C-stem suffix alternants of Table 3 are basic, the rule that provides maximal predictability of nonbasic (i.e. V-stem) alternants will be one that inserts *r* intervocalically at verb stem boundary; such a rule will account correctly for the V-stem alternants of the first three categories of Table 3.[7] I will thus assume that the analysis that takes C-stem alternants as basic incorporates such an *r*-Epenthesis rule; call this analysis "Analysis A".

(2) Analysis A
   a. Basic Alternants: C-stem suffixes
   b. Rule: $\phi \rightarrow r \;/\; V_{Vb}][\_\_V$

In rule (2b), brackets mark morpheme boundary, and the label "Vb" indicates that the leftward morpheme bears the lexical category specification [Verb]. The precise set of environments in which the *r*-Epenthesis rule (2b) applies will be discussed in section 2.4.

If, on the other hand, the V-stem alternants of Table 3 are basic, the rule that provides maximal predictability of nonbasic (i.e. C-stem) alternants will be one that deletes the second of two consonants at verb stem boundary; such a rule will account correctly for the C-stem alternants of the first five categories of Table 3. I will thus assume that the analysis that takes V-stem alternants as basic incorporates such a C-deletion rule; call this "Analysis B".[8]

(3) Analysis B
   a. Basic Alternants: V-stem suffixes
   b. Rule: $C\,[\text{-stop}] \rightarrow \phi \;/\; C_{Vb}][\_\_$

The consonant-deletion rule of Analysis B has been written as applying only to nonstops because the *t* of *t*-initial suffixes is unaffected, as illustrated by the examples /kar + ta/, /kaw + ta/ → [katta] of note 8. Alternatively, if

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[6] For C-stem alternants as basic, see de Chene 1985, 1987; for V-stem alternants as basic, see McCawley 1968: 93ff.; for longer alternants as basic, see e.g. Kuroda 1960 or Chew 1973; for symmetrical listing, see Bloch 1946/1970:24 (with environments specified) or Ito and Mester 2004 (with alternant choice determined by ranked constraints).

[7] The alternative of a rule deleting the second of two vowels at verb stem boundary would account for the alternations of only two suffixes, the Infinitive and Negative (Categories 6,7), and would potentially neutralize the distinction between the Indicative, Infinitive, and Imperative forms and the Potential stem (Categories 1,6,8,9) for V-stem verbs, given that the basic form of each of those suffixes consists of a single vowel if C-stem suffixes are basic.

[8] While it is sometimes suggested (Hasegawa 1999:63, Miyagawa 1999:236) that deletion of the second of two consonants represents a general principle of Japanese phonology, the usual treatment of clusters is in fact assimilation of the first consonant to the second: /kar + ta/ "clip" + Perfect → [katta], /kaw + ta/ "buy" + Perfect → [katta], /but + sak-/ "beat + tear" → [bussak-] "tear violently", /hik + sage-/ "draw + hang" → [hissag-] "carry"; /it + kai/ "one + time" → [ikkai], /it + sai/ "one + year of age" → [issai], /it + pai/ "one + glass" → [ippai].

t-initial suffixes are added not to stems but to Infinitive forms, as suggested by the relevant forms of *s*-stems ([oʃita] "pushed", analyzable as /os + i + ta/ "push" + Infinitive + Perfect), forms with *t*-initial suffixes can be derived with rules that are ordered after (3b), and this restriction will be unnecessary.

If, finally, the longer suffix alternant is basic in each case, the rule that provides maximal predictability of nonbasic (i.e. shorter) alternants will be one that deletes both the second of two consonants and the second of two vowels at verb stem boundary; such a rule will account correctly for the shorter alternants of the first seven categories of Table 3. I will thus assume that the analysis that takes longer alternants as basic incorporates such a rule; call this "Analysis C".

(4) Analysis C
   a. Basic Alternants: longer suffixes
   b. Rule: $[\alpha \text{cons}] \rightarrow \phi \ / \ [\alpha \text{cons}]_{Vb}] [\ \_\_$

Under Analysis C, if *t*-initial suffixes are not to be treated as exceptions to deletion, they will have to be added to infinitive forms rather than to stems.

In introducing Analyses A, B, and C, we have already noted which suffix alternants will be basic and which will be regularly derived under each analysis; the irregular suffixes are the complement within the set of nonbasic suffixes of the regularly derived set. Table 4 below displays the tripartition of suffix alternants corresponding to each of the three analyses, with basic suffixes unmarked in each case, regular suffixes underlined, and irregular suffixes shaded.

		Analysis A		Analysis B		Analysis C	
	Suffix	C-stem	V-stem	C-stem	V-stem	C-stem	V-stem
1	Indicative	mat-u	mi-ru	mat-u	mi-ru	mat-u	mi-ru
2	Provisional	mat-eba	mi-reba	mat-eba	mi-reba	mat-eba	mi-reba
3	Passive	mat-are-	mi-rare-	mat-are-	mi-rare-	mat-are-	mi-rare-
4	Hortative	mat-oo	mi-yoo	mat-oo	mi-yoo	mat-oo	mi-yoo
5	Causative	mat-ase-	mi-sase-	mat-ase-	mi-sase-	mat-ase-	mi-sase-
6	Infinitive	mat-i	mi-ϕ	mat-i	mi-ϕ	mat-i	mi-ϕ
7	Negative	mat-an(a-)	mi-n(a-)	mat-an(a-)	mi-n(a-)	mat-an(a-)	mi-n(a-)
8	Imperative	mat-e	mi-ro	mat-e	mi-ro	mat-e	mi-ro
9	Potential	mat-e-	mi-rare-	mat-e-	mi-rare-	mat-e-	mi-rare-

Table 4 Basic, Regular (__), and Irregular ( ) Alternants according to Analyses A, B, C

It is immediately clear from Table 4 that, as we have already observed, Analysis C is the most successful of the three analyses in terms of maximizing phonological predictability of suffix alternants, given that it treats seven of nine suffix alternations as regular. Analysis B, with five alternations treated as regular, is the next most successful analysis in this regard, and Analysis A, with only three alternations treated as regular, is the least successful.

The lexical representations of the nine suffixes under a given analysis can, to a first approximation, be read off the data of Table 4. Basic alternants will be lexically listed; temporarily treating irregular alternants as suppletive, they will be listed as well, along with a specification of environment. Concerning regular derived alternants, while we noted in section 1 that they may be stored in memory, I will assume here, following standard generative practice, that they are not lexically listed. I will further assume that insertion of inflectional elements into syntactic terminal nodes is governed by the principles (5) (Halle and Marantz 1993:123-124, Halle 1997:428).

(5) a. Inflectional elements are inserted into terminal nodes based on feature matching.
   b. The features of an inflectional element must constitute a subset of the features of the node into which that element is inserted.
   c. An element matching in more features takes precedence over one matching in fewer.
   d. Among elements matching in the same features, an element with a more complex environment takes precedence over an element with a simpler environment.

Given the assumption that irregular alternants, but not basic alternants, are listed with their environments, (5d) will guarantee that the irregular and basic alternants corresponding to a single category constitute a disjunctively ordered pair, with the basic alternant as the elsewhere or default case. Since the question of the feature structure of the set of nine inflectional categories of Tables 3 and 4 is orthogonal to the morphophonological issues we are concerned with here, I will assume for present purposes that there is a one-to-one correspondence between categories and features. Letting the category numbers of the tables stand in for those features, the lexical representations of the nine suffixes in question under Analysis A will, under the above assumptions, be as in (6) (where, in category 7, only the Eastern Japanese alternant is listed).

(6) Lexical Representations under Analysis A of the Suffixes of Table 3 (Version 1)

1 u	4 [yoo / V__ oo]	7 [na / V__ ana]
2 eba	5 [sase / V__ ase]	8 [ro / V__ e]
3 are	6 [ϕ / V__ i]	9 [rare / V__ e]

In categories 4, 5, 7, and 9, the two suffix alternants have material in common, and the alternation is thus not in fact suppletive, but morpholexical. In categories 4, 5, and 9, the longer alternant occurs in the more complex environment, so that the representations of the two alternants can be collapsed into one in which the shared material appears only once using the standard notational convention of angled brackets, as noted above for the Causative suffix of category 5. In category 7, where the shorter alternant occurs in the more complex environment, this convention is inapplicable. In order to allow in this case as well a representation of the suffix in which the material shared by the two alternants appears only once, I will define the "reverse angled bracket" notation >X<Y<Z> as abbreviating the disjunction of YZ and XY. (6) may then be rewritten as (7).

(7) Lexical Representations under Analysis A of the Suffixes of Table 3 (Version 2)

1 u	4 <y>oo </ V__>	7 >a<na </ V__>
2 eba	5 <s>ase </ V__>	8 [ro / V__ e]
3 are	6 [ϕ / V__ i]	9 <rar>e </ V__>

Since the lexical representations of the nine suffixes under Analyses B and C may be computed in parallel fashion from the classification of alternants in Table 4, I will omit those representations here.

In section 1, we noted that our model of the retrieval and generation of basic, regular derived, and irregular morpheme alternants had the consequence that only the irregular alternants are potentially unstable, and that the only type of change predicted to occur if that instability is realized is replacement of irregular alternants by regularly derived substitutes. It is thus straightforward to compute from the data of Table 4 the predictions of each of the three analyses for potential change: a prediction will be generated for each shaded suffix alternant of that table, and the predicted innovative alternant will be the result of applying the rule postulated by the analysis in question to the basic form postulated by that analysis for the relevant suffix in the context provided by the relevant stem type.

To illustrate, consider the Imperative, a category for which all three analyses take one of the existing suffix alternants

as irregular. According to Analysis A, V-stem *-ro* is irregular; if retrieval fails for that irregular alternant, the basic alternant *-e* will be added to V-stems as well as C-stems, and the *r*-Epenthesis rule (2b) will apply to that alternant in the context of a V-final stem to produce an innovative suffix alternant *-re*. This derivation is displayed in (8).

(8) Predicted innovative V-stem Imperative under Analysis A if retrieval of irregular *-ro* fails
Input [[mi $_{Vb}$][e]]
(2b) [[mi $_{Vb}$][re]]
Output [mire]

In the same way, C-stem Imperative *-e* is irregular according to Analyses B and C; if retrieval fails for that alternant, the basic alternant *-ro* (in much of Western Japan, *-yo* (note 5)) will be added to C-stems as well as V-stems, and the C-deletion rule (3b) of Analysis B or the more general deletion rule (4b) of Analysis C will apply to that alternant in the context of a C-final stem to produce an innovative suffix alternant *-o*. This derivation is displayed in (9).

(9) Predicted innovative C-stem Imperative under Analyses B/C if retrieval of irregular *-e* fails
Input [[mat $_{Vb}$][ro]]
(3b)/(4b) [[mat $_{Vb}$][o]]
Output [mato]

More generally, for Analysis A, each regularly derived substitute for an irregular V-stem suffix alternant will consist of the corresponding C-stem alternant preceded by *r;* for Analysis B, each regularly derived substitute for an irregular C-stem suffix alternant will consist of the corresponding V-stem alternant minus its first consonant; and for Analysis C, each regularly derived substitute for an irregular short suffix alternant will consist of the corresponding longer alternant minus its first vowel or consonant (the regularizations predicted by Analysis C are thus a proper subset of those predicted by Analysis B). The predictions of the three analyses are summarized in Table 5, where the form given for the Negative suffix under Analysis B assumes that *n* (unlike *t*) is subject to deletion.

		Analysis A		Analysis B		Analysis C	
	Suffix	C-stem	V-stem	C-stem	V-stem	C-stem	V-stem
4	Hortative		mi-roo				
5	Causative		mi-rase-				
6	Infinitive		mi-ri	mat- ϕ			
7	Negative		mi-ran(a-)	mat-(a-)			
8	Imperative		mi-re	mat-o		mat-o	
9	Potential		mi-re-	mat-are-		mat-are-	

Table 5 Predicted Changes in Case of Regularization

It is the predictions of Table 5 that we will now compare with the facts of change in progress.

2.3 Change in Progress: Innovative *r*-Suffixes

With the publication, by the National Language Research Institute,[9] of the six-volume, 350-map Grammar Atlas of Japanese Dialects (GAJ = Kokuritu Kokugo Kenkyuuzyo 1989-2006), data concerning verbal inflection has become available for 807 localities in Japan, 41 from the Ryukyu dialect area and 766 from the Japanese dialect area proper (here we will consider only the latter).[10] Under the idealizing assumption that they have developed independently of each other, a set of related dialects like that recorded in the GAJ constitutes a kind of linguistic laboratory or natural

[9] Known in English since October 2009 as the National Institute for Japanese Language and Linguistics.
[10] While Ryukyu varieties (eleven languages according to Grimes 2000:649-650) are by no means irrelevant to our topic, their divergence from each other and from Japanese proper presents problems of interpretation that are beyond the scope of this paper.

experiment--for our purposes, a natural morphophonological experiment.

Data for the GAJ was gathered in interviews between local informants (most of them men born before 1925 and between 55 and 75 years old at the time of the survey in 1979-1982) and survey workers, typically dialect experts at local universities; each survey item asked informants to provide a local equivalent for an expression presented in standard Japanese. The GAJ is thus fundamentally based on self-reporting and shares the potential drawbacks of that methodology (see Labov 2001:194ff. and references cited there), although the interview format did allow survey workers to suggest forms not volunteered by informants. In many cases, furthermore, the GAJ does not add significantly to what was already known from the descriptive dialect literature (e.g. Iitoyo et al. 1982-1986 and references cited there) about the occurrence of particular forms or constructions in particular localities. Its great virtues, apart from the visual convenience of its maps, are that it is an exhaustive, uniform nationwide survey and that its results are quantifiable.

The verdict of the GAJ data is unambiguous. First, all predictions of Analysis A are confirmed, both with regard to which suffix alternants should be stable and which unstable and with regard to the changes to be expected if instability is realized: all six of the *r*-initial innovative V-stem suffixes listed under Analysis A in Table 5 are widely attested.[11] Table 6 shows data from the GAJ on the frequency of those six suffixes, with one map chosen to illustrate each suffix.

	Survey Item	Volume (Map)	Innovative Form	Innovative Localities	Reference Set	Innovative Percentage
4	ne-yoo	3 (108)	ne-roo etc.	141	505	２８％
5	ko-sase-ru	3 (120)	ko-rase-ru etc.	267	747	３６％
6	mi wa sinai	4 (161)	mi-ry-aa-sen etc.	109	504	２２％
7	mi-na-i	2 (74)	mi-ran	143	738	１９％
8	mi-ro	2 (86)	mi-re	174	747	２３％
9	kiru koto ga dekiru	4 (176)	ki-re-ru	283	608	４７％

Table 6 Frequency of Innovative *r*-Suffixes for Representative GAJ Survey Items

The percentages in the last column of Table 6, which give a rough idea of the strength of each innovative suffix, are the ratios of the figures in the two previous columns, where the reference set is the set of localities deemed potentially capable of showing the innovative suffix. The reference set was calculated, for each survey item in question, by subtracting from 766 (a) the number of nonresponding locations for the item in question and (b) either the number of locations that systematically lack the relevant basic alternant (i.e. the corresponding C-stem suffix) or, when that figure was unavailable due to a lack of relevant survey items, the number of locations whose responses to the survey item in question involved a construction or form distinct from that of the standard Japanese model.[12]

The figures of Table 6 are useful as a means of comparing the relative strength of the six innovative suffixes because in computing them, two factors that would otherwise have skewed the results were controlled for. The first of these, as already indicated, was variation by category in the number of localities that could in principle have displayed the relevant innovative suffix. The second is variation by category in the number of relevant GAJ survey items: for the Infinitive, whose many uses were not systematically investigated, there are only three relevant items (Maps 21 and 161-162), while for the Potential, there are seven (Maps 175-179 and 184-185). More revealing than the figures of Table 6 with regard to the overall strength of the evidence for Analysis A, however, is the percentage of the 766 GAJ locations that display one or more of the six innovative *r*-suffixes, showing that Analysis A is in force at that location. Even excluding Potential *-re-* (Category 9), the most common member of the set, over 60% of all locations display at least one innovative suffix, while when the Potential is included, the percentage rises to over 80%. The number of locations and percentage of the whole represented thereby are presented in Table 7 for the six innovative *r*-suffixes

[11] The innovative Negative suffix occurs only in the Western Japanese form *-ran;* this is perhaps because speakers with irregular Eastern *-na-* identify it with the homophonous negative existential adjective, an identification that would be rendered impossible by innovative *-rana-*.

[12] By category number, the two figures in question are as follows (NR = nonresponding, BL = base lacking, DC = distinct construction): Cat 4: NR 1, BL 260 (Map 109); Cat 5: NR 19, BL 0; Cat 6: NR 55, DC 207; Cat 7: NR 1, BL 27 (Map 80); Cat 8: NR 8, DC 11; Cat 9: NR 9, BL 150 (Maps 173-174, 181-183) [one location in both sets].

individually and for the disjunctions of suffixes 4-8 and 4-9. [13]

	Suffix	Number	Percent
4	Hort *-roo*	159	20.8
5	Caus *-rase-*	273	35.6
6	Inf *-ri*	129	16.8
7	Neg *-ran*	142	18.5
8	Imp *-re*	205	26.8
9	Pot *-re-*	419	54.7
Any of 4－8		472	61.6
Any of 4－9		620	80.9

Table 7　Frequency of Innovative *r*-Suffixes over All GAJ Survey Items

The evidence supporting Analysis A, then, is extremely widespread. Further, there are a number of reasons why even the figures of Table 7 somewhat understate the extent of that evidence. One reason, already referred to, is the fact that the Infinitive form was not a focus of investigation for the GAJ; that form occurs in the survey items that do contain it more or less by accident. Systematic investigation would almost certainly have revealed many more instances of innovative Infinitive *-ri* than are recorded in Table 7, as can be inferred from examples of that suffix that show up in the GAJ data for survey items other than the three on which the Table 7 figure was based.

For example, Tokyo Japanese displays a number of weak imperative constructions that involve the Infinitive (see Martin 1975:964-965), and it is clear that the same is true of many regional varieties. Only in a few areas, however, is such a construction salient enough as a substitute for the Imperative to emerge as a response to an Imperative survey question; when it does, we sometimes see innovative Infinitive *-ri,* as in forms like *okirin* (～ *okin*) "get up!" from location 656816 on the Atsumi Peninsula in Aichi Prefecture (for discussion of this construction in the region in question, see Yoshikawa and Yamaguchi 1972:152-154). Location 636625 in Yamaguchi Prefecture shows parallel forms. The Infinitive-based potential expressions of Kyushu also reveal innovative Infinitive *-ri* in a number of cases; sample forms, based on *ki-* "wear, put on" are *kiri-kiru* (～ *ki-kiru*) (738398, Kumamoto Prefecture) and *kiri-ga-naru* (839421, Kagoshima Prefecture) "can put on" (Map 175). None of these occurrences of *-ri* are reflected in Table 7. It is safe to say that comprehensive data on Infinitive-based constructions would raise the Table 7 figure for that suffix considerably.

A second reason that the figures of Table 7 somewhat understate the extent of the evidence for Analysis A, insofar as the basic forms of that analysis are concerned, is that there are areas in which, to a first approximation, intervocalic *r* is subject to deletion, so that when irregular V-stem suffixes are eliminated, the expected *r*-initial substitutes show up without their *r*:

In particular, there are 21 locations[14] in the Kii Peninsula (Mie/Nara/Wakayama Prefectures) that show generalization to V-stems of C-stem Negative *-an* in accordance with the predictions of Analysis A, but no *r*-Epenthesis, so that the innovative suffix appears as *-yan* (e.g. *miyan* "doesn't look"); neighboring locations show variation between *-ran* and *-yan*. None of these 21 locations shows any innovative *r*-suffix from categories 4-8 (although twelve of them have Potential *-re-*); inclusion of them as evidence for Analysis A would thus raise the Table 7 figures both for the Negative and for Categories 4-8 by slightly under three percentage points. Similarly, the southernmost GAJ location in the Japanese dialect area proper, 924994 in the Tokara island group, displays Negative *-yan* and Imperative *-e* (e.g. *mie* "look!") in the absence of any innovative *r*-suffix.

For the Kii Peninsula, the dialect literature describes general loss of intervocalic *r* (and *s*) for Wakayama Prefecture (Murauchi 1962:374-375, KH (Kooza Hoogengaku = Iitoyo et al. 1982-1986) 7:177), but not for Mie or Nara. It is thus implausible that the *r*-Epenthesis rule (2b) is in force over the entire area, with its effects being undone by a low-level *r*-Deletion rule. Nor, given forms like *neyo(o)* "let's go to bed/sleep" (GAJ Map 108), does it seem likely that all instances of intervocalic *y* at verb-stem boundary over the area in question can be accounted for in terms of the spreading process discussed in Kawahara 2003, since that process operates only when the second vowel is lower than the first (the form *koyoo* "let's come", which would show this even more clearly, is lacking in the area in question, which shows *koo* instead (GAJ Map 110)). The possibility thus emerges that much of the Kii Peninsula has a morphologically restricted

[13] The location-by-location data supporting the figures of Table 7 are available from the author on request.
[14] 654612, 655476, 655506, 656387, 656423, 656514, 656673, 657332, 657379, 657543, 657685, 658088, 658438, 658735, 659044, 659147, 659501, 750046, 750391, 750408, 751369.

y-Epenthesis rule parallel to the *r*-Epenthesis rule of Analysis A. Innovative V-stem Passive *-yare-* (replacing *-rare-*) and Causative *-yas-* (replacing *-sas-*), common over much of the area (Umegaki 1962b:37), could also be seen as suggesting this, although the *y* in question could also be explained in terms of spreading. This issue clearly deserves further attention. Again, however, innovative *y*-suffixes, like innovative *r*-suffixes, are based on C-stem suffixes and show that the latter are basic, as postulated by Analysis A.

A third and final reason that not all of the evidence for Analysis A appears in Table 7 is that the set of innovative *r*-suffixes observed across the range of Japanese dialects is not limited to the six that we have examined. Let us look briefly at several additional examples of *r*-suffixes whose historical origin and development are relatively clear.

Among the many honorific auxiliary verbs (morphologically speaking, inflectional stem-forming suffixes) displayed by the 17th-century Japanese of the Kyoto/Osaka area ("Kamigata-go") is one that takes the form *-assyar-* ～ *-asyar-* after C-stems and *-sassyar-* ～ *-sasyar-* after V-stems (Matsumura 1971:972). This suffix thus in principle shows the same *s* ～ *ϕ* alternation as the Causative suffix, and is in fact composed historically of Causative *-(s)ase-* plus the old Indicative form *-raru* of the Passive suffix (Matsumura 1971:264) reanalyzed as *-rar-u*, with the subsequent development *-(s)aserar-* > *-(s)asear-* > *-(s)asyaar-* > *-(s)assyar-* ～ *-(s)asyar-*. In several areas, however, as shown by the data for GAJ Map 291, the V-stem alternant *-sassyar-* has been or is being replaced by *-rassyar-,* parallel to the replacement of Causative *-sase-* with *-rase-*.[15] Similarly, the honorific auxiliary *-(s)ahar-* of the Shonai region of Yamagata Prefecture, identified with *-(s)asyar-* by the *Nihon Kokugo Daiziten* (*Great Dictionary of the Japanese Language*), displays variation between conservative V-stem *-sahar-* and innovative V-stem *-rahar-* (Kokuritu Kokugo Kenkyuuzyo 1953:226).

An example where the original alternation is of the form V ～ *ϕ* rather than C ～ *ϕ* is provided by the Hortative suffix *-(a)zu* of Nagano, Yamanashi, and Shizuoka Prefectures (GAJ Maps 106-111), which goes back to Muromachi period *-(a)uzu* and Kamakura period *-(a)muzu* (Matsumura 1971:968,962); the historical development will have been *kak-amuzu* > *kakaĩzu* > *kakauzu* > *kakaazu* > *kakazu* "let's write" and *oki-muzu* > *okiĩzu* > *okiuzu* > *okiizu* > *okizu* "let's get up". Variation between conservative V-stem *-zu* and innovative V-stem *-razu* is displayed by all five of the candidate stems (Maps 106-108, 110-111) at GAJ location 567318, which otherwise lacks innovative *r*-suffixes, and parallel innovations, with variant forms of the suffix, are observed at 660401 (C-stem *-ada,* V-stem *-da* ～ *-rada*), 661368 (C-stem *-aza,* V-stem *-za* ～ *-raza*), and 662454 and 663432 (C-stem *-asu,* V-stem *-su* ～ *-rasu*).

In our final example, the "spontaneous activity" suffix *-(r)asar-,* best known as characteristic of Hokkaido and northern Tohoku (and observable over that range as a potential suffix in GAJ Map 181), the replacement of an *a* ～ *ϕ* alternation with *r* ～ *ϕ* has evidently gone to completion in many localities; Sasaki and Yamazaki 2006, for example, cites no V-stem form other than *-rasar-*. Examples in the dialect section of the entry for the auxiliary *saru* in the *Nihon Kokugo Daiziten,* however, make it clear that *-(r)asar-* descends from a suffix of the form *-(a)sar-* that is attested in various meanings starting in the 16th century (they also show, along with references cited by Sasaki and Yamazaki (2006:352), that the range of the suffix, in its spontaneous activity meaning, extends south into the southern Tohoku, Kanto and Tokai regions). As in our other examples, in other words, the conservative V-stem alternant (here, *-sar-*) was irregular; its loss resulted in the basic alternant (*-asar-*) being added to V-stems as well as C-stems, triggering *r*-Epenthesis and the emergence of a regular derived V-stem alternant (*-rasar-*).

It is clear, then, that evidence for Analysis A is not only extremely widespread but open-ended, in that it is not limited to the six innovative suffixes of Tables 6 and 7. In contrast, no development anywhere that I am aware of provides any evidence for Analyses B or C.[16] It thus seems reasonable to conclude that Analysis A is the unique descriptively adequate analysis of the system of alternations that we saw first in Table 3--the only analysis of that system, in other words, that is permitted by universal principles.

2.4 The Environment of *r*-Epenthesis

To this point, we have characterized the environment of the *r*-Epenthesis rule (2b) as "intervocalically at verb stem boundary" (V_{Vb}] [__ V). In fact, however, the rule applies only in a proper subset of the cases that meet this condition. In the present section, we refine our characterization of the environment of *r*-Epenthesis by discussing five minimal pairs for the application of the rule, where in each case the first member of each pair constitutes an *r*-Epenthesis environment and the second is a minimally different formation in which *r*-Epenthesis fails to apply and hiatus either remains unresolved or is resolved through coalescence and monophthongization.

The first minimal pair contrasts the stem *mire-* of the innovative potential verb *mireru* "can see", where *r*-Epenthesis

[15] GAJ 469792, 562484, 563227; 653922, 654853, 655824, 662070; 722975, 732095, 737096.

[16] Hokuriku region C-stem "Imperatives" in -o (～ -oo) (HK3:100, Iwai 1959:100ff.) are Hortatives with semantic range extended to include imperative uses, reflecting grammaticization of a presumably universal tendency (thanks to Takuichiro Onishi for clarification on this point).

takes place at the boundary between the stem *mi-* "see" and the potential morpheme *-e-*, with the stem *mie-* of *mieru* "be visible", where hiatus remains unresolved (in the examples below, a single underline marks a sequence of vowels that undergoes *r*-Epenthesis, and a double underline marks an apparently parallel sequence that does not).

(10) a. mi-e- [mire-] "can see"
b. mi=e- [mie-] "be visible"

The crucial difference between the two stems of (10) is that while (10b) is listed in the lexicon, (10a), as an inflectional formation, is naturally analyzed as syntactically derived. For others of the suffixes of Table 3, dependence on syntactic operations is even clearer: the Passive and Causative suffixes are associated with changes in argument structure, and the Indicative and Infinitive forms are distinguished in part in that the former occurs sentence-finally, the latter sentence-medially. There is thus little question that *r*-Epenthesis is part of the post-syntactic phonology. In line with the fundamental assumption of Lexical Phonology, inherited from Chomsky and Halle 1968, that the internal structure of one level is invisible at later levels ("bracket erasure" (see e.g. Kaisse and Shaw 1985:11)), it is natural to assume that the internal structure of a lexical stem is erased on entry into the derivation. If so, the observed difference will follow: when *r*-Epenthesis applies, the stem (10b) of *mieru* will be effectively monomorphemic.

The second minimal pair contrasts the stem of *mireru* (= (10a)) and that of *ieru* "can say", both syntactically derived.

(11) a. mi-e- [mire-] "can see"
b. i=e- [ie-] "can say"

The stem of "say" is /iw-/, as shown by its shape before *a*-initial suffixes (Passive *iw-are-*, Causative *iw-ase-,* Negative *iw-ana-*). *w* eventually deletes before any vowel other than *a,* but must clearly still be in place when *r*-Epenthesis applies. I will assume a word-level and a phrase-level stratum within the postsyntactic phonology, with *r*-Epenthesis belonging to the former and *w*-Deletion to the latter; in the traditional terminology of Lexical Phonology, *w*-Deletion is a postlexical rule. The postlexical status of *w*-Deletion is attested to by its exceptionlessness (for discussion, see Vance 1987:25-26).

The third minimal pair contrasts the stems of *mirareru* "be seen" and *mioeru* "finish looking", both syntactically derived (for the syntactic status of the latter, see Kageyama 1999:301-303 and references cited there).

(12) a. mi-are- [mirare-] "be seen"
b. mi=oe- [mioe-] "finish looking"

I will take pairs like (12) to show that the rightward morpheme in the environment of *r*-Epenthesis must be grammatical rather than lexical. Syntactically, the difference between *-are-* "be (passive)" and *oe-* "finish" is that the former is an auxiliary verb and the latter a main verb, like their English counterparts *be* and *finish,* respectively; morphologically, the difference is that the former is an affix and the latter a root, so that while (12a) is an example of affixation, (12b) is an example of compounding. Abbreviating the positive value of the feature [±Grammatical] as "Af" (for *affix*), the *r*-Epenthesis rule (2b) can thus be rewritten as in (13).

(13) $\phi \rightarrow$ r / $V_{Vb}]\,[_{Af}$ __ V

In conjunction with the minimal pair of (10), the upshot of (12) is that *r*-Epenthesis applies only in inflectional formations: it is excluded from derivation (and from lexical compounds) by its postsyntactic status in conjunction with the convention of bracket erasure, and it is excluded from syntactic compounds by the requirement that the rightward morpheme be affixal.

The fourth minimal pair contrasts the innovative and conservative Imperative forms of *miru* "see, look" recorded at GAJ locations 641131, 642049, and 642157 in the Izumo region of Shimane Prefecture (for Tokyo and most other localities, the same point can be made with reference to the irregular Imperative form *ko-i* "come!").

(14) a. mï-e [mïre] "look!" (innovative)
b. mï-ï [mïï] "look!" (conservative)

The fifth minimal pair, parallel to the fourth, contrasts the innovative and conservative Hortative forms of *okiru* "get up" recorded at GAJ locations 728951 (Nagasaki Prefecture) and 734265 (Fukuoka Prefecture).

(15) a. oki-oo [okiroo] "let's get up" (innovative)
b. oki-u [okyuu] "let's get up" (conservative)

Like C-stem suffixes, and unlike the V-stem suffixes of Table 3, the V-stem suffixes of (14b) and (15b), Imperative *-i* and Hortative *-u,* are vowel-initial. In contrast to C-stem suffixes, however, Imperative *-i* and Hortative *-u* do not trigger *r*-Epenthesis when they are added to vowel-final stems. As shown by the surface form of (15b) and by the widespread occurrence of monophthongized Imperative forms *akee/akii* < *ake-i* "open!" and *kee/kii/koo* < *ko-i* "come!" (GAJ maps 87 and 90, respectively), they do trigger a different hiatus reduction process, namely the coalescence of two adjacent syllables into one, which is a necessary condition for the observed monophthongizations. Moreover, these are exactly the same processes undergone by the homophonous adjectival suffixes Indicative *-i* and Polite Infinitive *-u,* as illustrated by examples like (16) and (17) (the monophthongizations of (16) are dependent on speech level and region; for evidence that the vowel sequences in question are tautosyllabic even when monophthongization does not occur, see Vance 1987:73-76).

(16) a. taka-i [takee] "expensive"
b. hido-i [hidee] "outrageous"
(17) a. arigata-u [arigatoo] "grateful(ly)"
b. yorosi-u [yorosyuu] "good, well"

Imperative *-i* and Hortative *-u,* then, are marked to undergo an independently motivated minor rule of Syllable Coalescence, which creates a bimoraic nucleus from a sequence of vowels in hiatus, and that rule is ordered before *r*-Epenthesis, bleeding it. This entails, in turn, that the two vowels constituting the environment of *r*-Epenthesis must belong to separate syllables.

In this section, we have seen that *r*-Epenthesis is a word-level rule of the post-syntactic phonology and that it applies only in inflectional formations between vowels in hiatus and is bled by the distinct hiatus-reduction rule of Syllable Coalescence.[17] In concluding, it is important to note that none of these restrictions is peculiar to *r*-Epenthesis; the rule of Analysis C, which deletes the second of two vowels across verb stem boundary, would have to be restricted in exactly the same way.[18]

3 Interlude Diachrony without Synchrony: Morpheme-Specific and Proportional Accounts of Innovative *r*-Suffixes

We saw in section 2 that, given an analysis of Japanese verbal suffix alternations according to which C-stem suffixes are basic and regular V-stem suffixes are derived by *r*-Epenthesis, the innovative *r*-suffixes of Tables 6 and 7 can be understood as the direct consequence of the elimination of irregularity--in particular, the elimination of irregular V-stem suffixes. A number of researchers, however, have made other proposals about how to understand innovative *r*-suffixes, proposals that for the most part make little or no reference to any synchronic analysis. In this section, we will examine such proposals and their shortcomings, concluding that attempting to analyze morphophonological change without due attention to synchronic structure is unlikely to be productive.

[17] de Lacy (2006:81-82), citing Mester and Ito 1989 and Lombardi 1998 (both of which refer to de Chene 1985), includes Japanese *r*-Epenthesis on a list of cases for which "Epenthesis is ... forced by some general prosodic requirement...." As the above discussion makes clear, *r*-Epenthesis in fact has a far more restricted range of application than is consistent with de Lacy's claim.

[18] Fukushima's (2004:195 (note 4)) criticism of the *r*-Epenthesis rule of de Chene 1987 for incorporating restrictions of the type indicated is thus misguided: the restrictions on where hiatus is (dis)allowed are a fact of the data rather than of any particular analysis thereof.

3.1 Morpheme-Specific Accounts: Conceptual Considerations

In the course of the 17th century, *reached* /ri:tʃt/ replaced *raught* /rɔ:t/ as the past tense of English *reach.* If we simply compare the earlier and later past tense forms, it might seem plausible to postulate a diachronic rule or process /ɔ:/ → /i:tʃ/ to account for this change. It is fairly clear, however, that no linguist would propose doing so, for several related reasons. First, this would be a morpheme-specific rule, and one with no plausible articulatory or perceptual motivation. Second, postulating such a rule would miss a generalization that relates the change in the past tense of *reach* to apparently parallel changes in other verbs, such as the change of *clomb* to *climbed* as the past tense of *climb* (completed in the 16th century) and the change from *holp* to *helped* as the past tense of *help* (completed in the 18th century). The generalization in question, of course, is that each innovative past tense form consists of the corresponding present tense form plus the suffix /d/. Finally, as this latter formulation makes clear, postulating a rule /ɔ:/ → /i:tʃ/ to account for the change from *raught* to *reached* would fundamentally misconstrue the nature of that change: the innovative form is not due to any process that operates directly on the conservative form, but to a process that generates a substitute for the conservative form from an independently existing base.

Such facts are relevant in the present context because of the continuing popularity of morpheme-specific accounts for the innovative *r*-suffixes of the Japanese verb, accounts that postulate direct transformation of conservative forms into their innovative counterparts. Such an account is particularly well known for innovative Potential *-re-,* a suffix that has attracted more attention than the other innovative *r*-suffixes because it is characteristic of Tokyo Japanese. Since the 1990s, the ongoing replacement of conservative Potential *-rare-* by *-re-* has become known as *ra-nuki* ("*ra*-removal")[19], a name that embodies the claim that Potential *-re-* arises from *-rare-* by deletion of the syllable *ra;* this claim has been taken up by, among others, Ito and Mester (2004) and Fukushima (2004).

Postulating a change process *rare* → *re* to account for the appearance of Potential *-re-,* however, is subject to all the same objections as is postulating a change process /ɔ:/ → /i:tʃ/ to account for the change from *raught* to *reached* as the past tense of *reach.* First, *ra*-Deletion is a morpheme-specific rule that lacks articulatory or perceptual motivation. Second, it misses a generalization--namely the generalization that all six of the innovative *r*-suffixes of Tables 6 and 7 (as well as the three we saw later) share the property of consisting of the corresponding consonant-stem suffix preceded by *r.* Finally, as that generalization suggests, postulating *ra*-Deletion arguably misconstrues the nature of the change in question: *-re-* and the other innovative *r*-suffixes are due not to "transformative" processes that work changes upon the conservative forms, but to a "substitutive" process that generates replacements for them, namely *r*-Epenthesis operating on basic forms that coincide with consonant-stem suffixes, as detailed above.

Morpheme-specific accounts for innovative *r*-suffixes are not limited to the *ra*-Deletion analysis of Potential *-re-,* but have been proposed for all such suffixes with the possible exception of Infinitive *-ri* (see e.g. Kobayashi 2004:582-595). Table 8 below summarizes such accounts by juxtaposing conservative and innovative V-stem suffixes and displaying the morpheme-specific changes necessary to account for latter on the hypothesis that they arise from transformation of the former. For comparison, Table 9 juxtaposes C-stem suffixes and innovative V-stem suffixes and shows that the latter can be produced from the former in each case by insertion of *r.*

	V-stem (Old)	V-stem (New)	Change
4	-yoo	-roo	y → r
5	-sase-	-rase-	s → r
6	- ϕ	-ri	ϕ → ri
7	-n	-ran	ϕ → ra
8	-ro	-re	o → e
9	-rare-	-re-	ra → ϕ

Table 8 Conservative and Innovative V-Stem Suffixes

	C-stem	V-stem (New)	Change
4	-oo	-roo	ϕ → r
5	-ase-	-rase-	ϕ → r
6	-i	-ri	ϕ → r
7	-an	-ran	ϕ → r
8	-e	-re	ϕ → r
9	-e-	-re-	ϕ → r

Table 9 C-stem and Innovative V-Stem Suffixes

[19] The word is absent from the first edition of *Daizirin* (1988) and the fourth edition of *Koozien* (1991), two standard dictionaries, but present in second edition of the former (1995) and the fifth edition of the latter (1998). Its appearance on the scene, then, can be dated quite precisely.

Table 8 makes it clear that there is no generalization to be obtained from a direct comparison of conservative and innovative forms: the rules it is necessary to postulate have no common factor. To put it differently, the advocate of a transformative account is faced in each case with the problem of explaining why just the observed change occurred, and not some logically possible alternative, a question that typically has no nonarbitrary answer.[20] The fact that the rules necessary to generate innovative V-stem alternants directly from conservative ones have nothing in common is underlined by a comparison of the rules for the Negative and the Potential, which are inverses of each other, the first inserting the syllable *ra* and the second deleting it. It is nevertheless not difficult to come up with post-facto "motivations" for such rules, as the following two quotations involving precisely those two apparent changes illustrate.

> "... because N [mora nasal] has a weak degree of independence as a sound, [speakers] have perhaps attempted to stabilize the form by inserting *ra* ..." (Kobayashi 2004:591 [translation BdC])

> "[D]eletion of a syllable ... reduces articulatory effort, and ... sets apart the potentials, ... relieving ... *-rare-* of the ... burden of covering five separate constructions." (Fukushima 2004:188)

The ease with which such "functional" accounts can be formulated means that they must be treated with extreme caution.

3.2 Morpheme-Specific Accounts: Empirical Considerations

To this point, the objections I have raised against "transformative" accounts of innovative *r*-suffixes have been theoretical or conceptual in nature: I have claimed that such accounts lack motivation, miss an important generalization, and misconstrue the nature of the changes involved. But because transformative accounts take innovative *r*-suffixes to be based on their conservative counterparts, while the substitutive account proposed above takes them to be based on consonant-stem suffixes, and because those two types of "bases" have sharply distinct geographical distributions for some categories, there is empirical evidence as well bearing on the choice between transformative and substitutive accounts for the categories in question.

Consider the distribution of C-stem and V-stem Imperative suffixes. With minor exceptions, C-stem *-e* occurs throughout Japan, while over the same geographical range, the three V-stem Imperative suffixes *-i, -yo,* and *-ro* exhibit (for *i*-stems) a roughly concentric distribution, with *-i* occupying Western Honshu and most of Shikoku, *-yo* observed in narrow bands on either side of the *-i* region, and *-ro* confined to Northwestern Kyushu and Eastern Japan (see GAJ map 86; for *e*-stems, Imperative *-i* originated earlier and has spread further). *-ro,* then, occurs in only a proper subset of the localities that have *-e.* As a result, transformative and substitutive accounts of innovative Imperative *-re* make distinct predictions about the geographical range over which that suffix should be observed. In particular, any account of *-re* that relates it directly to *-ro* (Kobayashi 2004:588, Lawrence 2004:25-26, Martin 1975:960) predicts that *-re* should be confined to the *-ro* region, while the analysis of *-re* as C-stem *-e* plus *r*-Epenthesis (Analysis A) predicts that *-re* should, other things being equal, be observed in the *-i* and *-yo* regions as well.

On this point it is the prediction of Analysis A that is borne out. Imperative *-re* is common, first of all, outside the *-ro* area in Kyushu. It also occurs in at least eight areas in Shikoku and Western Honshu, a point on which the GAJ data and the descriptive dialect literature are in complete agreement. To document this claim, we first inventory the GAJ locations that satisfy the conditions in (18).

(18) a. At least one occurrence of *-re*
b. No occurrence of *-ro*
c. At least one occurrence of a non-*ro* conservative V-stem Imperative suffix

Satisfaction of (18c) guarantees that the suffix *-re* has replaced or is replacing is not *-ro.*

The largest contiguous area satisfying (18) is an swath of southern and central Kyushu that in GAJ includes 21 of 22 mainland Kagoshima

[20] For the advocate of a transformative (i.e. *ra-nuki*) account of innovative Potential *-re-,* this is compounded by the problem of explaining why the change affects just the Potential sense, and not the Passive or Honorific sense, of the morpheme *-rare-*.

Prefecture locations, most of northern Kumamoto Prefecture, and a band of Miyazaki Prefecture that connects northern Kumamoto to Kagoshima. 34 locations are involved; adding four offshore island Kagoshima locations and two isolated locations in Oita Prefecture that satisfy (18) brings the total for Kyushu to 40. [21] In most of this area, *-re* is the only V-stem Imperative suffix reported for the stems *mi-* "look" and *oki-* "get up", and (18c) is satisfied by the retention of *-i* (typically merged with the stem) as the Imperative suffix for *ake/u-* "open".

The remaining (clusters of) locations outside the *-ro* area that that satisfy the conditions (18), ordered roughly from west to east, are as in (19). In each case, the relevant GAJ location or locations are listed, followed a reference to the descriptive literature confirming the presence of innovative Imperative *-re* in the area in question.

(19) a. Izumo region, Shimane Prefecture (641131,642049,642157; HK (Hoogengaku Kooza = Tojo et al. 1961) 3:310)
b. Hata region, Kochi Prefecture (746200,747138; HK3:380-1, KH8:448)
c. Tajima region, Hyogo Prefecture (641910,642809; Okada and Umegaki 1962:521-2)
d. Awajishima (island), Hyogo Prefecture (647995; Okada and Umegaki 1962:521-2)
e. Hashimoto city and environs, Wakayama Prefecture (657294; Murauchi 1962:391)
f. Yoshino region, Nara Prefecture (659300,659398,659420; Nishimiya 1962:312, 328)
g. Environs of Mikawa Bay, Aichi Prefecture (654733,654853,655765,655824,655955,656816; Yoshikawa and Yamaguchi 1972:154)
h. Eastern Mino region, Gifu Prefecture (651909; Okumura 1976:260)

19 locations are listed in (19); there is one further Hyogo location (645839) midway between the (19c) and (19d) areas and one further Aichi location (652852) midway between the (19g) and (19h) areas.[22] In all, there are thus at least 61 GAJ locations that satisfy (18), 40 in Kyushu and 21 elsewhere. And this is probably a low estimate: some locations (e.g. 836382) have been excluded from the list for having an occurrence of *-ro* that is probably due to influence from Tokyo Japanese rather than reflecting local usage, and some non-*ro* locations that are known from the descriptive literature to have *-re* (e.g. Oita city (see KH9:257)) do not show up as such in GAJ. Many of the locations of (19), moreover, show variation between Imperatives in *–re* and Imperatives in *–yo* or *–i* for one or more stems, so that it is possible to observe in progress the replacement of the latter with the former, unmediated by any occurrence of *–ro*.

It seems fair to conclude, then, that there is little hope of maintaining an account of *-re* that treats it as a transformation of *-ro* or in any way conditioned by that suffix. The same is true of the relationship between innovative Hortative *-roo* and the conservative suffix *-yoo* of which it is sometimes claimed to be a transformation (Kobayashi 2004:587).[23] The suffix in question, present throughout western Japan but absent from the Kanto and Tohoku regions (see GAJ map 109), is historically *-au* < *-am* < *-amu* after consonants and *-u* < *-m* < *-mu* after vowels, so that the phonologically expected forms for typical verbs are *matoo* < *mat-au* ("wait"), *okyuu* < *oki-u* ("get up"), and *akyoo* (in Kyushu, *akyuu* (see KH9:10)) < *ake-u* ("open"). Modern standard *okiyoo* and *akeyoo,* dating from the 16th century, result from reanalysis of *okyuu* and *akyoo* as based on the stems *oki-* and *ake-* plus a suffix *-yoo* (Matsumura 1971:159-160). This reanalysis, however, took place in only a proper subset of the region that uses the suffix; judging from GAJ map 107 (*akeyoo*), it failed to occur in an area that includes all of Kyushu and the five-prefecture Chugoku region and extends into the Tajima region of northern Hyogo and the Tango region of northern Kyoto prefectures. I will assume that in that area, the V-stem Hortative suffix is still /–u/, with *okyuu* and *akyoo* ～ *akyuu* resulting from the rules of syllable coalescence and monophthongization that we saw above in connection with examples (14)-(17). Since *-yoo* is absent from the *-u* area, any account of innovative *-roo* that relates that suffix to *-yoo* predicts that *-roo* should be absent from the *-u* area as well. In contrast, since C-stem *-oo* occurs throughout the *-u* area, Analysis A predicts that, other things being equal, *-roo* should be observed there just as it is in the area with *-yoo*.

Again it is the predictions of Analysis A that accord with the observed distribution of the innovative suffix. For the Hortative of *okiru,*

[21] The GAJ localities are: mainland Kagoshima except for 836382; 739405,830466,831372,831452,832440,833436, 834556,835428 (Miyazaki); 736312,737331,737399,737412, 738221 (Kumamoto); 822996,824818,839421,924994 (offshore Kagoshima); 733434,736769 (Oita). 833350 (mainland Kagoshima) shows *miye* and *okiye,* but Provisional *okiyeba* < *okireba* at that location shows that those forms represent a regular phonological development from *mire* and *okire*. Similarly, 924994 shows *mie,* but it is clear from other forms that *r* is subject to loss intervocalically at that location.

[22] 555819 (Toyama Prefecture) satisfies (18) but will be excluded from the count because it is in an area known to have *-ro* as well as *-yo* (KH6:324-325).

[23] Kobayashi (2004:587-588) recognizes the problems of this hypothesis and proposes an alternative proportional account. On top of the shortcomings of proportions (see section 3.3 below), however, the alternative has empirical problems of its own in that it requires a wider distribution in Kyushu of inferential Indicative + *roo* than is actually attested.

okiro(o) is common in central and southern Kyushu, and for the Hortative of *neru* "sleep", *nero(o)* is the majority case, with *nyuu* remaining only in Nagasaki and Saga prefectures and in part of Kumamoto. The greater part of Kyushu, then, satisfies the correlates for the Hortative of the conditions (18) above: an occurrence of *–roo,* no occurrence of *–yoo,* and an occurrence of a non-*yoo* conservative V-stem Hortative suffix, namely *–u.* Further, parallel with what we saw with the Imperative, it is possible to observe in progress the replacement of *–u* with *–roo,* in the form of localities that show variation between *n(y)uu* and *neroo* (GAJ 724935 (Saga), 736312 (Kumamoto), 830029, 822996 (Kagoshima)) or between *okyuu* and *okiroo* (728951 (Nagasaki), 734265 (Fukuoka)) in the absence of any form in *-yoo.* These facts make it extremely difficult to maintain a transformative account of *-roo*--in particular, an account that treats it as a transformation of or in any way conditioned by *-yoo.*

The empirical argument we have made against transformative accounts of innovative Imperative *-re* and innovative Hortative *-roo* depends, as we have seen, on a discrepancy in geographical distribution between the corresponding C-stem suffixes (*-e* and *-oo,* respectively) and the conservative V-stem suffixes from which the *r*-suffixes are sometimes held to have developed (*-ro* and *-yoo*). For three of the remaining four *r*-suffixes of Tables 6 and 7, no such discrepancy obtains: Infinitive *-i* and *-* ϕ (C-stem and V-stem, respectively) are both of nationwide distribution, as are Causative *-ase-* and *-sase-;* Negative *-an(a-)* and *-n(a-)* are not fully general in their distribution, but they are present or absent together. For the last case, the Potential, the situation is somewhat more complicated.

For the five categories just mentioned, the geographical range of the C-stem alternant includes, properly or improperly, the range of any V-stem alternant, and the logical possibility of a location that displays the V-stem alternant but not the C-stem alternant is never realized. For the Potential, whose two alternants, V-stem *-rare-* and C-stem *-e-,* have entirely different origins historically and whose C-stem alternant has less than a nationwide distribution, this situation does arise, at least sporadically. For such a situation, transformative and substitutive accounts of the innovative V-stem alternant *-re-* make sharply distinct predictions. On a transformative (i.e. *ra-nuki*) account, there is no reason for *-re-* not to appear in the absence of *-e-* as long as *-rare-* is (or has been) present; in fact, other things being equal, *-re-* should appear at the same rate in the absence of *-e-* as it does in its presence. On a substitutive account like that of Analysis A, in contrast, the appearance of *-re-* in the absence of *-e-* would be prima facie inexplicable. Of the 148 GAJ locations for which Potential *-e-* fails to appear in the data for Maps 173-174 and 181-183, there are seven that are recorded as having *-re-,* one in Hokkaido (172535), one in northern Iwate Prefecture (373577), and five in Kyushu. Of the five Kyushu locations, four are scattered in Oita (733397, 733671, 736525) and southern Fukuoka (734265) Prefectures, while the fifth (723882) is located in the city of Hirado in Nagasaki Prefecture. In all seven cases, however, there are reasons to believe that the recorded combination **-e-/-re-* fails to reflect accurately the usage of the locations in question.[24]

Of 33 Hokkaido locations, first of all, 172535 is the only one to fail to show *-e-;* it apparently does so only because all five of its C-stem Potential responses are of the form Indicative + *koto ga dekiru* (see note 24). At 373577 in Iwate, the most common Potential suffix, transcribed *-(r)e:-,* is evidently a contraction and monophthongization of *-(r)ae-,* a variant of *-(r)are-* that is common in neighboring Aomori and Akita Prefectures. In one case (*ogireru* "can get up"), however, the suffix appears without a notation of length. Assuming *-e-* is genuinely lacking at the location in question (contra HK2:192), this is probably either a sporadic shortening or a transcription error. In the case of Hirado (Nagasaki), the existence of another location (723767) ten kilometers westward that displays *-e-* as well as *-re-* strongly suggests that the occurrence of a single form (*koreru* "can come") in *-re-* in the absence of any in *-e-* for location 723882 is an accidental fact about the responses of one informant rather than a systematic characteristic of the area. With regard to the Oita/Fukuoka group, finally, the descriptive literature, in particular Tsuda 2000, claims explicitly that both *-e-* and *-re-* (and both *-are-* and *-rare-*) are in use as potential suffixes in Oita, with *-(r)e-* expressing situational impossibility due to internal factors and *-(r)are-* situational impossibility due to external circumstances.

It seems likely, then, that the small handful of GAJ locations whose data appears to counterexemplify Analysis A's prediction that innovative Potential *-re-* should not occur in the absence of C-stem *-e-* can be accounted for in a manner consistent with that prediction. If that conclusion is accurate, it means that the occurrence of *-e-* is a precondition for the appearance of *-re-*. This, however, is inexplicable if *ra*-deletion is a possible change, since the great majority of the 148 GAJ locations that are recorded as lacking *-e-* do have V-stem *-rare-*. For Potential *-re-* as well as Imperative

[24] This is to some extent a problem for the GAJ data on potential expressions in general; one reason is that all survey questions asked for local equivalents of Verb (Indicative) + *koto ga dekiru,* "it is possible to V", and some informants, regardless of the range of expressions that neighboring locations suggest are probably available to them, answered most or all of the twelve relevant survey items with that locution exclusively (see e.g. 376718 or 738504).

-re and Hortative *-roo,* then, we appear to have empirical evidence against a transformative account.

In section 3.1, we saw that a unified account of innovative *r*-suffixes was possible only if those suffixes were viewed as substitutes for conservative V-stem suffixes that are derived from the corresponding C-stem suffixes rather than as transformations of the conservative V-stem suffixes themselves. In this section, we saw first that for two innovative *r*-suffixes, Imperative *-re* and Hortative *-roo,* no transformative account is available at all, given they replace multiple conservative suffixes, *-i, -yo,* and *-ro* in the case of Imperative *-re* and *-u* and *-yoo* in the case of Hortative *-roo.* We then noted that innovative Potential *-re-* appears to be observed only in the presence of C-stem *-e-,* a fact explicable only on a substitutive account of the former. We thus have both conceptual and empirical evidence against transformative accounts of innovative *r*-suffixes. In section 3.3 below, we turn to a type of account that is not transformative in nature, but which has in common with transformative accounts that it attempts to treat the facts of linguistic change without inquiring into the nature of the synchronic system that is changing. This is the type of account that appeals to Neogrammarian four-term proportions.

3.3 Proportional Accounts

Proportional accounts of innovative *r*-suffixes have a long tradition in the Japanese dialectological literature (see e.g. Kindaichi 1977:141) and continue to be popular therein (Matsumaru 2006). In thinking about them, let us start from the observation that the inflected forms that appear in proportions are invariably presented as unsegmented, as in (20) (from Matsumaru 2006:40), where *kiru* is the Indicative of *kir-* "cut" and *miru* the Indicative of *mi-* "see".

(20) kiru : kire ＝ miru : x (x = mire)

As a result, a proportion like (20) appears to suggest that speakers do not segment inflected forms into morphemes, but treat each as an unanalyzable unit, a morphological atom. Particularly in a relatively agglutinative language like Japanese, however, such a suggestion is similar to claiming that speakers do not segment sentences into words, but treat each sentence as an unanalyzable unit. In either case, such a claim is falsified by speakers' ability to produce novel combinations--in the case of inflected forms, novel combinations of stems and inflectional affixes, as with innovative verb stems formed by suffixation of *r* to truncated nominal bases (*hamo-r-* (< *haamonii*) "to harmonize").[25]

Let us assume, then, that the inflected forms of a proportion like (20) must be considered to be segmented. Suppose first that they are segmented as we have assumed to this point, namely as in (21).

(21) kir-u : kir-e ＝ mi-ru : x (x = mi-re)

Since the operative part of the proportion expressed by (21) involves the suffixes, that proportion may be rewritten without loss of information as (22).

(22) -u : -e ＝ -ru : x (x = -re)

What (22) expresses, however, namely the extension of the *r*-zero alternation of the Indicative suffix to the Imperative suffix, is one instance of what is captured by the *r*-Epenthesis rule of Analysis A. In the end, then, (21)-(22) make essentially the same claim as that analysis, but in an unsystematic, morpheme-specific manner.[26]

There are other conceivable segmentations for the forms of (20), however. Under the traditional analysis of verb conjugation, still universal in dictionaries and secondary school textbooks, what we have called *r*-stems are (because of the syllabic writing system) vowel-stems all of whose inflectional endings begin with *r.* If that analysis is adopted, and if what we have called vowel-stems are also vowel-stems, the segmentation of (20) will be as in (23).

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[25] I assume that the stem-formation rule in question is motivated by the fact that *r* is the most common stem-final consonant and that it is unrelated to the *r*-Epenthesis rule (13), which results from generalization of the *r*-zero alternation in categories 1-3 of Table 3.

[26] (21)-(22) express an instance of the motivation for the *r*-Epenthesis rule (the pre-existing *r*-zero alternation of the Indicative suffix) as well as an instance of the extension of that rule; in the framework assumed here, the motivation for *r*-Epenthesis is a question of explanation rather than description and is dealt with in section 4 below.

(23) ki-ru : ki-re = mi-ru : x (x = mi-re)

Another possibility is that what we have called *r*-stems and what we have called vowel-stems are both *r*-stems, so that the segmentation of (20) is as in (24).

(24) kir-u : kir-e = mir-u : x (x = mir-e)

According to either (23) or (24), *r*-stems and vowel-stems are in fact both stems of the same type phonologically. The difference between the two conjugations will then reside entirely in their respective suffixes, which will be distinct for six of nine categories in conservative varieties of Japanese. Stems of the minority conjugation, that of *miru,* will need to carry a diacritic lexical mark to distinguish them from stems of the default, majority conjugation, as underlined by minimal pairs such as *kir-* "cut" and *ki-* "wear", which both of which will be *ki-* under the segmentation of (23) and *kir-* under the segmentation of (24) (similarly *ner-* "knead", *ne-* "sleep").

The claim that what we have called vowel-stems carry a diacritic mark to distinguish them from what we have called *r*-stems, however, entails a prediction that is not realized, namely that we should see stem-by-stem assimilation of vowel-stem to *r*-stem conjugation. This is because the diacritic mark in question is an example of the "excess information" which in 1.2 above we proposed tends to get eliminated from lexical entries. But stem-by-stem switches from vowel-stem to *r*-stem conjugation are not observed; the changes under consideration always proceed suffix by suffix.[27] There is no reason to believe, in other words, that there is anything irregular about the stems of verbs like *miru,* but that is precisely the claim that the segmentations of (23) and (24) force us to make.

In sum, depending on whether or not their terms are segmented and if so, how, four-term proportions either (a) imply that speakers learn each inflected form individually as an unanalyzed unit, an unacceptable conclusion; (b) duplicate the main claims of Analysis A in a less systematic manner; or (c) make predictions that are demonstrably false. We are forced to conclude, then, that such proportions do not add to our understanding of innovative *r*-suffixes.

3.4 Conclusion

In summing up the conclusions of a volume devoted to the analysis of morphological change, Lahiri (2000:11-12) writes that such change is "conditioned by the entire grammatical system"--that is, that "examining items that have changed individually is meaningful only if the grammatical system as a whole is taken into consideration." The common characteristic of the transformative and proportional accounts of innovative *r*-suffixes that we have examined in section 3, I would claim, is that, in spite of occasional references to synchronic structure, they fail to heed this injunction, attempting to treat diachrony in essential isolation from synchrony. If one of the lessons of section 2 was that diachronic change can be understood as conditioned by synchronic structure, what we have learned in this section is that, at least in the area of morphophonology, change can be understood only in this way, and that attempting to analyze it with little or no reference to the synchronic system is likely to prove sterile.

4 Explanation

We now need to tackle the problem of why it is Analysis A that has been chosen by speakers--alternatively, the problem of why Analysis A is the descriptively adequate analysis of the system of alternations we have been considering. In order to put the proposals we will make in context, we will begin, in section 4.1, by considering the problem of choice of basic or underlying forms for alternating morphemes in general, starting from the superficially paradoxical fact that there are both cases in which principles like "take isolation forms as basic" and "take most frequent alternants as basic" are apparently necessary to explain speaker choice of basic forms and cases in which such principles appear to give incorrect results. Returning to the Japanese case, we will first see, in section 4.2, that the choice of Analysis A follows from two hypotheses adapted from proposals of Albright 2002. Then, in sections 4.3 and 4.4, we will examine those

[27] There is one well-known exception, the verb "kick", which was *ke-* into the 18th century (Matsumura 1971:211), but is now *ker-* in most localities that retain it (GAJ maps 82, 89, 104).

hypotheses more closely, leading to a revised understanding of both the choice of Analysis A and the hypotheses themselves; in 4.3, important evidence will come from the Portuguese and Korean reanalyses mentioned in section 1. Our conclusions will be summarized in section 4.5.

4.1 Prolegomenon: Two Types of Phonology

In the course of section 4, the following proposals about how speakers choose basic forms for alternating morphemes will all be appealed to (sometimes in modified form) in attempting to explain the choice of the descriptively adequate analysis in the Japanese case discussed above and the Portuguese and Korean reanalyses that will be cited as corroborative evidence:

(25) a. Basic forms are identified with isolation forms, when those exist.
b. Basic forms are identified with the most frequent alternants in inflectional paradigms.
c. Basic forms must be drawn from a consistent morphological environment over a lexical class.
d. Basic forms must coincide with surface alternants.

It is not difficult, however, to find data that appear to falsify the proposals of (25). Kenstowicz and Kisseberth (1977:18-19, 26-27, 31-33), for example, showed more than thirty years ago that a very simple data set involving two automatic alternations of Russian appears to falsify all four at once. The alternations in question are *akan'e,* as a result of which atonic *o* merges with *a,* and final devoicing. In (26), these alternations are illustrated by the nominative and genitive singular forms of four oxytone nouns, in whose paradigm accent falls on the first vowel of the suffix if there is one and on the last vowel of the stem otherwise (single underlines identify forms in which final devoicing has applied, and double underlines forms in which *akan'e* has applied).

(26) a.	vráč "doctor"	c.	<u>vrák</u> "enemy"	e.	stól "table"	g.	<u>pirók</u> "pie"
b.	vrač-á	d.	vrag-á	f.	<u>stal</u>-á	h.	<u>pirag</u>-á

As a comparison of the forms for "doctor" and "enemy" shows, it is suffixed forms that reveal underlying values for the voicing alternation; the basic form for "enemy" must thus be /vrag/, in violation of (25a). As a comparison of "enemy" and "table" shows, it is unsuffixed forms that reveal underlying values for the *o* ～ *a* alternation. The basic form for "table" must thus be /stol/; this violates (25b), because that alternant occurs in only two of the twelve case forms (singular and plural), the nominative and accusative singular. (25c) is violated by the combination of /vrag/ and /stol/, since the former appears in suffixed forms and the latter in unsuffixed. Finally, when both alternations appear in the same stem, as is the case for "pie", the fact that suffixed forms reveal underlying voicing values and unsuffixed forms reveal underlying values for the *o* ～ *a* alternation precludes taking either alternant as basic; the basic form must be a composite of the existing alternants (here, /pirog/), in violation of (25d).[28]

How are we to understand the fact that there appear to exist both data sets for which criteria like those of (25) are crucial in understanding speakers' choice of analysis and data sets for which such criteria appear to be irrelevant? I would like to suggest that the reason is that there are in fact two different modes of phonological analysis that are governed by distinct explanatory principles and that correspond, respectively, to the historical processes of phonologization and reanalysis.

Since the work of Kruszewski and Baudouin de Courtenay (see Baudouin de Courtenay 1895/1972), phonologists have been familiar with the idea that there is a natural life cycle for phonological processes and a corresponding typology of alternations--in particular, a crucial distinction between alternations that result directly from the phonologization of universal, automatic phonetic tendencies, on the one hand, and alternations that have been reanalyzed in any of a number of ways, on the other; typical results of the reanalysis of an alternation are, in traditional

[28] The conclusion that the alternations of (26) counterexemplify the principles (25) depends on those alternations being stable, since there is no irregularity in the system under the analysis postulated; if basic forms are chosen according to any of (25), in contrast, there will be lexical irregularity, and leveling or extension of one of the alternations will be predicted. A small informal survey of native speakers (LinguistList 18.1382/18.1466) suggests that the alternation pattern of "pie" is indeed stable, implying that the same is true for the two alternations generally.

generative terms, the inversion, morphologization, or loss of the rule responsible for it.

Consider a newly phonologized alternation according to which X becomes Y in environment Z. The alternation will be natural in the sense of corresponding directly to a known path of phonologization; assume it is also surface-true and productive (Blevins 2004:§9.3). In that case there will be an exceptionless constraint *X/Z proscribing X in environment Z; in Optimality Theoretic terms, *X/Z will be undominated by any other constraint. In this situation, speaker choice of underlying representations for alternating morphemes can be taken to be determined by the very simple principle (27), which limits discrepancies between underlying and surface forms to what is required by *X/Z.[29]

(27) Given natural alternation A governed by exceptionless constraint C, underlying representations of morphemes that alternate according to A are chosen so that they surface unchanged apart from the need to satisfy C.

(27) will apply regardless of the (non)contrastiveness of the alternating feature; it will apply, that is, both to allophonic and neutralizing alternations. For the latter, it derives the standard rule of thumb that the underlying value of an alternating feature in a given morpheme is the one that occurs in the environment of contrast for that feature rather than the one that occurs in the environment of neutralization. In the Russian case, which falls under (27) because of constraints prohibiting word-final voiced obstruents and unstressed *o,* that principle will have the result that, as in the analysis proposed above, the underlying value of [voice] in the final segment of [vrak] ～ [vrag] "enemy" is [+voice], the value that occurs intervocalically, where [+voice] and [-voice] obstruents contrast, and the underlying value of [round] in the vowel of [stol] ～ [stal] "table" is [+round], the value that occurs under stress, where *o* and *a* contrast.

I suggest, then, that the reason for the existence of alternations for whose analysis principles like (25) are irrelevant is that newly phonologized alternations are analyzed by means of (27) (or a more general principle that has (27) as a consequence), and that this state of affairs persists for as long as those alternations resist reanalysis. The inception of reanalysis is notoriously difficult to predict: while reanalysis is typically associated with loss of productivity and/or loss of phonetic motivation, cases of inversion like that which produced English *r*-Epenthesis (for discussion including consideration of alternative analyses, see McMahon 2000:ch.6) and the leveling and extension in Korean noun stems that we will consider in section 4.3.2 show that neither of these can be taken as a necessary condition for the process: the *r*-Deletion (English) and Coda Neutralization (Korean) rules that underwent inversion were (and remain) both natural in Blevins' (2004:252-254) sense and surface true and productive. Abstracting away from the actuation or triggering problem for reanalysis, however, we may say that the inception of reanalysis is marked by the coming into play of principles like (25).

While we have identified the onset of reanalysis of a phonologized alternation with the applicability of principles like (25), it is important to note that this cannot be taken to imply, conversely, that every case in which principles like (25) are applicable involves the reanalysis of an alternation with an identifiable origin in phonologization.[30] The Japanese *r*-zero alternation that we have claimed to be governed by the *r*-Epenthesis rule (13) is a case in point. In the first three categories (Indicative, Provisional, Passive) of Table 3, the alternation between *r* in V-stem suffixes and zero in the corresponding C-stem suffixes goes back to the eighth-century Japanese of the earliest documents,[31] where it is an isolated pattern, apparently a fossilized residue something like the Verner's Law alternations of English *lose/lorn* and *was/were.*[32] Crucially, stem-final vowels, either *i* or *e,* alternated with *u* before the two inflectional endings beginning with *r,* those of the *rentaikei* or adnominal form, ancestor of the modern Indicative, and the *izenkei* or "realis" form,

[29] (27) is similar in spirit to Lexicon Optimization (LO, Prince and Smolensky 2004:225) but crucially distinct from the latter in its provision that faithfulness violations incurred for the sake of satisfying the relevant markedness constraint do not count against a hypothesis concerning underlying forms; as a result, it will have to be supplemented, for nonalternating morphemes, by the principle that a hypothesis that incurs no faithfulness violations at all is to be preferred when available. (LO, defined originally only for nonalternating morphemes, has been claimed both to be inapplicable to alternations (McCarthy 2002:78) and to be adaptable to them (Inkelas 1995, Tesar and Smolensky 2000:77-83).)

[30] The claim here is parallel to that of Garrett and Blevins (2009), who show that morphophonological rules may result from generalization of fortuitous patterns that have no basis in phonologization.

[31] The passive/potential suffix is *-aye-* ～ *-raye-* in eighth-century Japanese, with an *r*-zero alternation that was extended to the suffix *-are-* that replaced *-aye-*.

[32] As a result, attempts to reconstruct the origin of the alternation (e.g. Unger 1977:70) are probably destined to remain ad hoc.

which underlies the modern Provisional.[33]

The eighth-century *r*-zero alternation in the three categories in question seems to have remained stable, but inert, for the next nine centuries. It clearly was not extended when reduction of the V-stem Hortative suffix *-mu* to *-u* became general and the V-stem Imperative suffix *-yo* began to vary with *-i* in the Muromachi period (1333-1573; see e.g. Matsumura 1971:964-968), corresponding with what we saw in section 2.4 concerning the failure of *r*-Epenthesis to apply before those suffixes synchronically. Judging from the high degree of complementarity, notably in Kyushu dialects, between verbs that display innovative *r*-suffixes and verbs that retain the alternation of *i/e* with *u* in the Indicative and Provisional,[34] elimination of irregular V-stem suffixes in favor of their C-stem counterparts and concomitant extension of the *r*-zero alternation must have occurred only when the *i/e* ～ *u* alternation began to be leveled in favor of *i/e* in the late 16th century; this leveling started in Eastern dialects (see Kokugogakkai 1980:76,856 and Rodriguez 1604-08/1955:29), progressed westward, and remains incomplete in Kyushu and isolated pockets of Western Japan to this day. While more work on this topic is necessary, it would seem that in paradigms where *r* occurs, in V-stem endings, only after the marked stem vowel alternant *u,* it is taken by speakers as conditioned by that vowel, becoming eligible for extension only when *u* is eliminated in favor of *i* or *e.* This historical scenario illustrates that what we are calling "reanalysis" must be understood to include cases in which speakers seize upon a long dormant pattern whose salience has been increased by unrelated changes and extend it. While the concept of reanalysis was motivated above by reference to a phonological rule "life cycle", then, it is in the end a more general concept than anything that can be identified with a particular stage in such a life cycle. Below, "reanalysis" will be taken to cover not only cases in which a rule with identifiable origins in phonologization has been reinterpreted by speakers, but cases in which speakers have postulated a morphophonological rule for which either no such origins can be demonstrated or (Garrett and Blevins 2009) for which it can be demonstrated that there are in fact no such origins.

The suggestion that while newly phonologized alternations are analyzed in terms of a principle like (27), reanalysis is implemented on the basis of principles like those of (25) amounts to claiming that there are two types of phonology, which, while sharing a descriptive vocabulary (features, segments, syllables, feet), are quite sharply distinct at the explanatory level. While this conclusion may seem unattractive, it is important to remember that simply labeling a set of linguistic phenomena (here, everything loosely "phonological") is no guarantee that that set actually constitutes a unified cognitive domain (Bye 2007:85-86). When we reflect that phonologization and reanalysis, respectively, correspond rather closely to what the Neogrammarians called "sound change" and "analogy" (Bermúdez-Otero 2006:497), we see that the conclusion that they are governed by distinct explanatory principles is actually quite unsurprising.[35] In what follows, the domain of applicability of all explanatory principles proposed will be assumed to be limited to cases of reanalysis.

In concluding this section, it is worth noting that while reanalysis has not been a notable focus of research within Optimality Theory, there is reason to believe that facing the problems it poses squarely will, even from an OT perspective, lead to conclusions consonant with those suggested here. Thus, Bermúdez-Otero's (2006:501-504) overview of the subject, in its "[focus] on OT's principles for the selection of input representations" (2006:501), reflects the insight that reanalysis starts from the re-evaluation of input forms (compare section 4.3 below); Bermúdez-Otero (2006:503-504) further notes (a) that Lexicon Optimization (see note 29), as adapted to alternating morphemes, will not in general predict the input forms that are chosen in reanalysis and (b) that when a weaker criterion produces

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[33] Concerning the morphemic affiliation of the *r* of the V-stem *rentaikei* and *izenkei* endings, there is general agreement that it belongs historically to a suffix with nominalizing function, but a variety of proposals as to the precise shape of the suffix, its mode of attachment, the relation between the two endings, and the changes that must be postulated to account for the attested forms (see Whitman 2008:167 (note 4) and references cited in that work).

[34] The most common pattern is for *i*-stems and monosyllabic *e*-stems to show innovative *r*-suffixes along with leveling of the *i/e* ～ *u* alternation and for polysyllabic *e*-stems to show conservative V-stem suffixes and retention of the alternation. While the Causative of *ake/u-* "open (tr.)" follows this pattern in showing conservative (*s*-initial) suffix alternants in all but two Kyushu locations (GAJ Map 118), there is evidence that the complementarity between the stem alternation and *r*-endings does not in general extend to stem-forming suffixes: for *kuru* "come", the only verb that retains the *i/e* ～ *u* alternation virtually everywhere in Japan, Negative *koran,* Imperative *kore,* and Hortative *koroo* are rare or unattested, as expected, but Causative *koraseru* and Potential *koreru* (and parallel forms) are common.

[35] On one recent view, analogical change is exhausted by the mechanism of relexicalization and "not directly relevant to the study of grammars as static knowledge states" (Hale and Reiss 2008:243). Cases in which speakers analyze an existing alternation by postulating an innovative rule exceptions to which are then gradually eliminated, however, show that such a view of analogy is seriously incomplete. We have seen one such case above and will see two more below.

indeterminate results, further "morphological or lexical criteria" (2006:504) will be necessary. Something of what these further criteria will have to look like is inferrable from Bermúdez-Otero and Hogg 2003:105, where innovative basic alternants that result from reanalysis are characterized as more "salient" than nonbasic alternants. But the aim of principles like those of (25), it seems natural to say, is precisely to provide a concrete characterization of what counts as salient for speakers in this regard; this is particularly clear in the case of (25a) and (25b), which mandate basic status for isolation alternants and alternants of high paradigmatic frequency, respectively. The degree to which OT as presently conceived is capable of accommodating and incorporating such principles of salience would seem to be very much an open question.

4.2 Explaining the Choice of Analysis A: A First Pass

We are now ready to turn to the problem of explaining speakers' choice of Analysis A in the Japanese case of sections 2-3. This problem is particularly pressing because under the feature-counting evaluation metric of classical generative phonology, which values maximally simple lexical entries and thus phonological prediction of alternants, Analysis A would be the least highly valued analysis of the three we considered, given that it treats six nonbasic suffix alternants as irregular and thus (in whole or in part) lexically listed, as opposed to the four of Analysis B and the two of Analysis C. In this section, we will see that the choice of Analysis A can be explained while retaining the concept of predictability from the classical evaluation metric if we modify our notion of just what it is that speakers--specifically children in the process of acquisition--are trying to predict when they set up basic forms. Following Albright 2002, I will claim that what speakers wish to be able to predict is not the set of morpheme alternants, but rather the entire set of inflected forms across the entire set of stems in the lexicon. This means that the factor of lexical frequency will enter into the predictability calculation. In particular, it may be advantageous to take a certain set of suffix alternants as basic in part because the set of stems to which they apply is more numerous than the set of stems to which some other set of alternants apply. Below, I will use the label "IF predictability" (introduced in section 1.1) to refer to the hypothesis that speakers attempt to predict inflected forms and the degree to which a particular analysis is successful in doing so.

A second hypothesis that I will borrow from Albright is that in choosing basic forms for systems of inflectional alternations, speakers limit themselves, as we provisionally assumed in section 1, to actually occurring alternants, and furthermore, that the set of basic alternants must be drawn from a consistent morphological or phonological environment. This condition, which of course has no counterpart in the classical evaluation metric, combines (25c) and (25d) above, replacing "consistent morphological environment" in the former with a formulation that allows for the possibility of phonological rather than morphological conditioning; it is given as (28a) below, while the hypothesis that speakers attempt to predict inflected forms is given as (28b).

(28) Two Hypotheses Concerning the Choice of Basic forms (following Albright 2002:ix)
   a. Basic forms are surface alternants drawn from a constant morphologically or phonologically defined environment across a given lexical category.
   b. Consistent with (28a), basic forms of both stems and affixes are chosen so as to maximize IF predictability--that is, so as to allow prediction of the maximal number of inflected forms from the paradigm of the maximal number of stems.

In order to be usable, (28b) requires a characterization of the set of inflected forms that are predicted by a given analysis of a given alternation. I will assume that this set consists of the inflected forms that involve alternants that are basic or regularly derived under that analysis, as opposed to those that involve irregular alternants--that is, alternants whose generation requires reference to diacritic or phonological "excess information", as discussed in section 1.2.

Let us now consider how (28a) and (28b) apply to the choice among Analyses A, B, and C of the Japanese suffix alternations. Consider first (28a). For each inflectional category, there are two alternants, distinguished by whether they are used after consonant-final or vowel-final stems. This factor, then, defines the only "constant morphologically or phonologically defined environment[s]" on the basis of which the set of basic forms can be determined. (28a) thus entails that basic forms must coincide either with the set of C-stem alternants or the set of V-stem alternants; the option of drawing basic forms now from one set, now from the other, on the basis of non-environmental characteristics (e.g.

the length of the alternants themselves) is excluded. (28a), in other words, excludes Analysis C.

Now consider the effect of (28b). It is well-known that C-stem verbs are roughly twice as common as V-stem verbs in the lexicon of Japanese, and have been throughout the recorded history of the language (see Suzuki 1977:202-210, Keino 1972:7-8, and de Chene 1985:205 (note 10) for statistics for various periods). Searching the relevant designations for conjugational class in electronic versions of Japanese language dictionaries confirms this ratio; for the *Iwanami, Sinmeikai, and Meikyoo Kokugoziten,* the C-stem figures are 67.5%, 67.3%, and 65.6%, respectively. Averaging and rounding to the nearest percent gives the result that of every 100 regular verbs, 67 are C-stems and 33 are V-stems. Assume a sample lexicon of 100 randomly selected verb stems, 67 consonant stems and 33 vowel stems. There will be 900 inflected forms for this set of verbs, 100 for each category of Table 3, distributed among C-stems and V-stems in the manner shown in Table 10. Of those 900 forms, those predicted by Analyses A, B, and C are as shown in Tables 11A, 11B, and 11C, respectively.

		C-stem	V-stem
1	Indicative	67	33
2	Provisional	67	33
etc.			

Table 10 Inflected Forms of 100 Randomly Selected Verbs

		C-stem	V-stem
1	Ind	67	33
2	Prov	67	33
3	Pass	67	33
4	Hort	67	
5	Caus	67	
6	Inf	67	
7	Neg	67	
8	Imp	67	
9	Pot	67	

Table 11A Forms Predicted by Analysis A
(603 + 99 = 702/900 = 78%)

		C-stem	V-stem
1	Ind	67	33
2	Prov	67	33
3	Pass	67	33
4	Hort	67	33
5	Caus	67	33
6	Inf		33
7	Neg		33
8	Imp		33
9	Pot		33

Table 11B Forms Predicted by Analysis B
(335 + 297 = 632/900 = 70%)

		C-stem	V-stem
1	Ind	67	33
2	Prov	67	33
3	Pass	67	33
4	Hort	67	33
5	Caus	67	33
6	Inf	67	33
7	Neg	67	33
8	Imp		33
9	Pot		33

Table 11C Forms Predicted by Analysis C
(469 + 297 = 766/900 = 85%)

For Analysis A, the predicted forms are all forms with C-stem suffixes plus V-stem forms for categories 1-3; for Analysis B, they are all forms with V-stem suffixes plus C-stem forms for categories 1-5; for analysis C, they are all forms with longer suffixes plus forms with shorter suffixes for categories 1-7. As the calculations under the three tables show, the number of forms predicted by the three analyses is: for Analysis A, 702, or 78% of the total; for Analysis B, 632, or 70% of the total; for Analysis C, 766, or 85% of the total. The crucial result is that, of the two analyses consistent with (28a), Analysis A has a higher IF predictability rating than Analysis B. The results of evaluating all three analyses vis-a-vis (28a) and (28b) are shown in Table 12.

Analysis	Satisfies (28a)	IF Predictability
A	Yes	78%
B	Yes	70%
C	No	85%

Table 12 Application of Hypotheses (28) to Analyses A, B, and C

In this way, the conjunction of (28a) and (28b) can be seen as determining the choice of Analysis A as the descriptively adequate analysis of the alternations of Table 3.

4.3 Examining the Explanatory Principles 1: Unitary Evaluation and IF Predictability

Hypothesis (28b) (IF predictability) is conceptually attractive in that it integrates the factors of lexical frequency and phonological predictability into a single criterion. But this observation begs a crucial question, namely that of whether speakers really do evaluate basic forms and rules together as a unit. In the Japanese case, the choice of Analysis A over the other two observationally adequate analyses clearly does not depend on their doing so: given that speakers attempt to predict inflected forms, the choice of Analysis A would follow equally if basic forms were chosen first, on grounds of predictability but without any attention to whether or not a plausible rule is available for deriving nonbasic forms, and the question of a rule dealt with only later. This is because the choice of C-stem suffixes as basic will in itself account for 67% of the entire set of verbal inflected forms, and no other choice of basic suffixes will account for as high a percentage. The *r*-Epenthesis rule of Analysis A could then be explained as a generalization of the most common of the alternations between C-stem and V-stem suffixes, given the former as input.

Let us call the hypothesis that speakers evaluate basic forms and rules as a unit the "unitary evaluation" hypothesis. The contrary hypothesis, namely that they choose basic forms first and rules later, can be called "sequential evaluation".[36] Given that unitary evaluation is an unstated assumption of hypothesis (28b), that hypothesis can be reformulated as the conjunction of a Unitary Evaluation provision and an IF Predictability principle, as in (29).

(29) a. Unitary Evaluation: Basic forms and rules are evaluated as a unit.
b. IF Predictability: Basic forms and rules are chosen, consistent with (29a), so as to maximize predictability of inflected forms.

This section will examine the two clauses of (29), with evidence drawn from two cases of reanalysis, one involving Portuguese, the other involving Korean.

4.3.1 Portuguese

One kind of case for which unitary and sequential evaluation make distinct predictions is defined by the following conjunction of characteristics, assuming an alternation A ～ B:

(30) a. There is a neutralizing rule N: A → B such that taking A as basic and postulating N affords essentially 100% predictability of inflected forms.
b. The number of inflected forms with B far exceeds the number with A.

In such a situation, unitary evaluation dictates taking A as basic, since taking B as basic will force a diacritic-based division of the lexicon, leaving a significant residue of unpredictability. Sequential evaluation, on the other hand, since it looks only at basic forms, will dictate taking B as basic. Here we will consider a case from the history of Portuguese that satisfies conditions (30).

Romance languages other than Romanian, Sardinian, and related dialects descend from an ancestor[37] with the seven stressed vowels *i e ɛ a ɔ o u* (*e* < Latin *ĭ/ē, ɛ* < *ĕ; o* < *ŭ/ō, ɔ* < *ŏ*) and the five unstressed vowels *i e a o u,* where unstressed *e* and *o* represent neutralization of the contrasts *e* : *ɛ* and *o* : *ɔ* respectively. In the protolanguage, these neutralizations will have produced alternations in verb paradigms, where nine forms (the singular imperative and persons 1236 of the present indicative and present subjunctive) had stem stress and all other forms had stress on an inflectional suffix. Thus the verb stems "deny" and "ask" (Latin *nĕgāre, rŏgāre*) will have been **nɛg-* ～ **neg-* and **rɔg-* ～ **rog-* depending on stress, contrasting with nonalternating mid-vowel stems like **pesk-* "fish" (Latin *pĭscāre*) and **pot-* "prune" (Latin *pŭtāre*).

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[36] This distinction does not arise under the classical evaluation metric, which claims that speakers minimize lexical listing, since under that metric, basic forms in isolation from rules--that is, in isolation from an assessment of what is regular and what irregular in nonbasic forms--do not constitute an appropriate object of evaluation.

[37] Proto-Italo-Western Romance (Hall 1976, Agard 1984), often called Proto-Western Romance (below, PWR); in addition to the vowels given, some words at this stage still preserved the diphthong /aw/ (see Hall 1976:12).

In this situation, taking stressed alternants as basic and postulating a rule neutralizing the *e* : *ɛ* and *o* : *ɔ* contrasts in unstressed syllables in favor of *e* and *o* will afford 100% predictability of the associated paradigms. Call this Analysis 1. Unitary evaluation predicts that that Analysis 1 should be adopted, given that the alternative of taking unstressed alternants as basic will require distinguishing stems with alternating *e/o* from stems with nonalternating *e/o* by means of a diacritic, resulting in a predictability deficit. Analysis 1, in turn, predicts stability of the system over time, since under that analysis, nothing is irregular.

Sequential evaluation, on the other hand, predicts that unstressed alternants should be taken as basic, given that they occur in a far wider range of inflected forms than stressed alternants. There are two variants of an analysis in which unstressed alternants are basic, depending on whether it is the alternating or the nonalternating pattern that is taken as regular. If the alternating pattern is taken as regular, there will be a rule (below, "Lowering") taking *e/o* to *ɛ/ɔ* under stress in verb stems, and nonalternating stems will be marked with an exception feature for that rule that will tend to be eliminated over time. Under this analysis (below, Analysis 2a), in other words, we should expect to see extension of the *e* ～ *ɛ* and *o* ～ *ɔ* alternations to formerly nonalternating stems. If the nonalternating pattern is taken as regular, on the other hand, Lowering will be a minor rule, and alternating stems will be marked with a rule feature triggering its application that will tend to be eliminated over time. Under this Analysis 2b, in other words, we should expect to see leveling of the Lowering alternation in favor of *e/o*.

What we actually observe in the history of Portuguese is extension of Lowering to formerly nonalternating stems, so that today, only mid stem vowels that are exempt from the alternation for phonological reasons (nasalization, hiatus with a suffixal vowel, adjacency to a palatal consonant (see Hensey 1972:290-291, Azevedo 2005:74)) fail to undergo the rule. The extension of Lowering is illustrated using our four original example stems in Table 13.

Gloss	Unstressed	Conservative Stressed	Conservative Alternation	Innovative Stressed	Innovative Alternation
"to fish"	pesk-	pesk-	---------	pɛsk-	e ～ ɛ
"to deny"	neg-	nɛg-	e ～ ɛ	nɛg-	e ～ ɛ
"to prune"	pod-	pod-	---------	pɔd-	o ～ ɔ
"to ask"	rog-	rɔg-	o ～ ɔ	rɔg-	o ～ ɔ

Table 13 Extension of Lowering in Portuguese Verb Stems

It is Analysis 2a, in other words, that has been adopted by speakers; the same conclusion could have been reached directly, in accordance with Table 1 above, by noting that unstressed alternants have been stable (and thus basic), while the original stressed alternants of formerly nonalternating stems have been replaced by innovative alternants in *ɛ/ɔ*, showing that the former were irregular and that the latter are regularly derived substitutes. The significance of this in the present context is that the Portuguese reanalysis counterexemplifies the hypothesis of unitary evaluation: only if basic forms were chosen separately from and prior to consideration of what pattern of (non)alternation is regular can the choice of unstressed alternants as basic be accounted for.

If sequential evaluation is correct, how are we to understand the IF Predictability provision (29b), which hypothesizes that basic forms and rules are chosen so as to maximize predictability of inflected forms? Clearly we need a version of IF Predictability that applies to the choice of basic forms and the choice of rules separately. Let us consider basic forms first.

Assume a morpheme M with allomorphs $\{m_i\}$ (i = 1, 2, ..., n); take M to be either an inflectional stem or an inflectional affix. In the former case, M may not be strictly speaking monomorphemic, but in view of bracket erasure, can be considered monomorphemic from the point of view of the postsyntactic morphology and phonology (see section 2.4 above).

If M is a stem, there is a one-to-one correspondence between the members of the set of affix combinations with which M (concretely, any of $\{m_i\}$) occurs and the members of the set of inflected forms in which M occurs (M's paradigm). Call the latter set IF_M. Then, for each m_i, m_i's type frequency can be defined as the percentage of IF_M in which m_i occurs. For example, in the inflectional system of the Portuguese verb, there are roughly 60 affix combinations (six person-number combinations each for present, imperfect, and future indicative and subjunctive and for preterit, pluperfect, and conditional; two imperative and four nonfinite forms) for conservative contemporary

varieties and the historical stage relevant to the reanalysis at issue--equivalently, 60 inflected forms for any verb stem. Of these, as we have noted, precisely nine, or 15%, are stem-stressed, meaning that 51, or 85%, have suffixal stress. For any verb stem, then, the type frequency of its stressed alternant will be 15%, and that of its unstressed alternant 85%.

If M is an affix, there is a one-to-one correspondence between the members of the set of stems with which M (concretely, any of $\{m_i\}$) occurs and the members of the set of inflected forms in which M occurs. Call the latter set, again, IF_M. Then, just as in the case where M is a stem, m_i's type frequency, for each m_i, can be defined as the percentage of IF_M in which m_i occurs. For example, since 67% of Japanese verb stems are C-stems, and 33% are V-stems, given a verbal inflectional suffix, its C-stem alternant will occur in 67% of all inflected forms with that suffix, and its V-stem alternant in 33%. The type frequency of the C-stem suffix alternant will thus be 67%, and that of the V-stem suffix alternant 33%.

Regardless of whether M is a stem or an affix, then, the type frequency of any allomorph m_i of M is the percentage of IF_M in which m_i occurs. It is now clear that both the choice of unstressed stem alternants as basic in Portuguese and the choice of C-stem suffix alternants as basic in Japanese follow from the very simple principle (31).

(31) Basic alternants are those with the highest type frequency.

(31), then, is the IF Predictability provision for basic forms on the assumption of sequential evaluation.

With regard to rules, recall that we speculated above that the *r*-zero alternation in Japanese verbal inflectional suffixes was interpreted as rule-governed because it was the most frequent such alternation, given the choice of C-stem suffixes as basic. This suggests that we define type frequency and formulate an IF Predictability principle for alternations in a way parallel to what we have proposed for basic forms. In the case of an alternating morpheme M, the set IF_M provided a precise measure of the potential range of applicability of any allomorph of M; in the case of an alternation, we will simply refer to the set of morphemes to which the alternation is "eligible" to apply. In (32) and (33), "alternation" is taken to include what could be called the null alternation--that is, a pattern of nonalternation.

(32) The type frequency of an alternation is the percentage of eligible morphemes to which the alternation applies.
(33) Regular alternations are those with the highest type frequency.

In the case of Portuguese mid-vowel verb stems, there are precisely two candidates for a regular pattern once stressless alternants have been taken as basic, the alternating and the nonalternating, as illustrated in Table 13 above. Given that it was the alternating pattern that was generalized, (33) would predict that there were more alternating than nonalternating mid-vowel stems at the relevant historical stage. While I do not at present have the data that would confirm or disconfirm this prediction, the second case of reanalysis to be considered in this section will provide an example in which (33) clearly makes the correct prediction about which of a set of alternations is taken to be regular. Let us now turn to that case, which involves Korean noun inflection.

4.3.2 Korean

As is well-known, stem-final consonants and consonant clusters in Korean alternate depending on whether they find themselves in syllable codas, where only nasal stops, plain oral stops, and *l* are allowed, or, as the result of resyllabification, at least partially in onsets.[38] In noun stems, the alternations in (34)-(36) are observed, where those in (34) involve coronal obstruents, those in (35) involve noncoronal obstruents, and those in (36) involve clusters. In all cases, the period represents syllable boundary, and syllable-final alternants precede alternants resulting from resyllabification.

[38] Resyllabification occurs across affix and clitic boundary, where clitics include case particles and the copula, but is blocked by compound and word boundary (Martin 1954:20, Sohn 1999:165). Consonants in prevocalic position before compound or word boundary undergo the neutralizations characteristic of codas but are ultimately resyllabified as onsets by phonetic level (postlexical) resyllabification (Ahn 1985:54, Sohn 1999:166).

(34) a. t. ～ .t
b. t. ～ .t^h
c. t. ～ .c
d. t. ～ .c^h
e. t. ～ .s

(35) a. p. ～ .p
b. p. ～ .p^h
c. k. ～ .k
d. k. ～ .k^h
e. k. ～ .k'

(36) a. p. ～ p.s
b. k. ～ k.s
c. l. ～ l.s
d. l. ～ l.p
e. k. ～ l.k

In contemporary Korean, the alternations of (34)-(36) are undergoing a mixture of leveling and extension in noun stems (see e.g. Martin 1992:107-108, Albright 2008:168, and references cited in the latter). Specifically, the alternations of (35) and (36) are being leveled in favor of the syllable-final form, while the alternations of (34a) through (34d) are being replaced by the *t* ～ *s* alternation of (34e). These changes are summarized in Table 14, whose columns are in one-to-one correspondence with those of Table 13 (Portuguese) above, and whose rows contain examples illustrating, respectively, the fate of alternations (34c), (35d), and (36a).

Gloss	Syllable-final	Conservative Resyllabified	Conservative Alternation	Innovative Resyllabified	Innovative Alternation
"debt"	pit.	pi.c	t. ～ .c	pi.s	t. ～ .s
"kitchen"	puək.	puə.k^h	k. ～ .k^h	puə.k	----------
"price"	kap.	kap.s	p. ～ p.s	ka.p	----------

Table 14 Leveling and Extension in Korean Noun Stems

The replacement of *pic* by *pis* as the resyllabification environment alternant of *pit* "debt", which is stable as the neutralized, syllable-final alternant, indicates, in accordance with Table 1 above, that *pic* is irregular, *pis* is a regular derivative, and *pit* is the basic form; that neutralized alternants are basic is confirmed by leveling in their favor in the other two types of stem. If *pit* is basic and *pis* is a regular derivative, there is a rule taking *t* to *s* when *t* is both final in a noun stem and syllable-initial (i.e. resyllabified). Postulating such a rule accounts, among other things, for the fact that when a noun is borrowed in a form ending in *t,* that *t* invariably alternates with *s* before a case particle or the copula (Kang 2003:138). The analysis of the Korean alternations of (34)-(36) in noun stems is thus as in (37).

(37) a. Basic forms: syllable-final alternants
b. Rule: $t \rightarrow s / . \_\_ _N]$

Like the Portuguese reanalysis discussed above, the Korean reanalysis counterexemplifies the hypothesis of unitary evaluation. This is because an analysis attaining total IF predictability would result from taking resyllabification environment alternants of alternating segments as basic and applying the neutralization rules necessary to produce the syllable-final alternants (the one qualification associated with this claim is that a small predictability deficit would result from taking as basic alternants preceding the vowel *i* because the contrasts between dental *t* t^h and palatal *c* c^h are neutralized in favor of the palatals in that environment). On the unitary evaluation hypothesis, then, just as in Portuguese, the analysis offering total IF predictability should be adopted, and no reanalysis should occur. The Korean case differs from the Portuguese, however, in that the observed choice of basic forms appears not to follow from the principle that basic alternants are those with the highest type frequency ((31) above).

Given that the definition of type frequency for a morpheme alternant presupposes the concept of inflected form and thus the concept of affix, the task of supporting the claim that type frequency does not predict the choice of neutralized alternants as basic for Korean nouns is complicated by the fact that there is in fact no well-defined set of nominal affixes in Korean: the relevant clitics or particles (Korean *cosa*) are (1) categorially promiscuous, attaching to a variety of phrase types up to and including TP/CP (see Sohn 1999:213) and (2) ill-defined as a class, shading off from structural case markers through markers of discourse function to exponents of a variety of spatial, temporal, and logical ("each", "only") meanings. Structural case markers, as is often noted, are also unaffixlike in being deletable. Abstracting away from this problem, however, it is clear that the great majority of the main nominal clitics and clitic combinations, including those of the nominative, accusative, and genitive; those of the locative, dative, goal, and source

for inanimates and the most general such items for animates; and that of the instrumental, which also marks direction, cause, and role or capacity, are vowel-initial after consonant-final stems and thus create resyllabification environments (see Sohn 1999:213-214, Lee and Ramsey 2000:143-156). The choice of the neutralized alternant as basic, then, can almost certainly not be attributed to that alternant's appearing in a greater number of "paradigmatic" forms.

If the choice of neutralized alternants as basic for Korean noun stems does not follow from considerations of type frequency, it would appear that a distinct criterion is necessary to explain that choice. In this context, the fact that essentially identical alternations at the end of verb stems (see Martin 1992:101) do not lead to reanalysis of neutralized alternants as basic compels us to look for a factor that distinguishes noun inflection from verb inflection. As is well known, the fact that noun stems, but not verb stems, may appear word-finally and prepausally gives the neutralized alternants of the former, but not the latter, the status of isolation forms (see e.g. Kenstowicz 1996:§3.2).[39] Let us assume then, in accordance with (25a) above, that it is this factor that dictates the basic status of neutralized alternants for nouns. Given that isolation forms may fail to be taken as basic when they are available only for a proper subset of a lexical category (Latin *honos,* eliminated by leveling in favor of *honor*), I will assume that the application of (25a) is restricted to cases in which all stems of a given category show isolation forms.

While the choice of basic forms given in (37a) thus appears not to follow from frequency considerations, both the *t*-to-*s* rule (37b) and leveling of the alternations of (35) are clearly interpretable as the consequence of (33), which states that regular alternations are those with the highest type frequency. This is confirmed by the relative frequency in the Sejong corpus (http://sejong.or.kr) of nouns that historically display the five *t* ∼ coronal alternations of (34), given in (38), and of nouns that historically display the *p* ∼ labial and *k* ∼ velar alternations of (35), given in (39) and (40), respectively (figures from Albright 2008:171).

(38) a.	t. ∼ .t	1	.15%
b.	t. ∼ .t^h	113	17.00%
c.	t. ∼ .c	17	2.55%
d.	t. ∼ .c^h	160	24.00%
e.	t. ∼ .s	375	56.30%

(39) a.	p. ∼ .p	1360	96.5%
b.	p. ∼ .p^h	64	4.5%

(40) a.	k. ∼ .k	5994	99.6%
b.	k. ∼ .k^h	18	.3%
c.	k. ∼ .k'	6	.1%

As is clear from (38), stems displaying the coronal alternation that has been generalized, that of (38e), comprise more than half of all stems ending in coronal obstruents and are more than twice as numerous as their nearest competitor. In the same way, for both labial and velar stops, the null alternation is overwhelmingly more frequent than its competitors. We thus have clear evidence that type frequency can determine the choice of a regular alternation from among several candidates.[40] As suggested at the beginning of section 4.3, then, we may plausibly take the choice of the *r*-zero alternation as regular in the Japanese case to follow from frequency considerations--that is, from (33)--as well.

There are two main conclusions to be drawn from the Portuguese and Korean reanalyses that we have examined. The first, supported by both reanalyses, is that unitary evaluation, the hypothesis that speakers make a IF predictability calculation on an analysis that consists of basic forms and rule(s) as a unit, is false: the two reanalyses can be explained only if basic forms were chosen with no reference to possible rules, a procedure we have called sequential evaluation. The second conclusion, supported in each case by one of the two reanalyses, is that both the choice of basic forms and the choice of a rule for a given alternation can be based on frequency considerations--in particular, on what we have called type frequency. We have defined type frequency separately for morpheme alternants and for rules, but in both cases, type frequency can be characterized as the percentage of eligible morphemes with which an alternant or an alternation co-occurs. As a result, the type frequency of an alternant or an alternation is a direct measure of the number of inflected forms that can be predicted on the basis of that alternant or alternation. Looking back at (29), repeated below as (41), our starting point in section 4.3, we see, then, that while unitary evaluation has

[39] It is nevertheless not quite true that verb stems "require an inflection" (Kenstowicz and Sohn 2001:255)--i.e., never occur unsuffixed, since a bare verb stem, like a bare noun stem, can appear as the first member of a compound; when this occurs, the compound boundary blocks resyllabification, as expected (puth- "stick" + an- "embrace" > putan- "hug"). Nor is it the case, of course, that verb stems "are not subject to the neutralizing effects arising in the bare citation form" (loc. cit.), given that many verbal suffixes are consonant-initial.

[40] The fact that a single principle of evaluation determines extension in the case of (38) and leveling in the case of (39)-(40) can be seen as supporting Garrett's (2008) claim that leveling is but a special case of extension--in particular, extension of a pattern of nonalternation.

been abandoned, IF predictability remains the central concept of phonological evaluation.

(41) a. Unitary Evaluation: Basic forms and rules are evaluated as a unit.
b. IF Predictability: Basic forms and rules are chosen, consistent with (41a), so as to maximize predictability of inflected forms.

4.4 Examining the Explanatory Principles 2: The Uniform Environment Condition

(41) = (29) constitutes an expansion of (28b), one of two principles that, following Albright 2002, were proposed in section 4.2 to explain the choice of Analysis A for the Japanese alternations of Table 3. We turn now to the other principle, (28a), which combines versions of the earlier (25c-d) and is repeated below as (42).

(42) Basic forms are surface alternants drawn from a constant morphologically or phonologically defined environment across a given lexical category.

In this section, I will set aside the requirement that basic forms be surface alternants (= (25d)), having no clear reason to doubt its validity for cases of reanalysis.[41] Concentrating, then, on the requirement that basic forms be drawn from a constant environment (below, the Uniform Environment Condition (UEC)), I will claim that there are two reasons to believe that no such principle is in fact in force: first, counterexamples to the UEC are too numerous, and second, cases that appear to support postulation of that condition can arguably be explained without it.

Above, we saw that, given stress-conditioned vowel alternations in the verb paradigm, Portuguese speakers took unstressed alternants as basic and then generalized the alternations to previously nonalternating stems. In other Romance languages, the outcome of parallel alternations is less consistent: leveling is the rule, but there is sporadic extension as well; and while unstressed stem alternants tend to be taken as basic, there is a significant residue of cases in which leveling favors the stressed alternant instead. In French, for example, where PWR *o and *ɔ in open syllables both give ø when stressed and *u* when stressless, verb stems with either of the PWR vowels in question came to alternate, in the present indicative, between ø in persons 1236 and *u* in persons 45, as in *il meurt* "he dies"*, nous mourons* "we die". Most verbs with this alternation have leveled it in favor of the unstressed alternant *u* (*il prouve, nous prouvons* ("prove")), but examples also exist in which leveling has gone the other way (*il pleure, nous pleurons* ("weep")). Similarly, the alternation between stressed ɛ and stressless *a* characteristic of verbs with PWR **a* in open syllables has typically been leveled in favor of *a* (*il clame, nous clamons* ("proclaim")), but occasionally in favor of ɛ (*il aime, nous aimons* ("love")).

Perhaps the strongest argument that directionality is in fact sometimes unpredictable is furnished by examples in which a single stem is leveled in both directions simultaneously in what is apparently a single speech community (although the possibility of dialect borrowing cannot always be excluded). Thus while on phonological grounds we would expect the Latin paradigm *de-us*, *dīv-ī* "god" on the stem **deiw-o-*, with *de-* in the nominative and accusative singular and *dīv-* elsewhere, what we find are twin paradigms *de-us*, *de-ī* and *dīv-us*, *dīv-ī*, the latter typically used adjectivally (Meillet and Vendryes 1979:79, Sihler 1995:179, Anttila 1972:94-95). In the same way, *Jū(piter)* (properly a vocative), *Jov-is* "Jupiter" and *diēs*, *diēī* "day" go back, respectively, to Sievers' Law variants **dyew-* and (in the accusative) **diyew-* > **diyē-* of the same root **dyew-* whose zero-grade **diw-* underlies **deiw-o-* (Szemerényi 1996:181,107,133; Sihler 1995:338-339 (with an alternate account of **diyē-*)).

Some cases in which the direction of leveling appears to depend on the individual stem are certainly to be understood in terms of the concept of local markedness (Tiersma 1982): if English *glove* (Sihler 2000:76) represents leveling in favor of the plural stem (from the OE singular *glōf* we would expect modern *gloof*), this is because, since gloves normally occur in pairs, the plural form will have been more frequent than the singular and in that sense unmarked with respect to it. Similarly, it is often asserted that the leveling in favor of stressed ɛ in the paradigm of French *aimer*

[41] The question is an empirical one, however: since that requirement disallows analyzing A ～ B as X ≠ A, B, it predicts that situations in which A ～ B coexists with both nonalternating A and nonalternating B are always unstable (see the end of section 1.2), a prediction that requires further investigation.

"love" that we saw above results from the frequency of the first person singular form (see Tiersma 1982:846). It is possible that more instances in which leveling displays unexpected directionality could be accounted for in this way if the circumstances surrounding the change were known in greater detail. The question of explicability aside, however, it is clear that counterexamples to any principle like the UEC abound in the recorded and reconstructed histories of known languages and constitute an argument against assuming the existence of such a principle.

The second argument against assuming a principle like the UEC is that insofar as the choice of basic forms depends on type frequency, as we have proposed above, and insofar as type frequency is constant across alternating morphemes, consistency in the environment of basic alternants will follow automatically with no need for stipulation. In the case of Japanese verbal suffix alternations, for example, there is essentially no variation across suffixes in what stems the suffix occurs with, so that, as we have already observed, any C-stem alternant will occur with 67% of all stems, and any V-stem alternant will occur with 33%. Each C-stem alternant will thus have a type frequency that is double the type frequency of the corresponding V-stem alternant, and will therefore be chosen as basic by principle (31) above, which states that basic alternants are those with the highest type frequency. As a result, there will be no need to invoke the UEC in order to exclude Analysis C of the Japanese alternations. In the same way, since there is little variation across Portuguese verb stems in what suffix combinations the stem occurs with, each unstressed alternant will appear with 85% of such combinations, and each stressed alternant with 15%. Each unstressed alternant will thus have a type frequency that is 5.67 times the type frequency of the corresponding stressed alternant and will be chosen as basic by principle (31). In view of the fact the UEC is both incompatible with a wide range of evidence indicating that choice of basic form can be morpheme-specific and dispensable in many and perhaps all cases in which basic forms are indeed taken from a uniform environment, it seems likely that no such principle exists.

4.5 Summary

After distinguishing the phonology of phonologization and the phonology of reanalysis in section 4.1 and claiming that the two are governed by distinct principles of base form choice, we proposed in section 4.2 an account of how the descriptively adequate Analysis A of the Japanese system of verbal suffix alternations is chosen from the set of observationally adequate alternatives. Each analysis, a complex of basic forms and a rule, was evaluated as a unit for IF predictability and was at the same time required to meet the condition that basic forms be surface alternants drawn from a constant environment. In the course of section 4.3, however, a rather different picture emerged of how the choice of the descriptively adequate analysis is made. To begin with, unitary evaluation, the hypothesis that basic forms and rules are evaluated as a unit, was abandoned in favor of sequential evaluation, according to which basic forms are chosen without regard for whether there is a rule-governed relationship between basic and nonbasic alternants and if so, what it is.

Under the hypothesis of sequential evaluation, IF predictability reduces to type frequency. Since the latter is defined morpheme by morpheme, the set of basic forms is not evaluated as a unit either. This leaves the door open for postulation of additional factors, such as local markedness, that could explain morpheme-specific choice of basic forms where that is observed while at the same time obviating a uniform environment condition for cases where no such additional factors appear to be operative. Finally, we proposed that choice of rule as well as choice of basic forms is dependent on type frequency, which for an alternation is the percentage of eligible morphemes to which the alternation applies. The *r*-Epenthesis rule of Analysis A is thus to be understood as a generalization of the most frequent pattern of alternation apparent in the Japanese data when C-stem alternants are taken as basic, just as the *t*-to-*s* rule of Korean noun inflection is a generalization of the most frequent pattern of noun stem alternation that takes *t* as input.

5 Conclusion

The material we have seen here suggests a number of lessons and raises a number of issues. First, the evidence establishing Analysis A as the descriptively adequate analysis of Japanese verbal suffix alternations not only disconfirms Analyses B and C, it also reconfirms more generally that speakers do postulate basic forms and rules in accounting for inflectional alternations. Analyses of the Japanese suffix alternations which list all suffix alternants lexically, whether with or without their environments (Bloch 1946 and Ito and Mester 2004, respectively), are therefore

disconfirmed in equal measure. At the explanatory level, the Japanese case clearly counterexemplifies both the feature-counting evaluation metric of classical generative phonology, which values phonological prediction of morpheme alternants because of the consequent reduction in lexical listing, and several other proposals that are sometimes made about the nature of basic forms for inflectional alternations and how speakers determine them.

First, it is sometimes suggested (Albright 2002, Bybee 1985:7) that speakers derive word-level inflected forms from one another within the paradigm of the same stem or lexeme. Such a model, however, is incapable of dealing with systems of affix alternations, which are irreducibly cross-lexemic in nature. The indicated conclusion is that morphophonological analysis, as assumed both by structural and by classical generative phonology and morphology, is in the general case morpheme-based rather than word-based. Second, it has been suggested that speakers obey word-level phonotactics in choosing basic forms (Hale 1973; for doubts about the existence of C-final verb stems in Japanese, see e.g. Vance 1987:199 and Nasukawa 2010). Our discussion of Japanese verbal inflection and the changes it is undergoing, however, depends at every point on postulating consonant-final verb stems that would be inadmissible in Japanese as phonological words.

Finally, it has been suggested that speakers typically choose basic forms on semantic criteria (Vennemann 1972:240, Bybee and Brewer 1980:203)--specifically, that alternants with more general or inclusive semantics will be taken as basic vis-a-vis alternants whose semantics is more highly specified. This can also be seen as the import of Kuryłowicz's (1945-49) well-known second law, which mandates basic status for alternants or categories that occur in environments where a semantic contrast is neutralized (e.g. for masculines vis-a-vis feminines if the former category has a gender-neutral use), since occurrence in an environment of neutralization is prima facie evidence of inclusive semantics. There are no semantic distinctions, however, among morpheme alternants whose distribution is determined by purely phonological factors, such as the C-stem and V-stem alternants of Japanese verbal suffixes. Cases involving phonologically conditioned alternation, then, show that there can be no general semantic theory of base form choice. While there may be cases in which appeal to a semantic criterion is necessary (see Garrett 2008 for a recent claim to this effect), it is worth noting that, other things being equal, we will expect the semantically unmarked (i.e. more inclusive) member of an inflectional opposition (a) to be compatible with more values of other inflectional features and/or (b) to make more formal distinctions over the same semantic range than the marked member. This suggests that the criterion of semantic inclusiveness and the criterion of IF predictability will give the same result in many or most cases where they are both applicable, since either (a) or (b) will result in a greater number of inflected forms for the unmarked member of the opposition.[42] It goes without saying, however, that more research on this issue is necessary.

Turning to the distinction that we made in section 4.1 between alternations that are the direct result of phonologization and alternations that reflect reanalysis, it is clear that the issue of how different the phonology of those two alternation types are at the descriptive and explanatory levels constitutes a major item on the phonological research agenda. At the descriptive level, there is no question that the structural changes of rules resulting from reanalysis sometimes closely mimic changes that could have developed through phonologization; a case in point is the Korean *t-to-s* rule ((37b) above), which has in fact been mistaken for phonetically motivated assibilation (Kim 2001:104; for discussion, see Kang 2003). Other rules resulting from reanalysis, such as Japanese *r*-Epenthesis, can be seen as natural at least in the sense that they produce unmarked structures--in the Japanese case, CV syllables. Such examples encourage the position that reanalysis, like phonologization, is constrained by principles of markedness (Bermúdez-Otero and Börjars 2006:740). On the other hand, the existence of rules that arguably could not have arisen through phonologization, both those that represent the reinterpretation of phonologized patterns and those that (Garrett and Blevins 2009) lack any historical basis in phonologization, are naturally taken to suggest that the constraints on reanalysis "must be much weaker than those restricting rule initiation" (Bach and Harms 1972:18).

The question of the extent to which rules resulting from reanalysis can diverge in form and content from what could arise through phonologization is a subtle and important one that we have not grappled with here. What we have seen,

[42] Thus, in the case Garrett (2008) cites, leveling of the present : aorist distinction of the Ancient Greek verb in favor of the latter, there are more aorist than present forms in the paradigm of a typical verb because the aorist shows a formal contrast between middle and passive voice that is lacking in the present. (Aorist passives are historically secondary, but are well established by Homeric times; while their stem typically lacks the *-s-* that characterizes the stem of regular aorist actives and middles, it shows an increasing tendency over time to be otherwise identical to that stem (Sihler 1995:564).)

however, in section 4.1, is that the phonology of phonologization and the phonology of reanalysis appear to be sharply distinct at the explanatory level--in particular, in their respective principles of base form choice. The major claim we have made with regard to the forces governing reanalysis, following Albright 2002, is that speakers attempt to predict inflected forms, a principle that can be seen as a natural alternative to the classical position that speakers attempt to predict alternations in order to minimize lexical listing. While conceptually the most attractive implementation of that principle might be that speakers make a single calculation that evaluates a complex of basic forms and rule(s) as a unit, we have been led to the conclusion that basic forms and rules are evaluated separately, with the result that IF predictability reduces to type frequency. An important question for future research is whether such sequential evaluation is completely general, or whether, on the other hand, there are cases of reanalysis in which speakers can be argued to have employed unitary evaluation.

As suggested by the quotations of section 1 concerning the need for external evidence in phonological analysis, classical generative phonology was marked by a tension between its claims of psychological reality for its descriptions and a reluctance to give up the practice of describing phonological systems simply on the basis of analyzing patterns of distribution and alternation, with no explicit attention to the question of whether the generalizations that appear significant to the linguist coincide with those that are taken as significant by native speakers. In the intervening decades, while important advances have been made in other areas of phonology, the project of bringing external evidence to bear on the question of how speakers analyze the alternations of inflectional morphology has remained for the most part on the back burner. In this paper, I have tried to suggest that, with regard to the descriptive and explanatory problems posed by the phenomenon of reanalysis--problems that, under the heading of "analogy", have in large part been on the agenda since Neogrammarian times--the Kenstowicz and Kisseberth (1977:3) research program of attempting to infer explanatory principles from cases for which the descriptively adequate analysis is known from external evidence is both necessary and feasible. It is my hope that the case study reported here will contribute to stimulating further research along these lines.

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HK (Hoogengaku Kooza) = Tojo et al. 1961

KH (Kooza Hoogengaku) = Iitoyo et al. 1982-1986

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