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

Brent de Chene

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), or by some other mechanism.

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 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 (1968:381-382) 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 the 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. While questions might be raised about the subsequent record of achievement of that research program, I will maintain here that for the phonology of inflection, it is both feasible and necessary. I will argue for this position in the course of presenting a case study Japanese verbal inflection (for a companion analysis of Korean nominal inflection, see de Chene 2009). “External” evidence for the descriptively adequate analysis will come from ongoing morphophonological change, following the dictum of Kiparsky (1978 [1982]:217) “that structure can determine change, with the corollary that change can therefore be diagnostic of structure.” The choice of the descriptively adequate analysis over other observationally adequate alternatives will be explained in terms of principles based for the most part on those proposed in Albright 2002.

In the remainder of this introduction, I will discuss the nature of the relation between synchronic structure and diachronic change that I take to hold in the area of inflectional morphophonology, thus indicating the form of the argument establishing descriptive adequacy that will be deployed in the remainder of the paper. Sections 2 and 4 of the paper will deal with the descriptive and explanatory aspects, respectively, of the Japanese case, and section 3 will comment on the fallacy of inferring from the replacement of an inflected form X by a substitute X' the existence of a (diachronic) rule deriving X' directly from X. Section 5 summarizes our conclusions.

Two assumptions of classical generative phonology that distinguished it sharply from the post-Bloomfieldian phonology it superseded were that, in analyzing alternations,
speakers postulate (1) basic or underlying forms and (2) rules to derive nonbasic forms. As
is well known, the basic forms of classical generative phonology are not constrained to coin-
cide with surface alternants. Below, however, I will hypothesize that for nonautomatic in-
fl ectional alternations, speakers do obey this constraint in postulating basic forms. For that
reason, I will assume in the following discussion that “basic/underlying form” is equivalent
to “basic alternant”.

Given that assumption, postulation of basic forms divides the entire set of morpheme
alternants into basic and nonbasic subsets. Further, the postulation of one or more rules
operating on basic forms divides nonbasic alternants in the general case into regular derived
forms, which are predicted accurately by the rules postulated, and irregular forms, which
are not. The result of these two binary divisions is the tripartition of alternants displayed
in (1).

\[
\text{(1) Alternants} \\
\quad \text{Basic} \quad \text{Nonbasic} \\
\quad \text{(Regular) Derived} \quad \text{Irregular}
\]

The basic link between synchronic structure and diachronic change in morphophonology is,
I claim, a consequence of this tripartition of morpheme alternants in that differential pre-
dictions concerning diachronic stability arise from the psychological interpretation of the
three alternant types—in particular, from how they are retrieved from memory or generated
online (see Albright (2002:12) and Marcus et al. (1992:vi, 15-18)).

Basic forms, to begin with, must be lexically listed—that is, recorded in memory. If
lexical retrieval fails for a basic form, there will be no way to generate an alternative, so
there is no way for a basic form to show instability. Regular derived forms, in contrast,
may be lexically listed, but they need not be, because they may also be generated “online”
by rule. The result of retrieval from memory and and the result of online generation will
be identical, though, so there is no way for a regular derived form to exhibit instability ei-
ther.

Irregular forms, finally, like base forms, must be lexically listed. In contrast to base
forms, however, if lexical retrieval fails for an irregular form, the speaker is free to derive
a substitute from the base form by application of the relevant rule. But for an irregular
form, in contrast to a regular derived form, the result of derivation will be an “over-
regularized” form, distinct from the result of retrieval from memory. As a result, if failure
of retrieval occurs with sufficient frequency for an irregular form, we will observe variation or fluctuation between that form and an innovative regular substitute; if over time the innovative form wins out, we will have a completed morphological change. It has long been understood that a core subtype of what the Neogrammarians called “analogy” has precisely this character; thus Bloomfield (1933:509) notes that “analogic change replaces irregular derivatives by regular.” (Another type of “analogy” has a natural interpretation in terms of a degenerate version of (1): if speakers postulate a basic (unmarked) vs. nonbasic (marked) distinction but no rule to derive regular nonbasic forms, the result of loss of irregular (i.e. marked) alternants will be simple leveling.)

Of the three alternant types under discussion, then, it is precisely the set of irregular alternants that are potentially unstable. As a result, any analysis that induces the tripartition of forms seen in (1) makes falsifiable predictions about what changes in the system are possible. This is the basis on which it is possible to determine what analysis of a set of alternations has been adopted by speakers—the basis on which it is possible to distinguish, that is, the descriptively adequate analysis from other observationally adequate analyses. In the next section, we will examine three observationally adequate analyses of the suffix alternations of Japanese verbal inflection, computing the predictions regarding potential instability for each and comparing the results with the facts of ongoing change.

2. Description

Verbal inflectional suffixes in Japanese (other than those that begin with t) alternate between a vowel-initial form after a consonant-final stem (C-stem) and a consonant-initial form (or zero) after a vowel-final stem (V-stem). In most cases, C-stem alternants and V-stem alternants differ in length by a single segment, with either the V-stem alternant longer by a consonant or the C-stem alternant longer by a vowel. The two suffixes underlined in Table 1 below are representative in this respect (sample verb stems are mat- “wait” and mi- “see”).

<table>
<thead>
<tr>
<th>Category</th>
<th>C-stem</th>
<th>V-stem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicative</td>
<td>mat-u</td>
<td>mi-ru</td>
</tr>
<tr>
<td>Negative</td>
<td>mat-an</td>
<td>mi-n</td>
</tr>
</tbody>
</table>

Table 1 Representative Suffix Alternations of Japanese Verbal Inflection

Regarding the basic or lexical forms of these two suffixes, there are at least the following
four possibilities: C-stem alternants (-u, -an) are basic; V-stem alternants (-ru, -n) are basic; longer alternants (-ru, -an) are basic; there are no basic suffixes, all alternants being listed lexically with their environments (/C_ or /V_). Nor are these possibilities hypothetical; all four types of analysis are attested in the literature. Even before considering the question of what rules (if any) are in force, then, it is clear that this is a system of alternations with multiple observationally adequate analyses.

With the above as background, let us look at the full set of nine suffixes that (in Tokyo Japanese) are vowel-initial after a C-stem and consonant-initial (or zero) after a V-stem. These are as in Table 2 below (for the Negative suffix, both Eastern and Western variants are given).

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

Table 2 Alternations of Japanese Verbal Inflectional Suffixes

The first three suffixes of Table 2 show the alternation between zero and r that we have already seen in Table 1, while suffixes 4 and 5 show alternations between zero and other consonants. For these five suffixes, then, the V-stem alternant is longer than the C-stem alternant by one consonant. For suffixes 6 and 7, on the other hand, the C-stem alternant is longer by one vowel. The alternations of suffixes 8 and 9, finally, are apparently idiosyncratic. In the next three subsections, I will introduce analyses of these alternations taking as basic C-stem suffixes (“Analysis A”), V-stem suffixes (“Analysis B”), and longer suffixes (“Analysis C”) along with the predictions about potential instability those analyses make. A fourth subsection will then present the data from ongoing change that shows which set of predictions is in fact realized.
2.1. Analysis A

Analysis A is defined, to begin with, by the choice of the vowel-initial C-stem suffixes of Table 2 as basic. Taking C-stem suffixes as a starting point, there are two recurring alternations that might serve as the basis for a rule. One is the \( r \sim \) zero alternation of suffixes 1-3; the other is the vowel \( \sim \) zero alternation of suffixes 6-7. Since the former alternation is more general, applying to three suffixes as opposed to two, I will assume that Analysis A incorporates the \( r \)-epenthesis rule (2), which will be referred to below as “Rule A”.

\[
(2) \quad \phi \rightarrow r \ / \ V_{\text{VH}} \ [\underline{\lambda} \_ \ _ \ V]
\]

Rule A inserts \( r \) intervocally at verb stem boundary—more specifically, at the head of a vowel-initial affixal morpheme that follows a vowel-final (word-internal) verbal constituent. We will look in more detail at the conditions governing the application of Rule A at the end of this subsection.

At first sight, Analysis A looks unpromising in that, of the nine V-stem suffixes, only three will be regularly derived under this analysis; the remaining six will be irregular. The tripartition (see (1) above) of the suffix alternants of Table 2 induced by Analysis A is shown in Table 3, where basic suffix alternants are unmarked, regular derived alternants are underlined, and irregular alternants are shaded.

<table>
<thead>
<tr>
<th></th>
<th>Category</th>
<th>C-stem</th>
<th>V-stem</th>
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<tbody>
<tr>
<td>1</td>
<td>Indicative</td>
<td>mat-u</td>
<td>mi-ru</td>
</tr>
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<td>2</td>
<td>Provisional</td>
<td>mat-eba</td>
<td>mi-reba</td>
</tr>
<tr>
<td>3</td>
<td>Passive</td>
<td>mat-are-</td>
<td>mi-rare-</td>
</tr>
<tr>
<td>4</td>
<td>Hortative</td>
<td>mat-o</td>
<td>mi-yoo</td>
</tr>
<tr>
<td>5</td>
<td>Causative</td>
<td>mat-ase-</td>
<td>mi-sase-</td>
</tr>
<tr>
<td>6</td>
<td>Infinitive</td>
<td>mat-i</td>
<td>mi-( \phi )</td>
</tr>
<tr>
<td>7</td>
<td>Negative</td>
<td>mat-an(a-)</td>
<td>mi-n(a-)</td>
</tr>
<tr>
<td>8</td>
<td>Imperative</td>
<td>mat-e</td>
<td>mi-ro</td>
</tr>
<tr>
<td>9</td>
<td>Potential</td>
<td>mat-e-</td>
<td>mi-rare-</td>
</tr>
</tbody>
</table>

Table 3 Tripartition of Suffix Alternants Induced by Analysis A

Because the nonbasic alternants of suffixes 4-9 are irregular, they must be lexically listed alongside the basic alternants. I will assume that in such cases, irregular alternants are listed with a specification of environment, while basic alternants are listed without any such specification. (While we noted above that regular derived forms may be stored in memory,
I will follow standard generative practice and assume that such forms are not lexically listed.) I will further assume that insertion of inflectional elements into syntactic terminal nodes is governed by the principles (3) (Halle and Marantz 1993:123-124, Halle 1997:428).

(3) 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 our assumption that only irregular alternants are listed with their environment, (3d) will guarantee that the irregular and basic alternants corresponding to a single category constitute a disjunctively ordered pair. Since the feature structure of the set of inflectional categories under consideration is an issue orthogonal to the one we are focusing on, I will assume for present purposes that there is a one-to-one correspondence between categories and features.

According to Analysis A, then, the lexical representations of the suffixes of Table 3 will be as in (4) below.

(4) Lexical Representations of Suffixes (Analysis A)

\[
\begin{array}{llllll}
\text{[1 Ind]} & /u/ & \text{[4 Hort]} & \text{yoo} / V \_ & \text{[7 Neg]} & \text{n(a)} / V \_ \\
& & & \text{oo} & & \text{an(a)} \\
\text{[2 Prov]} & /eba/ & \text{[5 Caus]} & \text{sase} / V \_ & \text{[8 Imp]} & \text{ro} / V \_ \\
& & & \text{ase} & & \text{e} \\
\text{[3 Pass]} & /are/ & \text{[6 Inf]} & \text{\_} & \text{[9 Pot]} & \text{rare} / V \_ \\
& & & \text{i} & & \text{e} \\
\end{array}
\]

We noted above that potential instability in a set of morpheme alternants over which the tripartition (1) is defined is limited to replacement of irregular alternants by regularly derived substitutes as the result of failure of lexical retrieval of the irregulars. If lexical retrieval fails for the irregular alternants of (4), the regularly derived substitutes produced in
their place will the result of applying Rule A to the combination of vowel-final stem and vowel-initial default ending. In case of instability and regularization, then, the changes in Japanese verbal inflection predicted by Analysis A are those of (5).

(5) Predicted Changes in Case of Regularization (Analysis A)

\[
\begin{align*}
[4 \text{ Hort}] & \quad /\text{mi-oo}/ \rightarrow [\text{mi-roo}] \\
[7 \text{ Neg}] & \quad /\text{mi-an(a-)}/ \rightarrow [\text{mi-ran(a-)}] \\
[5 \text{ Caus}] & \quad /\text{mi-ase-}/ \rightarrow [\text{mi-rase-}] \\
[8 \text{ Imp}] & \quad /\text{mi-e/} \quad \rightarrow [\text{mi-re}] \\
[6 \text{ Inf}] & \quad /\text{mi-i/} \quad \rightarrow [\text{mi-ri}] \\
[9 \text{ Pot}] & \quad /\text{mi-e-/} \quad \rightarrow [\text{mi-re-}]
\end{align*}
\]

Analysis A, in other words, predicts the emergence of the six r-initial innovative V-stem suffixes -roo, -rase-, -ri, -ran(a-), -re, and -re-.

In closing this subsection, let us return to the issue of the conditions under which Rule A would apply. Informally speaking, Rule A is limited to regular verbal inflection: it does not apply in irregular inflection, in adjectival inflection, or in derived or compound stems (including syntactic compounds (see Kageyama 1999: 301-303 and references cited there)); nor does it apply in the phrase-level or “postlexical” phonology. More generally, this will be true of any rule that resolves hiatus at inflectional verb stem boundary (see the discussion of Analysis C below), because hiatus remains unresolved in all the contexts indicated, as exemplified in (6).\(^3\)\(^4\)

(6) a. Derived verb stem \(\text{/mi-e/} \quad \text{“to be visible”}\)

b. Compound verb stem (lexical) \(\text{/mi-otos-/} \quad \text{“to overlook” (“see” + “drop”)}\)

c. Compound verb stem (syntactic) \(\text{/tabe-oe-/} \quad \text{“to finish eating”}\)

d. Adjectival inflection \(\text{/oso-i/} \quad \text{“late”}\)

e. Irregular verbal inflection \(\text{/ko-i/} \quad \text{“come!”}\)

f. Phrasal phonology \(\text{[a-oo]} \quad \text{“let’s meet” (hiatus due to w-deletion)}\)

It is well-known that the phonological processes operative in a given language typically vary both with the traditional morphological subdomains of inflection, derivation, and compounding and within subdomain, as in the case of English stress-sensitive and stress-neutral derivational affixes (Chomsky and Halle 1968) or Malayalam subcompounds and co-compounds (Mohanan 1986:80-105). Regarding hiatus at morphological boundary in particular, the Japanese situation has a close parallel in Turkish, where vowel sequences are disallowed across inflectional boundary but occur freely across compound boundary (orta+okul “middle school”); Turkish differs from Japanese in that derivation groups in this regard with inflection rather than with compounding (see examples in Kornfilt 1997, section 2.2).
There are several ways to deal with with restrictions like those we have seen to apply to Rule A, including appeal to independently motivated properties of the architecture of the grammar, appeal to stratal distinctions of the type postulated by Lexical Phonology, and writing the restrictions into the rule itself. Below, I sketch a treatment of the restrictions on Rule A that makes use of all three of these methods. A full consideration of the issues involved, however, is well beyond the scope of this paper.

I assume first that Merge, the syntactic structure-building operation, is driven by the selectional features of lexical items. These lexical items must therefore be stems rather than roots, because roots, capable in the general case of underlying stems of various lexical categories, are not guaranteed to have selectional features. As a result, a large part (at least) of stem-formation must be pre-syntactic—that is, performed internal to the lexicon. At the same time, in accordance with the abandonment of overgeneralization and filtering that characterizes Minimalist syntax, I assume that inflection, definable as the phonological spellout of features that are (potentially) syntactically determined, is uniformly post-syntactic.5 Rule A will be a rule of the (post-syntactic) phonology, so that if the internal structure of lexical stems is erased on their entrance into the syntactic derivation, it will be invisible to that rule. Among the examples of (6), (6a) and (6b) are lexical stems. The failure of Rule A to apply to those examples, then, is a consequence of grammatical architecture: (6a) and (6b) are formed pre-syntactically, but Rule A is post-syntactic.

The failure of Rule A to apply to examples (6c) and (6d), on the other hand, is a consequence of conditions that have been written into the rule: since the pre-hiatus element must be verbal, (6d) will fail to meet the rule’s input conditions, and since the post-hiatus element must be affixal, the same will be true of (6c). Syntactically created stems like /tabe-are-/ “be eaten” and /tabe-oe-/ “finish eating”, that is, are minimally different in that /are/ “passive” is an affix while /oe/ “finish” is a root (as shown by English, in a less agglutinative language the same contrast appears as the distinction between auxiliary and main verbs). The failure of Rule A to apply to examples (6e) and (6f), finally, is probably best understood as the result of stratification within the post-syntactic phonology, given that it is not unusual for for the phonology of regular inflection to differ systematically both from the phonology of irregular inflection and from the phonology of phrasal units.

2.2. Analysis B

In direct contrast to Analysis A, Analysis B takes the V-stem suffixes of Table 2 above as basic. With V-stem suffixes as a starting point, the C-stem suffixes of categories 1-5 may be produced by a rule deleting the second of two consonants across verb stem
boundary. Suffix-initial t, as in Perfective /-ta/ and Gerund /-te/, however, does not delete after a stem-final consonant: /tt rt wt/ across verb stem boundary surface as [tt], and /nt mt bt/ surface as [nd]. Given that the consonants that do delete, r, y, and s, are all non-stops, the consonant-deletion rule in question (below, “Rule B”) may be written as in (7).

(7) C [-stop] → φ / C v.]

The C-stem suffixes of categories 6-9, which cannot be produced by Rule B from the corresponding V-stem suffixes, will be irregular under Analysis B. Table 4 below shows the tripartition of suffix alternants induced by that analysis, where, as in Table 3 above, basic suffix alternants are unmarked, regular derived alternants are underlined, and irregular alternants are shaded.

<table>
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</tr>
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</tr>
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<td>mi-yoo</td>
</tr>
<tr>
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<td>mat-ase-</td>
<td>mi-sase-</td>
</tr>
<tr>
<td>6 Infinitive</td>
<td>mat-i̊</td>
<td>mi-φ</td>
</tr>
<tr>
<td>7 Negative</td>
<td>mat-an(a-)</td>
<td>mi-n(a-)</td>
</tr>
<tr>
<td>8 Imperative</td>
<td>mat-e</td>
<td>mi-ro</td>
</tr>
<tr>
<td>9 Potential</td>
<td>mat-e̊</td>
<td>mi-rare-</td>
</tr>
</tbody>
</table>

Table 4 Tripartition of Suffix Alternants Induced by Analysis B

Since basic and irregular suffix alternants, but not regularly derived alternants, will be lexically listed, the lexical representations of the nine suffixes in question according to Analysis B will be as in (7).

(7) Lexical Representations of Suffixes (Analysis B)

\[
\begin{align*}
[1 \text{ Ind}] & \quad /ru/ & [4 \text{ Hort}] & \quad /yoo/ & [7 \text{ Neg}] & \quad \text{an(a)}/C \underline{\text{__}} \\
& & & & \quad \text{n(a)} \\
[2 \text{ Prov}] & \quad /reba/ & [5 \text{ Caus}] & \quad /sase/ & [8 \text{ Imp}] & \quad e / C \underline{\text{__}} \\
& & & & \quad \text{ro}
\end{align*}
\]
In case of instability, we expect the irregular alternants of (7) to be replaced by regularly derived substitutes. In particular, we expect the replacements of (8).

(8) Predicted Changes in Case of Regularization (Analysis B)

<table>
<thead>
<tr>
<th>Case</th>
<th>Form</th>
<th>Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neg</td>
<td>/mat-n(a-)/</td>
<td>$\rightarrow$ [mat-(a-)]</td>
</tr>
<tr>
<td>Imp</td>
<td>/mat-ro/</td>
<td>$\rightarrow$ [mat-o]</td>
</tr>
<tr>
<td>6 Inf</td>
<td>/mat-φ/</td>
<td>[9 Pot] /mat-rare-/ $\rightarrow$ [mat-are-]</td>
</tr>
</tbody>
</table>

While it is sometimes suggested that something like the consonant-deletion rule of Analysis B represents a general principle of Japanese phonology because it results in a preferred syllable structure, the available evidence argues against such a suggestion. The available evidence is somewhat limited, since most Japanese consonant clusters that arise have second members that are oral stops, and such clusters are explicitly excluded from the input of Analysis B’s deletion rule. But clusters with second member /s/ must undergo that rule because of Causative /sase/, and it is not difficult to show that in other contexts, clusters with second member /s/ are simplified not by deleting /s/ but by assimilating the first consonant to it, as shown by the b and c examples of (8)-10 below (cf. Mester and Ito 1989:274-275 (fn.34)).

(8) a. /mat-sase/- $\rightarrow$ [matase-]
    b. /but-sak/- $\rightarrow$ [bussak-]
    c. /but-san/ $\rightarrow$ [bussan]

(9) a. /kak-sase/- $\rightarrow$ [kakase-]
    b. /hik-saraw/- $\rightarrow$ [hissaraw-]
    c. /hik-sage/- $\rightarrow$ [hissage-]

(10) a. /kes-sase/- $\rightarrow$ [kesase-]
    b. /maC-sugu/ $\rightarrow$ [massugu]

The consonant-deletion rule of Analysis B, then, much like the r-enphethesis rule of Analysis A, will have to be limited to inflectional morphology.

2.3. Analysis C

Analysis C takes advantage of the fact that, just as V-stem suffixes 1-5 are longer than their C-stem counterparts by a single consonant, C-stem suffixes 6-7 are longer than their
V-stem counterparts by a single vowel. In order to collapse the consonant-deletion rule covering suffixes 1-5 and the vowel-deletion rule that will cover suffixes 6-7, however, it is necessary to dispense with the limitation to non-stops that we wrote into Rule B, as in (11) (below, “Rule C”).

\[ [\text{a cons}] \rightarrow \phi \]  \[ (a \text{ cons}_v)_v \]  \[ \_a \_ \]

As a result, under Analysis C, it will be necessary either to mark t-initial suffixes as not undergoing Rule C or to derive forms containing such suffixes from representations in which the suffixes are added not to stems, but to infinitives, as was the case historically. Table 5 below shows the tripartition of suffix alternants induced by that analysis; as above, basic suffix alternants are unmarked, regular derived alternants are underlined, and irregular alternants are shaded.

<table>
<thead>
<tr>
<th>Category</th>
<th>C-stem</th>
<th>V-stem</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Indicative</td>
<td>mat-u</td>
<td>mi-ru</td>
</tr>
<tr>
<td>2 Provisional</td>
<td>mat-eba</td>
<td>mi-reba</td>
</tr>
<tr>
<td>3 Passive</td>
<td>mat-are-</td>
<td>mi-rare-</td>
</tr>
<tr>
<td>4 Hortative</td>
<td>mat-oo</td>
<td>mi-yoo</td>
</tr>
<tr>
<td>5 Causative</td>
<td>mat-ase-</td>
<td>mi-sase-</td>
</tr>
<tr>
<td>6 Infinitive</td>
<td>mat-i</td>
<td>mi-( \phi )</td>
</tr>
<tr>
<td>7 Negative</td>
<td>mat-an(a-)</td>
<td>mi-n(a-)</td>
</tr>
<tr>
<td>8 Imperative</td>
<td>mat-e</td>
<td>mi-ro</td>
</tr>
<tr>
<td>9 Potential</td>
<td>mat-e</td>
<td>mi-rare-</td>
</tr>
</tbody>
</table>

Table 5 Tripartition of Suffix Alternants Induced by Analysis C

Since basic and irregular suffix alternants, but not regularly derived alternants, will be lexically listed, the lexical representations of the nine suffixes in question according to Analysis C will be as in (12).

(12) Lexical Representations of Suffixes (Analysis C)

\[ [1 \text{ Ind}] \ /ru/ \quad [4 \text{ Hort}] \ /yoo/ \quad [7 \text{ Neg}] \ an(a) \]

\[ [2 \text{ Prov}] \ /reba/ \quad [5 \text{ Caus}] \ /sase/ \quad [8 \text{ Imp}] \ e / C \_ \quad \_ \]

\[ ro \]
In case of instability, we expect the irregular alternants of \( \{2\} \) to be replaced by regularly derived substitutes. In particular, we expect the replacements of \( \{3\} \).

\[ \begin{array}{c}
\{3\text{ Pass}\} /\text{rare}/ \\
\{6\text{ Inf}\} /i/ \\
\{9\text{ Pot}\} \left[ e / C _{\text{rare}} \right]
\end{array} \]

Because Rule C deletes the second of two vowels across morpheme boundary, it must be restricted in exactly the same way as Rule A: just as in the case of \( r \)-epenthesis, in other words, every instance of unresolved hiatus is an apparent counterexample. From our survey of the limitations on the environment of the rules associated with each of our three candidate analyses, it seems fair to conclude that there is no plausible argument for one analysis over the others on the basis of the generality of the rule proposed.

### 2.4. Ongoing Change

With the appearance of National Language Research Institute 1989-2006, data concerning verbal inflection has become available for 807 localities in Japan, 41 from the Ryukyuu dialect area and 766 from the Japanese dialect area proper (here, I will limit consideration to the latter). Under the idealizing assumption that they have developed independently of each other, a set of dialects of this sort constitutes a kind of linguistic laboratory, a natural morphophonological experiment, and an ideal way to test the predictions of the analyses we have seen.

The verdict of change in progress 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 in fact realized. Table 6 shows representative statistics for the six \( r \)-initial innovative V-stem suffixes (below, “\( r \)-suffixes”), the percentages in the last column giving a rough idea of the strength of each.
In contrast, no change predicted by Analyses B/C is attested. We may evidently conclude that Analysis A is the unique descriptive adequate analysis of the system of alternations in question—that is, the only analysis allowed by synchronic principles of grammar (UG).

3. Distinguishing Substitution from Transformation

We have looked at data from ongoing change as confirmation or disconfirmation of predictions that were generated on independent grounds—in particular, as consequences of the synchronic analyses A, B and C. Let us now temporarily alter our perspective and imagine that we have been confronted with the diachronic data in isolation from any concept of synchronic rules and representations. In that case, we might be tempted to treat the six innovative suffixes individually, in isolation from each other, and propose accounts like those quoted in ¶¶:

¶¶ a. Neg -n - ran “... the syllabic nasal has a low degree of independence, and it can be speculated that by inserting ra, the form was stabilized.” (Kobayashi 2004: 591)

b. Pot -rare- - re- “[D]election 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 crucial characteristic of such accounts is that they postulate diachronic rules that directly relate conservative and innovative suffix alternants. Such rules are of necessity suffix-specific, since there are no generalizations to be made about the relation between the two sets of alternants; this is particularly clear from the two cases cited, where the diachronic
rules postulated have precisely the opposite effect, one inserting the syllable -ra- and the other deleting it. Table 7 makes it clear both that the relationship between the innovative and conservative V-stem alternants is unsystematic—that is, that there is no generalization to be extracted from a comparison of columns 2 and 3, as the “changes” in column 4 show—and that the relationship between the innoviative V-stem alternants and the C-stem alternants, in contrast, is entirely systematic, each innovative V-stem alternant consisting of the corresponding C-stem alternant preceded by r.

<table>
<thead>
<tr>
<th>1 C-stem</th>
<th>2 V-stem (旧)</th>
<th>3 V-stem (新)</th>
<th>4 “Change”</th>
</tr>
</thead>
<tbody>
<tr>
<td>-oo</td>
<td>-yoo</td>
<td>-roo</td>
<td>y → r</td>
</tr>
<tr>
<td>-ase-</td>
<td>-sase-</td>
<td>-rase-</td>
<td>s → r</td>
</tr>
<tr>
<td>-i</td>
<td>-φ</td>
<td>-ri</td>
<td>φ → ri</td>
</tr>
<tr>
<td>-an</td>
<td>-n</td>
<td>-ran</td>
<td>φ → ra</td>
</tr>
<tr>
<td>-e</td>
<td>-ro</td>
<td>-re</td>
<td>o → e</td>
</tr>
<tr>
<td>-e-</td>
<td>-rare-</td>
<td>-re-</td>
<td>ra → φ</td>
</tr>
</tbody>
</table>

Table 7 C-stem suffixes, V-stem suffixes (conservative), V-stem suffixes (innovative)

But postulating category-specific rules to relate conservative and innovative forms does not simply fail to capture a generalization. Such accounts represent a fundamental misconstrual of the change process involved, a confusion of two totally distinct types of change. To see this, let’s look at an example from the history of English.

Table 8 shows the regularization of the past tense forms of three verbs, reach, help, and climb, with the four columns corresponding to those of Table 7.

<table>
<thead>
<tr>
<th>1 Present</th>
<th>2 Past (旧)</th>
<th>3 Past (新)</th>
<th>4 “Change”</th>
</tr>
</thead>
<tbody>
<tr>
<td>reach</td>
<td>raught</td>
<td>reached</td>
<td>ɔo → ıtf</td>
</tr>
<tr>
<td>help</td>
<td>holp</td>
<td>helped</td>
<td>oLP → elpt</td>
</tr>
<tr>
<td>climb</td>
<td>clomb</td>
<td>climbed</td>
<td>om → ımpd</td>
</tr>
</tbody>
</table>

Table 8 English present tense, past tense (archaic), past tense (modern) verb forms

In this case, presumably no linguist would postulate diachronic rules deriving innovative past tense forms directly from their conservative counterparts. But this is not just because there is no generalization to be made about the changes involved. Rather, it is because it is evident in this case that the innovative forms are not transforms of the conservative
forms they replace. Rather, they are substitutes for those conservative forms generated by an independent process, here simply the addition of the default form of the suffix to the default form of the stem. In the same way, the innovative V-stem alternants of Table 7 are not transforms of the conservative alternants they replace, but substitutes generated by an independent process, namely r-epentheses as applied to the default suffix when it follows a vowel-final stem. Category-specific accounts of innovative r-suffixes, including but not limited to the well-known “ra-nuki” account of innovative vowel-stem potentials, thus represent a confusion between transformation and substitution, a distinction central to historical linguistics since the Neogrammarians.

In some cases, there is also empirical evidence against particular transformative accounts of innovative suffix alternants. This evidence arises because the claim that innovative suffix Y represents a transformation of the conservative suffix X entails that the distribution of Y should be included within the distribution of X, and it is sometimes possible to show that this entailment is contrary to fact. For example, the idea that innovative imperative -re is based on conservative -ro is belied by the existence of localities where mire has replaced or is in the process of replacing not miro, but miyo or mii, and the idea that innovative hortative -roo is based on conservative -yoo is belied by the existence of localities where miroo has replaced or is in the process of replacing not miyoo, but myuu or myoo.

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. 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 alternations, Analysis A would be the least highly valued analysis of the three. This is because Analysis A treats six nonbasic suffixes as irregular, as opposed to the four of Analysis B and the two of Analysis C. Correspondingly, given that nine basic alternants must be listed in any case, there will be fifteen suffix alternants in the lexicon under Analysis A, as opposed to thirteen under Analysis B and eleven under Analysis C.

What I will propose is that that the choice of Analysis A can be explained if we retain the concept of predictability, but 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 will mean that the factor of lexical frequency will enter into the predictability calculation. In particular, it may be advantageous to take a certain set of 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.

There is another hypothesis that I will borrow from Albright as well, the idea that in choosing basic forms for systems of inflectional alternations, speakers do limit themselves, as we have implicitly assumed to this point, to actually occurring alternants, and furthermore, that the set of basic alternants must be drawn from a consistent morphological or phonological environment. Although Albright takes this condition to be completely general, I think it is clear that it does not apply to alternations that are phonetically motivated and automatic, although I will not try to demonstrate that here. This latter hypothesis is given as Hypothesis 1 in (§5) below, while that concerning predictability is given as Hypothesis 2. In order to be usable, Hypothesis 2 requires a characterization of the set of inflected forms that are predicted by a given analysis; this is given in the appended definition.

(§5) Two hypotheses (based on Albright 2002:ix)

a. Hypothesis 1 Base forms are surface alternants drawn from a fixed morphologically or phonologically defined environment. (Condition: Hypothesis 1 applies only to non-productive (non-automatic) alternations.)

b. Hypothesis 2 Base forms of both stems and affixes are chosen, consistent with Hypothesis 1, so as to allow prediction of the maximal number of inflected forms from the paradigm of the maximal number of stems. (Definition: The inflected forms predicted by a given analysis are those that follow from the base forms and rules of that analysis (in the present case, forms with basic or derived suffixes, but not forms with irregular suffixes).)

Let us now consider how these two hypotheses apply to the choice among Analyses A, B, and C. Consider first Hypothesis 1. For each inflectional category, there are two allomorphs, distinguished by whether they are used after consonant-final or vowel-final stems. This factor, then, defines the only “fixed morphologically or phonologically defined environment[s]” on the basis of which the set of base forms can be determined. Hypothesis 1, then, means that base forms must coincide either with the set of C-stem alternants or the set of V-stem alternants; the option of drawing base 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. Hypothesis 1, in other words, excludes Analysis C.
Now consider the effect of Hypothesis 2. It is well-known that consonant-stem verbs are roughly twice as common as vowel-stem verbs in the lexicon of Japanese, and have been throughout the history of the language. I will base my figures on the result of searching the relevant designations for conjugational class in three dictionaries on CD-ROM, computing the ratio between the two classes expressed as a percentage of the total, and averaging the results for the three dictionaries. Rounding to the nearest percent gives the result that of every 100 regular verbs, 67 are consonant-stems and 33 are vowel-stems.

Assume a sample lexicon of 100 verb stems, 67 consonant stems and 33 vowel stems. There will then be 900 inflected forms, 100 for each category, distributed among C-stems and V-stems in the manner shown in Table 9.

<table>
<thead>
<tr>
<th>Category</th>
<th>C-stem</th>
<th>V-stem</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Indicative</td>
<td>67</td>
<td>33</td>
</tr>
<tr>
<td>2 Provisional</td>
<td>67</td>
<td>33</td>
</tr>
<tr>
<td>3 Passive</td>
<td>67</td>
<td>33</td>
</tr>
<tr>
<td>4 Hortative</td>
<td>67</td>
<td>33</td>
</tr>
<tr>
<td>5 Causative</td>
<td>67</td>
<td>33</td>
</tr>
<tr>
<td>6 Infinitive</td>
<td>67</td>
<td>33</td>
</tr>
<tr>
<td>7 Negative</td>
<td>67</td>
<td>33</td>
</tr>
<tr>
<td>8 Imperative</td>
<td>67</td>
<td>33</td>
</tr>
<tr>
<td>9 Potential</td>
<td>67</td>
<td>33</td>
</tr>
</tbody>
</table>

Table 9 Inflected forms of 100 randomly selected verbs

Of those 900 forms, those predictable by Analyses A, B, and C, according to the definition attached to Hypothesis 2, are as shown in Tables 10-12, respectively.
Table 10 Predicted Forms (Analysis A) Table 11 Predicted Forms (Analysis B) Table 12 Predicted Forms (Analysis C)

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 and forms with shorter suffixes for categories 1-7. The total number of forms predicted by Analysis A is 702, or 78% of the total; for Analysis B, the number is 632, or 70% of the total; and for Analysis C, it is 766, or 85% of the total. The crucial result is that, of the two analyses consistent with Hypothesis 1, Analysis A has a distinctly higher predictability rating than Analysis B. The results of evaluating all three analyses vis-a-vis both hypotheses are shown in Table 13.

Table 13 Evaluation of Analyses A, B, and C on the basis of Hypotheses 1 and 2

In this way, the conjunction of Hypotheses 1 and 2 determine the choice of Analysis A as the descriptively adequate analysis.

In closing this section, let us say a word about the factor of lexical frequency. First, the literature contains many instances of the claim that lexical or type frequency (but not
token frequency) is a crucial determinant of the strength of morphological and phonological patterns (see e.g. Albright 2007:15, Hayes and Londe 2006:65, Bybee 2001:118ff.). Brute force application of that claim to the case at hand might yield a principle such as “If stem-type A is more common than stem-type B, affixes associated with stem-type A are basic with respect to affixes associated with stem-type B.” But such a formulation clearly lacks generality, is implausible as a principle governing acquisition, and ignores the role of phonological predictability. Hypothesis 2 resolves all three of these problems. While the calculation we have just performed might be viewed as artificial, then, its crucial property is that it represents the integration of the factors of lexical frequency and phonological predictability into a single criterion.

5. Conclusions

There are a number of conclusions that can be drawn from our treatment of Japanese verbal inflection. First, speakers do not simply memorize every suffix alternant with its environment, as a pre-generative treatment (e.g. Bloch 1946) would claim; the generative hypothesis that speakers postulate base forms and rules to derive non-base forms is supported, at least for inflectional alternations. Second, since Hypotheses 1 and 2 are both necessary to account for the choice of Analysis A over Analyses B and C, we have evidence that both, in some form, are synchronic principles of grammar—that is, part of UG.

Finally, at least three suggestions that are sometimes made about the nature of base forms for inflectional alternations and how speakers determine them are counterexemplified by the case we have seen, showing that at the least, such suggestions do not attain full generality. The first of these is that speakers derive inflectional word forms from other inflectional word forms within the paradigm of the same stem or lexeme (Albright 2002, Bybee 1985:7). Such a model is inherently incapable of dealing with interparadigmatic alternations of suffixes like the ones we have seen here. In the general case, in other words, inflectional morphology is morpheme-based, not word-based.

A second claim that is counterexemplified by the Japanese case is that speakers choose base forms on semantic criteria (Bybee 1985:57). There are, it goes without saying, no semantic distinctions between C-stem and V-stem alternants of the suffixes we have examined. A strong hypothesis regarding semantic determination would be that reference to semantic categories is eliminable in favor of an appropriate concept of predictability.

A third and final claim about how speakers choose base forms for alternating morphemes that is inconsistent with the Japanese case is that speakers obey word-level phonotactics in
doing so (Hale 1973; for doubts about the existence of C-final verb stems in Japanese, see Vance 1987:199, 207–208). The entire story we have told here depends on postulating consonant-final verb stems for Japanese that would be inadmissible as phonological words.

In closing, it is important to point out that, while we have proposed here that speakers are interested in predicting inflected forms rather than, as in classical generative phonology, morpheme alternants, the central role of predictability represents an important point of continuity with the earlier tradition.

References

Albright, Adam. 2007. Modeling Analogy as Probabilistic Grammar. Ms., MIT.
Kiparsky, Paul. 1971. Historical Linguistics. Lecture, University of Maryland. Published in Dingwall 1978 and in


NOTES

1 The negative suffix is given for convenience here in its Western Japanese form -(a)n; in Eastern Japan, it is an adjectival stem-forming suffix -(a)na-. 

2 de Chene 1985, 1987 (C-stem alternants as basic); McCawley 1968: 93ff. (V-stem alternants as basic); Kuroda 1960, Chew 1973 (longer alternants as basic); Bloch 1946 (listing of all alternants).

3 Fukushima’s (2004:195 fn.4) criticism of the r-epenthesis rule de Chene 1987 for incorporating restrictions of 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.

4 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 in a list of cases for which “Epenthesis is ... forced by some general prosodic requirement...” As the examples of (6) show, Rule A has a much more restricted range of application than is consistent with de Lacy’s claim.

5 Insofar as the phonology of irregular inflection overlaps with the phonology of lexical (i.e. presyntactic) morphology, the post-syntactic placement of irregular inflection raises a problem of duplication which I will not try to resolve here.

6 On this point, I would like to acknowledge the generosity of the National Language Research Institute in allowing me to view unpublished results of the preparatory survey for the Grammar Atlas of Japan.