Optimization of the Verbal Inflectional Paradigm by the Cyclic Application of Morphophonological Processes: Evidence from Potential Forms in Japanese

Abstract: In Japanese, a series of morphophonological changes that reorganizes the verbal inflectional paradigms is currently underway. The changes in potential forms involve two innovative processes: ar-Deletion and re-Insertion. This paper analyzes these morphophonological changes in the Japanese potential forms, and models the mechanism that governs the sequential changes, using the Corpus of Spontaneous Japanese. By positing a chronological order between the changes, I argue that the initial change in consonant-final verbs is motivated by semantic disambiguation, and the subsequent change in vowel-final verbs is triggered by analogical leveling for the optimization of the conjugation paradigm. This analogical leveling reorganizes the paradigm in order to counter the increased discrepancy between potential forms of consonant-final verbs and vowel-final verbs caused by the previous change. I propose that positing this two-step process is crucial to understanding the diachronic changes at issue.

Keywords: corpus, morphophonology, modeling, insertion, deletion, analogical leveling, semantic disambiguation

1 Introduction


The previous research has examined each of these phenomena in terms of linguistic as well as social (extra-linguistic) factors. Some studies have contributed to our understanding of the interaction between the changes and social factors (e.g., Matsuda, 1993; Sano, 2011), while others have contributed to the development of linguistic theory (e.g., Fukushima, 2004; Ito & Mester, 2004; Sano, 2011). However, the two morphophonological phenomena has mostly been analyzed separately, and therefore a unifying account is still lacking. Furthermore, previous work has drawn on intuition-based and dictionary-based data, while data from spontaneous speech have rarely been used. Thus, the underlying mechanism governing the changes is not yet fully understood. This paper, therefore, further examines the morphophonological
changes in the Japanese potential forms. I propose a unified account of the seemingly separate phenomena, and propose a single mechanism that governs the sequential changes in potential forms. The proposed model is based on an empirical analysis of the two changes in the *Corpus of Spontaneous Japanese* (henceforth, the CSJ; Kokuritsu Kokugo Kenkyuujo, 2008).

The remainder of this paper is organized as follows. Section 2 describes the verbal inflections and potential forms in Japanese, as well as the properties of each innovative process. Section 3 presents a quantitative examination of the changes. Based on the results of the quantitative examination, Section 4 proposes a model of the changes. Finally, Section 5 concludes the discussion.

# 2 Background

In this section, I first describe the verbal inflectional patterns, including the potential forms in Japanese. Then, I present the properties of each of the innovative processes. In doing so, I clarify the issues to be discussed in the following sections.

## 2.1 Verbal inflections in Japanese

Japanese verb stems are classified into two types: a consonant-final verb (henceforth, C-verb) that has a stem ending with a consonant (as in *ik* ‘go’ and *nom* ‘drink’); and a vowel verb (henceforth, V-verb) that has a stem ending with a vowel (as in *mi* ‘see’ and *tabe* ‘eat’) (Bloch, 1946). Each of the inflectional forms in Japanese is obtained by attaching a suffix to a verb stem. As shown in Table 1, the difference in the types of verbs produces allomorphy in the verbal inflectional paradigm; in other words, the suffixes undergo morphophonological alternation in such a way that the C-verbs and V-verbs take different inflectional suffixes.

<table>
<thead>
<tr>
<th>Inflectional form</th>
<th>C-verb (e.g., <em>ik</em>)</th>
<th>V-verb (e.g., <em>mi</em>)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present indicative</td>
<td><em>ik-u</em></td>
<td><em>mi-ru</em></td>
</tr>
<tr>
<td>Imperative</td>
<td><em>ik-e</em></td>
<td><em>mi-ro</em></td>
</tr>
<tr>
<td>Conditional</td>
<td><em>ik-eba</em></td>
<td><em>mi-reba</em></td>
</tr>
<tr>
<td>Causative</td>
<td><em>ik-ase</em></td>
<td><em>mi-sase</em></td>
</tr>
<tr>
<td>Passive</td>
<td><em>ik-are</em></td>
<td><em>mi-rare</em></td>
</tr>
<tr>
<td>Honorific</td>
<td><em>ik-are</em></td>
<td><em>mi-rare</em></td>
</tr>
<tr>
<td>Spontaneous</td>
<td><em>ik-are</em></td>
<td><em>mi-rare</em></td>
</tr>
</tbody>
</table>

Table 1 illustrates the suffix allomorphy for representative inflectional forms. The passive, honorific, and spontaneous forms take identical suffixes, -*are* for C-verbs and -*rare* for V-verbs. What becomes crucial in the following discussions is that the C-verbs take vowel-initial suffixes, whereas the V-verbs take consonant-initial suffixes. This alternation is partly driven by the preference for the CV syllable structure in Japanese (Ito, 1989). Furthermore, except for the imperative forms, the difference between the suffixes for the C-verbs and those for the V-verbs mostly lies in the presence/absence of initial consonants. For example, for the present indicative, C-verbs take -*u* as in *ik-u*; on the other hand, V-verbs take -*ru* as in *mi-ru*, and hence, the difference between the two suffixes is the presence/absence of [r]. The potential forms, however, do not conform to this pattern. In the next section, I will describe the suffix allomorphy of the potential forms in more detail.

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1 The causative, passive, honorific, and spontaneous forms are followed by suffixes such as -*r-u* (present indicative) and -*ta* (past), while the present indicative, imperative, and conditional forms are not.

2 The suffix -*rare* does not have a spontaneous meaning if it is combined with the verb *ik* ‘go.’ However, the homonym of *ik* with the meaning ‘pass away’ can have the spontaneous meaning.
2.2 Potential forms

The potential forms presented here are based on the current norm for Standard Japanese.3

Table 2. Suffix allomorphy in potential forms

<table>
<thead>
<tr>
<th>Inflectional form</th>
<th>C-verb</th>
<th>V-verb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential</td>
<td>ik-e</td>
<td>mi-rare</td>
</tr>
<tr>
<td></td>
<td>nom-e</td>
<td>tabe-rare</td>
</tr>
</tbody>
</table>

(1)  Asita-wa  gakkoo-ni  ik-e-nai.
     tomorrow-TOP  school-LOC  go-POT-NEG.NonPast
     ‘Tomorrow, (I) cannot go to the school.’

(2)  Kokode  hosi-ga  mi-rare-ru.
     here  star-NOM  see-POT-NonPast
     ‘(We) can gaze at the stars here.’

As shown in Table 2 and examples (1) and (2), C-verbs take the potential suffix -e, as in ik-e ‘can go’ and nom-e ‘can drink.’ V-verbs, on the other hand, take the potential suffix -rare, whose initial segment is a consonant, as in mi-rare ‘can see’ and tabe-rare ‘can eat.’ Unlike other inflectional forms, the difference between these two suffixes is the presence/absence of [rar], instead of [r] alone.

2.3 Innovative processes

The morphophonological changes in the potential forms in Japanese are created by a sequence of two diachronic changes: ar-Deletion and re-Insertion. The application of these processes produces the sequential changes in potential forms. In this section, I describe the properties of the innovative processes one by one. An overview of the different phases in the sequential changes is presented in Figure 1.

![Figure 1. Phases in the sequential changes](image)

Specifically, ar-Deletion caused the change from Phase 1 to Phase 2 and from Phase 2 to Phase 3; and re-Insertion caused the change from Phase 3 to Phase 4 and from Phase 4 to Phase 5. Additionally, the current norm reflects the potential forms in Phase 2. This means that there is a gap between “Standard Japanese” and more colloquial forms.

3 Standard Japanese is a conservative variety based on the written language that is taught in schools, used in formal speech and writing, etc. By these standards, innovations such as those discussed in this paper are generally considered “grammatical errors,” or at the very least, colloquial language.
2.3.1 *ar*-Deletion (C-verbs)

As mentioned above, *ar*-Deletion led to the change from Phase 1 to Phase 2. The innovative process of *ar*-Deletion has been observed since the 16th century, and the change is now complete (Yamaguchi & Akimoto, 2001). Importantly, only C-verbs are subject to *ar*-Deletion in Phase 1; in other words, the change that potential forms of C-verbs underwent during the transition from Phase 1 to Phase 2 is interpreted as the consequence of *ar*-Deletion. Unlike the current norm, potential forms for C-verbs during this time period were derived by attaching the potential suffix -are to verb stems (Hibiya, 1999; Sato, 1977; Yamaguchi & Akimoto, 2001). That is, the potential forms used to take the same suffix that passive, honorific, and spontaneous forms did (see Table 1). In (3) and (4), respectively, I present examples of the classical variant and modern variant in C-verbs that were observed in the CSJ.

(3) Examples of the classical variant in C-verbs
   a. Gaikoku-ni nanka ik-are-nai. (S00M0213)
      foreign country-LOC NPI go-POT-NEG.NonPast
      ‘(I) can never go to foreign countries.’
   b. Kono kata-to-nara nakayoku yatteik-are-ru. (S01F1388)
      this person-with-if friendly get along-POT-NonPast
      ‘With this person, (I) can get along.’
   c. Mono-o tabe-nakereba iki-te-ik-are-nai. (S07F1002)
      thing-ACC eat-NEG.COND live-TE-go-POT-NEG.NonPast
      ‘Without eating, (we) cannot survive.’

(4) Examples of the modern variant in C-verbs
   a. Yutorinoaru kaigairyokoo-mo ik-e-ru. (A07F0908)
      leisurely foreign travel-too go-POT-NonPast
      ‘(I) can make a leisurely foreign trip, too.’
   b. Kanzyoo-o arawas-e-ru. (A07F0908)
      emotion-ACC express-POT-NonPast
      ‘(I) can express emotions.’
   c. Meikakuna kotae-ga das-e-nai. (S00M0061)
      clear answer-NOM provide-POT-NEG.NonPast
      ‘(I) cannot provide a clear answer.’

The classical variant of the potential for a C-verb comprises the consonant-final stem and the potential suffix -are; on the other hand, *ar*-Deletion yields the modern variant that comprises the verb stem and -e. The crucial difference between the classical and modern variants is that [ar] are deleted in the modern forms, as shown in Figure 2.

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4 The verbs in (3) are all based on *ik* (*ik*, and compounds with *ik*). In the past, the classical variants of potential forms were able to take various kinds of verbs; however, as a result of the change/decline, they can take only specific verbs in contemporary Japanese. Even in the CSJ, which has a large amount of speech data, we can observe only *ik*-based examples.

5 The alpha-numeric character at the end of each example (S00M0213) is the speech ID, which is used as the index of each data item in the CSJ. In each speech ID, the leading character “A” indicates that the sample in question is classified as academic presentation speech (APS). “S” indicates simulated public speaking (SPS). The letter in the middle, “M” or “F,” indicates whether the speaker is male or female.
ar-Deletion \( \rightarrow \) Changes in the potential suffix attached to a C-verb stem

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>ik ‘go’</td>
<td>ik-are</td>
</tr>
<tr>
<td>nom ‘drink’</td>
<td>nom-are</td>
</tr>
</tbody>
</table>

Figure 2. Changes in the potential suffix from Phase 1 to Phase 2

2.3.2 \textit{ar}-Deletion (V-verbs)

\textit{ar}-Deletion also affected V-verbs at a later diachronic stage. Specifically, it produced the change from Phase 2 to Phase 3. This innovative process has been observed since the 1920s, and it is regarded as a change in progress (Kindaichi et al., 1995). The potential forms for V-verbs in Phase 1 and Phase 2 were derived by attaching the potential suffix \textit{-rare} to verb stems. Similar to C-verbs, the potential forms for V-verbs also took the same suffix as the passive, honorific, and spontaneous forms do (see Table 1). Thus, the potential suffix subject to \textit{ar}-Deletion in V-verbs was \textit{-rare} (Fukushima, 2004; Ito & Mester, 2004; Kanda, 1964; Matsuda, 1993; Nakamura, 1953; Sano, 2010, 2011). In (5) and (6), respectively, I present examples of the classical variant and modern variant in V-verbs.

(5) Examples of the classical variant in V-verbs
   a. Wazukana okane-de ironna mono-ga tabe-rare-ru. (S11F1157)
      a little money-by various things-NOM eat-POT-NonPast
      ‘(We) can eat various foods with only a little money.’
   b. Siai-ni-wa de-rare-masen-desita. (S01M0158)
      match-DAT-TOP participate-POT-NEG.POL-POL
      ‘(I) could not participate in the match.’
   c. Zitti-no siken-wa uke-rare-nai. (S04F0069)
      field-GEN test-TOP take-POT-NEG.NonPast
      ‘(We) cannot take the field-test.’

(6) Examples of the modern variant in V-verbs
   a. Kare-wa byooki-datta-kara ko-re-nai. (A05M0890)
      He-TOP sick-COP.Past-because come-POT-NEG.NonPast
      ‘He cannot come, because he was sick.’
   b. Mawari-ga mattaku mi-re-naku-naru. (S00M0475)
      around-NOM completely look-POT-NEG-become.NonPast
      ‘(We) completely lose sight of our surroundings.’
   c. Hokani-mo kangae-re-ru-ndesu-ga. (A03M0555)
      other-too think-POT-NonPast-POL-but
      ‘(We) can also think of others, but...’

The classical variant of the potential for a V-verb takes the potential suffix \textit{-rare}, while \textit{ar}-Deletion produces the modern suffix \textit{-re}.

This innovative process has traditionally been analyzed as “\textit{ra}-Deletion” where the initial syllable [ra] is

\footnote{There are a number of extensive studies on \textit{ar}-Deletion (especially for V-verbs) from various linguistic perspectives, and its sociolinguistic aspects have been examined (Nakamura, 1953; Kanda, 1964; Matsuda, 1993; Inoue, 1998; and others). These previous studies show that \textit{ar}-Deletion (i) is more compatible with affirmative contexts than with negative contexts; (ii) is restricted to short stem verbs; (iii) does not occur in compound verbs, auxiliary verbs, or causative verbs; (iv) is more frequent in main clauses than in subordinate clauses; (v) is more compatible with verb stems that end in \textit{i} than with verb stems that end in \textit{e}; (vi) is preferred by younger speakers; and (vii) is preferred by female speakers.}
deleted from the classical -rare. This is because past phonological studies of Japanese have been conducted based on CV-moras, but not on segments, with attention to the preference for the CV syllable structure in Japanese. In this study, however, I assume ar-Deletion where the two segments [ar] in the middle of -rare are deleted. The outcomes produced by the two analyses are identical in the sense that both deletion processes yield -re from -rare; however, if we assume the former analysis, ar-Deletion, the diachronic changes in potential forms become more consistent and straightforward.\(^7\) That is, the analysis that assumes ra-Deletion ends in three innovative processes: ar-Deletion, ra-Deletion, and re-Insertion, where C-verbs and V-verbs undergo two different processes (ar-Deletion, ra-Deletion). On the other hand, the analysis that assumes ar-Deletion needs only two innovative processes: ar-Deletion and re-Insertion, where C-verbs and V-verbs undergo the same process (ar-Deletion). Another advantage of the latter analysis is that the two innovative processes apply cyclically, in the diachronic sense, in the same manner. In the first cycle, ar-Deletion yields the change in C-verbs (Phase 1 to Phase 2) and, subsequently, the change in V-verbs (Phase 2 to Phase 3). In the second cycle, re-Insertion yields the change in C-verbs (Phrase 3 to Phase 4) and, subsequently, the change in V-verbs (Phase 4 to Phase 5). Thus, I assume that the two segments [ar] in the middle of -rare are deleted by ar-Deletion.

Ar-Deletion produces the change in potential forms for V-verbs in the following manner: the classical variants such as mi-rare ‘can see’ and tabe-rare ‘can eat’ change to the modern variants such as mi-re and tabe-re, as shown in Figure 3. At this stage, where C-verbs and V-verbs have undergone ar-Deletion, the suffixes representing the potential forms for both C-verbs and V-verbs become distinct (-e and -re) from those representing the passive, honorific, and spontaneous forms (-are and -rare).

\[ar-\text{Deletion} \Rightarrow \text{Changes in the potential suffix attached to a V-verb stem}\]

<table>
<thead>
<tr>
<th>Phase 2</th>
<th>Phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>mi ‘see’</td>
<td>mi-rare =&gt; mi-re</td>
</tr>
<tr>
<td>tabe ‘eat’</td>
<td>tabe-rare =&gt; tabe-re</td>
</tr>
</tbody>
</table>

**Figure 3. Changes in the potential suffix from Phase 2 to Phase 3**

### 2.3.3 re-Insertion (C-verbs)

Re-Insertion produced the changes from Phase 3 to Phase 4, and from Phase 4 to Phase 5. This innovative process has been observed since the 1990s, and the change is currently underway (Shioda, 2000; Inoue & Yarimizu, 2002). Similar to the previous deletion process, re-Insertion was initially observed in C-verbs, followed by V-verbs, producing the change from Phase 3 to Phase 4. After the application of ar-Deletion (from Phase 2 to Phase 3), potential forms for C-verbs are derived by attaching the potential suffix -e to verb stems. Thus, the potential suffix subject to re-Insertion is -e (Inoue & Yarimizu, 2002; Sano, 2010, 2011; Shin, 2004; Shioda, 2000).\(^8\) In (7), I present examples of the emerging variant in C-verbs. Because the potential forms in C-verbs in the transition from Phase 3 to Phase 4 have undergone ar-Deletion, the modern variant here is same as the variant presented in (4).

(7) Examples of the emerging variant in C-verbs (after ar-Deletion)

a. Sinu-made soko-de sum-ere-tara. (S03M0570)
   die-until there-LOC live-POT-COND
   ‘If (I) could live there, I would— for the rest of my life.’

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7 This analysis was suggested by James Whang (personal communication).
8 Although re-Insertion is less well understood, the previous studies have identified several factors affecting its distribution. These studies show that re-Insertion (i) is more frequent in short stem verbs than in long stem verbs; (ii) is more compatible with negative contexts; (iii) is preferred by male speakers; (iv) is preferred by younger speakers; and (v) is more compatible with the casual speech style.
b. Kou-iu siki-de arawas-ere-ru. (A07M0956)
   like this formula-by express-POT-NonPast
   ‘(We) can express (it) in this kind of formula.’

c. Yuuzai-ni motteik-ere-ru. (S04M1512)
   guilty-DAT take-POT-NonPast
   ‘(We) can get a conviction.’

The modern variant of the potential suffix is -e; on the other hand, re-Insertion changed it to -ere. This change is shown in Figure 4.

re-Insertion => Changes in the potential suffix attached to a C-verb stem

<table>
<thead>
<tr>
<th>Phase 3</th>
<th>Phase 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ik ‘go’</td>
<td>ik-ere</td>
</tr>
<tr>
<td>nom ‘drink’</td>
<td>nom-ere</td>
</tr>
</tbody>
</table>

Figure 4. Changes in the potential suffix from Phase 3 to Phase 4

2.3.4 re-Insertion (V-verbs)

Re-Insertion subsequently diffused to V-verbs and produced the change from Phase 4 to Phase 5 (Inoue & Yarimizu, 2002; Shioda, 2000). After the application of ar-Deletion, potential forms for V-verbs in Phase 3 and Phase 4 are obtained by attaching the potential suffix -re to verb stems. Thus, the potential suffix subject to re-Insertion is -re (Inoue & Yarimizu, 2002; Sano, 2010, 2011; Shin, 2004; Shioda, 2000). In (8), I present examples of the emerging variant in V-verbs. Because the potential forms in the transition to Phase 4 underwent ar-Deletion, the modern variant here is same as the variant presented in (6).

(8) Examples of the emerging variant in V-verbs (after ar-Deletion)

a. Subete zibun-de kime-rere-ru. (S08M1255)
   everything self-by decide-POT-NonPast
   ‘(I) can decide everything by myself.’

b. Sono kodomo-mo kendo-no boogu-o tuke-rere-ru. (S08M1255)
   that child-too Kendo-GEN protector-ACC wear-POT-NonPast
   ‘Also, the child can wear Kendo gear.’

c. Itiban-dearu yoona mono-o uke-rere-ru-nodeareba, … (S08M1255)
   best-COP like thing-ACC take-POT-NonPast-AUX
   ‘If (I) can take one that is like one of the best, …’

The modern variant of the potential suffix is -re; re-Insertion produces the emerging variant, -rere, as exemplified in Figure 5.

re-Insertion => Changes in the potential suffix attached to a V-verb stem

<table>
<thead>
<tr>
<th>Phase 4</th>
<th>Phase 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>mi ‘see’</td>
<td>mi-re</td>
</tr>
<tr>
<td>tabe ‘eat’</td>
<td>tabe-rere</td>
</tr>
</tbody>
</table>

Figure 5. Changes in the potential suffix from Phase 4 to Phase 5
The previous studies identified the properties of each of the phenomena, except that I argued that what has been hitherto treated as *ra*-Deletion should be treated as *ar*-Deletion. However, in order to shed light on the global picture of the change and the mechanism behind the whole change, I conducted an empirical study of the use of these variants in a large-scale corpus of spontaneous speech. Section 3 presents the quantitative analysis of the data.

### 3 A quantitative analysis

This section presents the quantitative analysis of the diachronic changes reviewed in Section 2. The purposes of using a speech corpus are as follows: (i) to understand the current distribution or usage of potential forms, (ii) to understand the progress of the changes, and (iii) to confirm the order of the changes proposed in the previous studies, as illustrated in Figure 6.

![Figure 6. Order of the changes in potential forms](image)

#### 3.1 Method

To investigate the current distribution of the potential forms and how the changes proceed, I searched through the CSJ (Kokuritsu Kokugo Kenkyuujo, 2008). The CSJ is one of the largest corpora of spoken Japanese, based on 662 hours of speech with 75 million words, produced by a total of 1,417 speakers. This corpus is large and comes with a rich annotation system. Most of the samples are monologues. These monologues are classified into two types: “Academic Presentation Speech (APS)” and “Simulated Public Speaking (SPS).” In general, the APS data are characterized by a formal speaking style, whereas the SPS data are characterized by a more casual and informal style. Thus, the APS and SPS data represent two different speech styles.

I retrieved the target items from the CSJ in the following manner: (i) I used YokkaGrep (http://www.yokkasoft.net/NoEditor/), which is a general text editor; (ii) all sub-corpora of the CSJ were targeted, and every utterance in the CSJ was included; and (iii) I employed the phonetic transcription provided by “TRN-SJIS” files.9 The retrieved data were then filtered as follows. In cases where potential forms were identical to passive, honorific, and spontaneous forms (the classical variants in C-verbs in Phase 1 before *ar*-Deletion, such as *ik*-are, and *nom*-are, and the classical variants in V-verbs in Phase 1 and Phase 2 before *ar*-Deletion, such as *mi*-rare, and *tabe*-rare), the data were manually examined with reference to the context, and forms other than potential forms were excluded from the dataset.

In the analysis, I assumed the apparent-time hypothesis (Bailey, 2002), where the difference in speakers’ birth year corresponds to the actual flow of time. That is, utterances produced by older speakers represent the properties of the dialect/language in the past, while utterances produced by younger speakers represent recent trends. By comparing the utterances by speakers in different generations, we can examine how the changes proceed. Although past speech cannot be directly observed, this method makes it possible to investigate linguistic changes across time.

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9 According to a pilot study, the total number of tokens of modern variants for re-Insertion exceeds 20,000, as opposed to 20 tokens of re-Inserted forms (emerging variants in C-verbs and V-verbs) in the CSJ. This yields a rate of re-Insertion of less than 0.01%, making it almost impossible to analyze the distribution of re-Insertion. Therefore, I extracted the modern variants with re-Insertion by limiting the target to verbs that produce the re-Inserted forms. In other words, if a verb is not observed with re-Inserted form, I do not include modern variants with re-Insertion for that verb in the dataset.
3.2 Current distribution

An exhaustive search of the CSJ yielded a dataset consisting of 13,176 tokens of potential forms. The variants were limited to either the post-change or pre-change variant. This primary classification constitutes the basis of the following analysis. The rate of post-change variants is calculated based on this variable. The breakdown of the dataset is shown in Table 3.

Table 3. Distribution of post- and pre-change variants of potential forms in the CSJ

<table>
<thead>
<tr>
<th>Process</th>
<th>Post-change</th>
<th>Pre-change</th>
<th>Rate of post-change variant (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ar-Deletion (C-verb)</td>
<td>1,304</td>
<td>37</td>
<td>97.24</td>
</tr>
<tr>
<td>ar-Deletion (V-verb)</td>
<td>543</td>
<td>7,615</td>
<td>6.66</td>
</tr>
<tr>
<td>re-Insertion (C-verb)</td>
<td>9</td>
<td>1,296</td>
<td>0.69</td>
</tr>
<tr>
<td>re-Insertion (V-verb)</td>
<td>11</td>
<td>2,361</td>
<td>0.46</td>
</tr>
</tbody>
</table>

In Table 3, the post-change variants represent the tokens that underwent processes specified in the leftmost column, and the pre-change variants represent the tokens that did not undergo the processes and remain intact. As Table 3 shows, the rate of ar-Deleted variants for C-verbs is close to 100%, suggesting that the change of ar-Deletion for C-verbs is almost complete. The rates of ar-Deleted variants for V-verbs and re-Inserted variants are less than 10%. This suggests that these changes are currently in progress, or just have started.\(^{10}\) The rate of re-Inserted variants for C-verbs is slightly higher than the one for V-verbs. However, the difference between the two is too minor (not statistically significant, \(\chi^2(1)=0.43, p=0.5113\)) to confirm that the change of re-Insertion started with C-verbs, and diffused to V-verbs (Inoue & Yarimizu, 2002). Nevertheless, this does not mean that we should deny the diachronic order of the changes, because the sample size of re-Inserted forms for C-verbs and V-verbs is too small in the current dataset, as these variants have been observed only recently. Although the present data do not support the order of the changes, there is a good chance that we obtain supportive evidence in future work.\(^{11}\) Thus, taking the order (re-Insertion: C-verbs => V-verbs) as a working hypothesis to be validated in future work, I develop the analysis of the changes based on Inoue and Yarimizu’s (2002) proposal.

On the assumption that changes spread gradually and the rates of each post-change variant reflect the degree of progression (the higher the rate of a post-change form, the more advanced the change), the order of the changes would be ar-Deletion (C-verbs) => ar-Deletion (V-verbs) => re-Insertion (C-verbs) =>(? ) re-Insertion (V-verbs). This is consistent with the previous observations: ar-Deletion for C-verbs has been observed since the 16th century; ar-Deletion for V-verbs has been observed since the 1920s; and re-Insertion has been observed since the 1990s; after which it diffused to V-verbs.

As illustrated in Figure 7, the change in the potential suffix following a C-verb stem is summarized as follows: the potential suffix originally takes the -are form, then ar-Deletion applies, resulting in the -e form, and, finally, re-Insertion applies, resulting in the -ere form. Similarly, the change in V-verbs is summarized as follows: the potential suffix originally takes the -are form, then ar-Deletion applies, resulting in the -re form, and, finally, re-Insertion applies, resulting in the -ere form. Based on the results of the quantitative analysis, Section 4 discusses the underlying mechanism that governs the changes.

\(^{10}\) Lower rates of ar-Deletion (V-verb) and re-Insertion are associated with speaking style. The utterances in the CSJ take the form of speeches rather than everyday conversation, and hence, non-standard variants such as ar-Deleted forms in V-verbs and re-Inserted forms are not frequently used because the settings are formal. Ar-Deleted forms, on the other hand, are incorporated into the current norm and are regarded as standard variants. Therefore, ar-Deleted forms are frequently used in formal settings.

\(^{11}\) I would like to thank an anonymous reviewer for making me aware of this possibility.
Change in the potential suffix attached to a C-verb stem

<table>
<thead>
<tr>
<th>ar-Deletion</th>
<th>re-Insertion</th>
</tr>
</thead>
<tbody>
<tr>
<td>ik ‘go’</td>
<td>ik-are</td>
</tr>
<tr>
<td>nom ‘drink’</td>
<td>nom-are</td>
</tr>
</tbody>
</table>

ik-are  => ik-e  => ik-ere
nom-are  => nom-e  => nom-ere

Change in the potential suffix attached to a V-verb stem

<table>
<thead>
<tr>
<th>ar-Deletion</th>
<th>re-Insertion</th>
</tr>
</thead>
<tbody>
<tr>
<td>mi ‘see’</td>
<td>mi-rare</td>
</tr>
<tr>
<td>tabe ‘eat’</td>
<td>tabe-rare</td>
</tr>
</tbody>
</table>

mi-rare  => mi-re  => mi-rere
tabe-rare  => tabe-re  => tabe-rere

Figure 7. Changes in the potential suffixes for C-verbs and V-verbs

4 Modeling

This section presents a unified model of the underlying mechanism that governs the sequential changes in potential forms. I perform a phase-by-phase analysis of the changes and subsequently propose a model of the changes in potential forms.

4.1 From Phase 1 to Phase 2 (ar-Deletion)

To begin, let us consider the change from Phase 1 to Phase 2, where ar-Deletion comes into play. As mentioned above, in the oldest paradigm (Phase 1), the potential forms for C-verbs take the same suffix as passive, honorific, and spontaneous forms (-are); in other words, a single suffix had four distinct meanings, as shown in Table 4.

Table 4. Verbal inflections for C-verbs (Phase 1 => Phase 2)

<table>
<thead>
<tr>
<th>Phase</th>
<th>Meaning</th>
<th>C-verb (e.g., ik)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Passive, Honorific, Spontaneous, Potential</td>
<td>ik-are</td>
</tr>
<tr>
<td>2</td>
<td>Passive, Honorific, Spontaneous Potential</td>
<td>ik-are  ik-e (ar-Deleted)</td>
</tr>
</tbody>
</table>

In Phase 1, the C-verbs express passive, honorific, spontaneous, and potential meanings by taking the suffix -are. In Phase 2, however, passive, honorific, and spontaneous forms remain -are; on the other hand, potential forms that have undergone ar-Deletion take the ar-Deleted suffix -e. That is, due to the application of ar-Deletion driven by analogical leveling (Paul, 1970),12 potential forms took suffix forms different from the passive, honorific, and spontaneous forms. As a result, the suffix -are, which needs to have four meanings in Phase 1, has three meanings in Phase 2. At the same time, the potential meaning is expressed only by the new suffix -e. The introduction of the innovative potential suffix reduced the number of meanings that each suffix had, and the four meanings involved in the single suffix -are were partly disambiguated (Ito & Mester, 2004; Inoue, 1998).

---

12 Analogical leveling is a morphophonological process, where among the allomorphs of a particular form in the inflectional paradigm, one allomorph changes to take a form similar to another allomorph by analogy. As a result, the number of allomorphs is reduced, and accordingly, the inflectional paradigm becomes uniform (Paul, 1970).
4.2 From Phase 2 to Phase 3 (ar-Deletion)

In the change from Phase 2 to Phase 3, ar-Deletion comes into play. The application of ar-Deletion to C-verbs contributed to semantic disambiguation, but at the same time, it created the larger gap in allomorphy in Phase 2. In Phase 1, the difference between the potential suffixes for C-verbs and V-verbs is only the presence/absence of initial [r] (-are for C-verbs and -rare for V-verbs). In Phase 2, however, the difference is the presence/absence of three segments [rar] (-e for C-verbs and -rare for V-verbs), as Table 5 shows, because ar-Deletion deleted the segments [ar] in -are for C-verbs, yielding the reduced form -e.

### Table 5. Verbal inflections (Phase 2 ⇒ Phase 3)

<table>
<thead>
<tr>
<th>Inflectional form</th>
<th>C-verb (e.g., ik)</th>
<th>V-verb (e.g., mi)</th>
<th>C-V difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present indicative</td>
<td>ik-u</td>
<td>mi-ru</td>
<td>r</td>
</tr>
<tr>
<td>Imperative</td>
<td>ik-e</td>
<td>mi-ro</td>
<td>e ~ ro</td>
</tr>
<tr>
<td>Conditional</td>
<td>ik-eba</td>
<td>mi-reba</td>
<td>r</td>
</tr>
<tr>
<td>Causative</td>
<td>ik-ase</td>
<td>mi-sase</td>
<td>s</td>
</tr>
<tr>
<td>Passive, Honorific, Spontaneous</td>
<td>ik-rare</td>
<td>mi-rare</td>
<td>r</td>
</tr>
<tr>
<td>Potential (Phase 2)</td>
<td>ik-e (ar-Deleted)</td>
<td>mi-rare</td>
<td>rar</td>
</tr>
<tr>
<td>Potential (Phase 3)</td>
<td>ik-e (ar-Deleted)</td>
<td>mi-re (ar-Deleted)</td>
<td>r</td>
</tr>
</tbody>
</table>

Subsequently, ar-Deletion was applied to V-verbs in Phase 3. Ar-Deletion deleted the segments [ar] in -rare for V-verbs, yielding the reduced form -re. As a result, C-verbs take -e, and V-verbs take -re. The difference was restored, namely, the presence/absence of initial [r], as shown in the rightmost column of Table 5 (Ito & Mester, 2004). Thus, ar-Deletion created the straightforward paradigm, in which suffix allomorphy is limited to the presence/absence of an initial consonant. In other words, the potential suffix for V-verbs was reduced to -re, reducing the discrepancy between the allomorphs to the presence/absence of an initial consonant and thus increasing consistency across the inflectional paradigm. This is a case of analogical leveling (Fukushima, 2004; Ito & Mester, 2004; Matsuda, 1993; Paul, 1970).

In addition to analogical leveling, ar-Deletion is also associated with semantic disambiguation. Similar to the inflections for C-verbs, the potential forms for V-verbs take the same suffix as passive, honorific, and spontaneous forms (-rare); in other words, a single suffix had four distinct meanings, as shown in Table 6.

### Table 6. Verbal inflections for V-verbs (Phase 2 ⇒ Phase 3)

<table>
<thead>
<tr>
<th>Phase</th>
<th>Meaning</th>
<th>C-verb (e.g., mi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Passive, Honorific, Spontaneous, Potential</td>
<td>mi-rare</td>
</tr>
<tr>
<td>3</td>
<td>Passive, Honorific, Spontaneous, Potential</td>
<td>mi-rare</td>
</tr>
</tbody>
</table>

In Phase 2, the suffix -rare following a C-verb expressed four meanings. In Phase 3, however, passive, honorific, and spontaneous forms still took -rare, but potential forms that had undergone ar-Deletion took the ar-Deleted suffix -re. That is, due to the application of ar-Deletion driven by analogical leveling, potential forms took suffix forms different from the passive, honorific, and spontaneous forms. As a result, the suffix -rare, which had four meanings in Phase 2, only had three meanings in Phase 3. At the same time, the potential meaning was expressed only by the new suffix -re. The introduction of the innovative potential suffix reduced the number of meanings that each of the suffixes had, and the four meanings involved in the single suffix -rare were disambiguated (Fukushima, 2004; Ito & Mester, 2004).
4.3 From Phase 3 to Phase 4 (re-Insertion for C-verbs)

The change from Phase 3 to Phase 4 is defined by re-Insertion. Re-Insertion enhances the potentiality expressed by potential forms. That is, the potential meaning expressed by potential forms with the re-Deleted suffix, such as *ik-ere*, is more clearly understood by hearers (Inoue & Yarimizu, 2002). As shown in Table 7, in Phase 3, the suffix following a C-verb stem does not make a distinction between potential meanings, as -e is used regardless of the potentiality.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Meaning</th>
<th>C-verb (e.g., ik)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>(Unambiguous) Potential</td>
<td>ik-e</td>
</tr>
<tr>
<td>4</td>
<td>Potential</td>
<td>ik-e</td>
</tr>
<tr>
<td></td>
<td>Unambiguous Potential</td>
<td>ik-ere (re-Inserted)</td>
</tr>
</tbody>
</table>

In Phase 3, the suffix following a C-verb stem expresses potential as well as unambiguous potential meanings by taking the suffix -e. In Phase 4, however, the potential forms remain as having -e, while the unambiguous potential forms that have undergone re-Insertion take the re-Inserted suffix -ere. That is, due to the application of re-Insertion, this “unambiguous potential” was disambiguated. As a result, the suffix -e that had two meanings in Phase 3 has only a single meaning in Phase 4. At the same time, the unambiguous potential meaning is expressed by the new suffix -ere.

4.4 From Phase 4 to Phase 5 (re-Insertion for V-verbs)

Re-Insertion also triggered the change from Phase 4 to Phase 5. The application of re-Insertion to C-verbs contributed to semantic disambiguation, but at the same time, it created an idiosyncratic allomorphy in Phase 4. In Phase 3, the difference between the potential suffixes for C-verbs and V-verbs is only the presence/absence of initial [r] (-e for C-verbs and -re for V-verbs). In Phase 4, however, the difference is the presence/absence of the initial vowel, unlike other inflectional forms (-ere for C-verbs and -re for V-verbs), because re-Insertion inserted the syllable [re] into the suffix -e for C-verbs, producing -ere.

<table>
<thead>
<tr>
<th>Inflectional form</th>
<th>C-verb (e.g., ik)</th>
<th>V-verb (e.g., mi)</th>
<th>C-V difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present indicative</td>
<td>ik-u</td>
<td>mi-ru</td>
<td>r</td>
</tr>
<tr>
<td>Imperative</td>
<td>ik-e</td>
<td>mi-ro</td>
<td>e ~ ro</td>
</tr>
<tr>
<td>Conditional</td>
<td>ik-eba</td>
<td>mi-reba</td>
<td>r</td>
</tr>
<tr>
<td>Causative</td>
<td>ik-ase</td>
<td>mi-sase</td>
<td>s</td>
</tr>
<tr>
<td>Passive, Honorific, Spontaneous</td>
<td>ik-are</td>
<td>mi-rare</td>
<td>r</td>
</tr>
<tr>
<td>Potential (Phase 4)</td>
<td>ik-ere (re-Inserted)</td>
<td>mi-re (ar-Deleted)</td>
<td>-e</td>
</tr>
<tr>
<td>Potential (Phase 5)</td>
<td>ik-ere (re-Inserted)</td>
<td>mi-rere (re-Inserted)</td>
<td>r</td>
</tr>
</tbody>
</table>

---

13 Inoue and Yarimizu (2002) do not mention the difference in the feasibility of events denoted by ordinary potential forms and unambiguous potential forms. However, what is crucial in the present discussion is that re-Insertion produces a difference in the potential meaning. The details of the potential meaning are beyond the scope of this study.
Subsequently, re-Insertion was applied to V-verbs in Phase 5. Re-Insertion again inserted the syllable [re] to -re for V-verbs, yielding the innovative suffix -rere. As a result, C-verbs take -ere, and V-verbs take -rere. The difference was restored; namely, the presence/absence of initial [r] that is a pattern consistent with other inflectional forms. Thus, re-Insertion also created the straightforward paradigm, in which the suffix allomorphy shows the presence/absence of an initial consonant. In other words, the potential suffix for V-verbs was modified to -rere to reduce the discrepancy between the allomorphs to the presence/absence of an initial consonant, thereby increasing consistency across the inflectional paradigm.

In addition to analogical leveling, re-Insertion can be associated with semantic disambiguation. That is, re-Insertion created the contrast in potential meaning also for V-verbs, as shown in Table 9.

<p>| Table 9. Verbal inflections for C-verbs (Phase 4 =&gt; Phase 5) |
|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>Phase</th>
<th>Meaning (Phase 4)</th>
<th>V-verb (e.g., mi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>(Unambiguous) Potential</td>
<td>mi-re</td>
</tr>
<tr>
<td>5</td>
<td>Potential</td>
<td>mi-re</td>
</tr>
<tr>
<td></td>
<td>Unambiguous Potential</td>
<td>mi-rere (re-Inserted)</td>
</tr>
</tbody>
</table>

In Phase 4, the C-verbs express potential as well as unambiguous potential meanings by taking the suffix -re. In Phase 5, however, potential forms are exclusively associated with -re, while the unambiguous potential forms that have undergone re-Insertion take the re-Inserted suffix -rere. That is, due to the application of re-Insertion, unambiguous potential forms become unique. As a result, the suffix -re that had two meanings in Phase 4 has only a single meaning in Phase 5. At the same time, the unambiguous potential meaning is expressed by the new suffix -rere. Introducing the innovative potential suffix reduced the number of meanings that each of the suffixes had, resulting in re-Insertion creating a contrast in potential meaning. In short, semantic disambiguation is again associated with re-Insertion and the change from Phase 4 to Phase 5.

4.5 Mechanism

In this section, we will consider the underlying mechanism that govern the sequential changes by summarizing the results of the analysis in the previous sections. The pattern in the sequential changes is summarized as shown in Table 10.

<p>| Table 10. Summary of sequential changes |
|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>Phase</th>
<th>C-verb (e.g., ik, nom)</th>
<th>V-verb (e.g., mi, tabe)</th>
<th>Main factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-are</td>
<td>-rare</td>
<td>NA</td>
</tr>
<tr>
<td>2</td>
<td>-e (ar-Deleted)</td>
<td>-rare</td>
<td>semantic disambiguation</td>
</tr>
<tr>
<td>3</td>
<td>-e (ar-Deleted)</td>
<td>-re (ar-Deleted)</td>
<td>analogical leveling</td>
</tr>
<tr>
<td>4</td>
<td>-ere (re-Inserted)</td>
<td>-re</td>
<td>semantic disambiguation</td>
</tr>
<tr>
<td>5</td>
<td>-ere</td>
<td>-rere (re-Inserted)</td>
<td>analogical leveling</td>
</tr>
</tbody>
</table>

The first change from Phase 1 to Phase 2, motivated by semantic disambiguation, affected C-verbs and rendered the innovative potential suffix -e through the deletion of the segments [ar] from -are (ar-Deletion), producing ar-Deleted forms such as ik-e and nom-e (Yamaguchi & Akimoto, 2001). The second change from Phase 2 to Phase 3, mainly motivated by analogical leveling (Paul, 1970), in turn affected V-verbs and rendered the innovative potential suffix -re through the deletion of the segments [ar] from -rare (ar-Deletion), producing potential forms such as mi-re and tabe-re (Fukushima, 2004; Ito & Mester, 2004; Matsuda, 1993).
The third change from Phase 3 to Phase 4, motivated by semantic disambiguation, affected C-verbs and rendered the innovative potential suffix -ere through the addition of the syllable [re] to -e (re-Insertion), resulting in potential forms such as ik-ere and nom-ere. Re-Insertion subsequently diffused to V-verbs motivated mainly by analogical leveling, and rendered the innovative potential suffix -rere through the addition of the syllable [re] to the suffix -re (re-Insertion), yielding potential forms such as mi-rere and tabe-rere (Inoue & Yarimizu, 2002). To summarize these processes, semantic disambiguation in C-verbs creates the larger gap in allomorphy; subsequently, analogical leveling in V-verbs optimizes the paradigm, i.e., it reorganizes the paradigm in order to counter the increased discrepancy between potential forms of C-verbs and V-verbs caused by the preceding change. Thus, I propose that the underlying mechanism governing the sequential changes is the cyclic application of this two-step process.

5 Conclusion

In this paper, I modeled the sequential changes of potential forms in Japanese. Through a quantitative analysis using the data from the CSJ, I proposed ordering the changes. The diachronic pattern is summarized as follows: first, semantic disambiguation triggered the change in C-verbs and expanded the gap in the inflectional paradigm; then, analogical leveling triggered the change in V-verbs and reorganized and optimized the inflectional paradigm. This two-step process is the principle governing the sequential changes. In addition, the analysis with ra-Deletion for V-verbs, instead of ar-Deletion, has been traditionally taken for granted in the literature. However, I proposed that considering this change as ar-Deletion results in a more consistent and straightforward model of the diachronic changes at issue.

Additionally, semantic disambiguation applies first and breaks the balanced paradigm; this implies that the forces motivating semantic disambiguation are stronger than those motivating analogical leveling or paradigm uniformity. If the sequence that I propose is correct, then we can predict that the next step in the change will be semantic disambiguation in C-verbs, after which analogical leveling in V-verbs will follow. In summary, this paper demonstrated the pattern by which the verbal inflectional paradigm has sequentially changed, and pointed out the root causes of the changes.

I conclude by arguing that the findings of this corpus-based study could not have been obtained by more traditional (i.e., intuition- and dictionary-based) studies. This emphasizes the importance of taking a variety of approaches in linguistic research.

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14 The question arises as to why semantic disambiguation first applies to C-verbs. If semantic disambiguation by ar-Deletion triggers the change in V-verbs first, an idiosyncratic allomorphy with the presence of an extra vowel in the suffix for C-verbs would be created (-are and -re), like the case of re-Insertion in C-verbs. On the other hand, if ar-Deletion applies first, the gap in allomorphy becomes three segments (-e and -rare). Compared with the former pattern, this pattern is more similar to other inflectional forms, i.e., the suffixes for V-verbs have extra segments. However, this account is not successful in the case of re-Insertion, because re-Insertion for C-verbs actually creates the idiosyncratic allomorphy (-ere and -re). It may be the case that the order of the two-step process has already been established, and re-Insertion follows this order, i.e., semantic disambiguation is applied to C-verbs first, then analogical leveling to V-verbs follows.
Abbreviations

ACC: accusative
AUX: auxiliary
COND: conditional
COP: copula
DAT: dative
GEN: genitive
LOC: locative
NEG: negative
NOM: nominative
NonPast: non-past tense
NPI: negative polarity item
POL: polite form
Past: past tense
POT: potential
TE: te form of the verb
TOP: topic marker

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