VIOLABLE AND INVIOABLE OCP EFFECTS ON LINGUISTIC CHANGES: EVIDENCE FROM VERBAL INFLECTIONS IN JAPANESE∗

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1. Background

This paper presents an empirical examination of the effects of Obligatory Contour Principle (OCP, Leben 1973; Goldsmith 1976; McCarthy 1986) in diachronic contexts, using a large-scale spontaneous speech corpus of Japanese. Specifically, I focus on two kinds of ongoing morphophonological changes in Japanese verbal inflectional paradigm, sa-Insertion and ra-Deletion, and show how the progress of these changes is affected by the OCP.

1.1 OCP

The OCP was originally proposed to account for the distribution of tones in tone languages, and states that adjacent syllables may not be marked for the same tone. Since then, the OCP has been widely applied to a wide variety of linguistic phenomena in many languages, and interpreted as a more general principle, as in OCP bans representations in which identical specifications are adjacent (Ito and Mester 1998, 2003; Meyers 1997, among others). In other words, the OCP has general dissimilararoy effects, and is the general principle that is associated with the similarity avoidance at a variety of linguistic levels ranging from phonology to syntax (Pearlmutter 1971, and subsequent works).

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As an example of segmental OCP effects, the identical consonant pairs are prohibited in Arabic verb roots, for example *dadam and *sasam (Greenberg 1950; McCarthy 1986; see Pierrehumbert 1993 and Frisch et al. 2004).¹

The effects of OCP have been examined in a variety of languages and theoretical frameworks (Meyers 1997; Padget 2002; Frisch et al. 2004, among others). Japanese is one of the languages where many OCP effects are observed, such as Lyman’s Law in sequential voicing (Vance 1980; Ito and Mester 1986, 2003) and in geminate devoicing in loanwords (Ito and Mester 1986; Nishimura 2003); the co-occurrence restriction on consonants in native vocabulary (Kawahara et al. 2006), and the Double-o constraint in syntax (Hiraiwa 2010).

Most of the examinations of OCP have been conducted focusing on its categorical effects; however, recent research has demonstrated that the OCP has gradient effects. The issue of categorical effects and gradient effects is extensively discussed in Frisch et al. (2004), based on the Arabic data mentioned above. Frisch et al. show that if the consonant pairs in verb roots are more similar, then such verb roots are not categorically excluded, but rather less frequent. Based on these results, they argue that the OCP-Place has both categorical/inviolable effects and gradient/violable effects.

However, there are also some other aspects of OCP effects that remain unexplored. For example, the research on OCP effects has focused mostly on synchronic aspects; and accordingly diachronic aspects, such as how OCP affects the progress of ongoing linguistic change, remain to be explored. Although Frisch (2004) touches upon the sociolinguistic and diachronic aspects of OCP effects, the diachronic process is yet to be examined empirically. Furthermore, the data that previous research used was non-natural language examples such as dictionary entries.

With this background, the goal of the present research is to examine the OCP effects in diachronic contexts. Specifically, I focus on the ongoing changes in the Japanese verbal inflectional paradigm, using data from spontaneous utterances in a large-scale corpus. The specific objective of this research is to address the following two questions: 1) whether the OCP effects are categorical, gradient, or categorical and gradient, 2) whether the OCP functions as trigger, blocker, or trigger and blocker, and approach the process in which the synchronic restriction like OCP shapes the lexical/grammatical patterns.

1.2 Ongoing Morphophonological Changes in Japanese

1.2.1 Verbal Inflections in Japanese

Verbs in Japanese are classified into two types: one type is called consonant verbs in which stem-final segments are consonants, as in ik- ‘go,’ and hasi- ‘run,’; the other type is called vowel verbs in which stem-final segments are vowels, as in mi- ‘see,’ and tabe- ‘eat.’ The causative and potential suffixes in Japanese show allomorphy; namely, these suffixes undergo morphophonological alternation according to the type of verb stem to which they attach, either consonant verbs or vowel verbs.²

¹ The co-occurrence restriction is sensitive to the positions in verb roots: There are no roots that repeat the same consonant in first and second positions; however, roots with identical consonants in second and third position are not prohibited, as in madad ‘stretch,’ samam ‘poison.’
² This alternation is partly driven by the strong preference for CV syllable structure in Japanese.
In causative forms, consonant verbs take *as* or *ase*, as in *ik-ase* ‘let someone go,’ and *hasir-ase* ‘let someone run.’ On the other hand, vowel verbs take *sas* or *sase*, whose initial segment is consonant, as in *mi-sase* ‘let someone see,’ and *tabe-sase* ‘let someone eat.’ Likewise, in potential forms, consonant verbs take *e*, as in *ik-e* ‘can go,’ and *hasir-e* ‘can run’; on the other hand, vowel verbs take *rare*, whose initial segment is consonant, as in *mi-rare* ‘can see,’ and *tabe-rare* ‘can eat.’

1.2.2 Sa-Insertion

Sa-Insertion is a change in causative forms in Japanese, and is restricted to consonant verbs. As mentioned above, causative forms in Japanese are obtained by attaching causative suffixes to verb stems. The traditional variant of the causative for a consonant verb comprises the verb stem and the causative suffix *ase*. In contrast, *sa*-Insertion yields the innovative variant, which comprises the verb stem and both the causative suffixes *as* and *ase*.\(^3\) I present below some examples of *sa*-Insertion retrieved from CSJ.

(1) happyoo-o owar-as-ase-te-itadakimasu. (cf. traditional: owar-ase-)
   ‘Let me finish (my) presentation.’ (polite) (A04M0229)\(^5\)

(2) isyoo-o tukur-as-ase-ru yootien (cf. traditional: tukur-ase-)
   costume-Acc make-Caus-Caus-Non-past kindergarten
   ‘Kindergarten that let (children) make their costumes.’ (S07F1336)

As exemplified above, in *sa*-Insertion both *as* and *ase* attach to a verb stem. Thus, *sa*-Insertion results in an extra syllable *sa* in causative forms, as opposed to traditional causatives. This is the crucial difference between these two variants.

1.2.3 Ra-Deletion

Ra-Deletion is also a change in the morphophonology of the potential form in Japanese (Ito and Mester 2004; Sano 2011, among others). The potential form of a Japanese vowel stem verb is obtained by attaching the potential suffix *rare* to the stem. There is also an innovative form, called *ra*-Deletion, which comprises of the verb stem and the innovative potential suffix *re* (i.e., in comparison to the traditional form, the *ra* syllable has been omitted), as shown in examples (3) and (4).

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\(^3\) The choice of *as* or *ase*, and *sas* or *sase* is dependent on the lexical/stylistic factors: The (s)as forms can function either as lexical causatives or as informal variants of productive causatives (see Miyagawa 1999).

\(^4\) I follow the analysis of Okada (2003) that *sa*-Insertion is a double causative that contains two causative suffixes.

\(^5\) The alphanumeric character annotated to the end of each example (e.g. A04M0229) is the ‘speech ID’ that is used as the index of each speech. See Sano & Hibiya (2012) for more detail.
Thus, the segments *ra* are deleted in *ra*-Deletion. In this sense, *ra*-Deletion is regarded as a kind of renewal within a single suffix.

## 2 Data

### 2.1 The Corpus of Spontaneous Japanese

Data was retrieved from the Corpus of Spontaneous Japanese (CSJ, Kokuritsu Kokugo Kenkyuujo 2008). The CSJ is a large-scale spontaneous speech corpus of common Japanese with rich annotation (Sano and Hibiya 2012).

### 2.2 Overall Distribution

Every relevant utterance in the CSJ was extracted (i.e., all causative forms of consonant verbs and all potential forms of vowel verbs), amounting to 9,698 tokens.

The variable is the binary choice; namely, the innovative forms or the traditional forms; for example, in causative forms *ik-ase-* is paired with *ik-as-ase-*, and in potential forms *mi-rare-* is paired with *mi-re-*. This primary classification constitutes the basis of the following analysis. The probability of innovative forms was calculated based on this variable. An exhaustive search for the CSJ brought forth the following dataset. Table 1 shows the breakdown of the retrieved data.

<table>
<thead>
<tr>
<th></th>
<th>Innovative</th>
<th>Traditional</th>
<th>Probability of innovative forms (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Causative</td>
<td>42</td>
<td>1,498</td>
<td>2.73</td>
</tr>
<tr>
<td>Potential</td>
<td>543</td>
<td>7,615</td>
<td>6.66</td>
</tr>
</tbody>
</table>

Specifically, the probability of *sa*-Insertion amounts to 2.73%, and the probability of *ra*-Deletion amounts to 6.66%.

### 2.3 Chronological Change of Variable Forms

Figure 1 illustrates the chronological changes of variable forms, according to the birth-year of speakers (grouped every ten years).
As Figure 1 shows, the probabilities of innovative forms gradually rise as the birth-year of speakers becomes more recent. Specifically, across every birth-year, the probability of ra-Deletion is consistently higher than the one of sa-Insertion. In terms of the slopes of fitted curves, the probability of ra-Deletion shows a steep ascent; while the probability of sa-Insertion shows the smooth one. The result suggests that the change of ra-Deletion begins first, followed by the change of sa-Insertion. Furthermore, we can argue that the change of ra-Deletion is currently in the intermediate stage, the change of sa-Insertion is in the beginning. This is consistent with the claims of previous studies. Thus, two kinds of changes in Japanese verbal inflections are shown to be in progress.

3 Method

Before moving on to the examination of the OCP effects, I present the method of the analysis. The procedure is summarized as follows.

Instead of a broad range of comparisons in Japanese phoneme inventory, this research adopted the pair-wise comparison, in which I focused on pairs of segmentally different variants in the same paradigm, and examined the similarity in sequences of verb stems and suffixes. The degree of similarity is based on the number of totally identical segments in each sequence; namely, for each segment the choice is categorical: totally identical or not. I compared the probabilities of innovative forms that differ in the degrees of similarity. However, the forms compared should be in the same inflectional paradigm; accordingly, the comparison of forms in causatives and potentials is impossible. The domain of similarity is local at moraic level; therefore, the segments compared are in the same position in adjacent CV sequences.

(5) a. C₁V₂ₖC₃V₇ (total identity)
   b. C₁V₂ₖC₇V₃ (consonants, different; vowels, identical)

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6 I plotted the transition of the rate of ra-Deletion focusing only on Academic Presentation Speech (APS), because the age distribution of speakers is biased in Simulated Public Speaking (SPS); most of the speech samples by speakers born in the 1980s are SPS. SPS is stylistically casual or informal, and ra-Deletion is more preferred by casual settings. This leads to the sharp rise in the 1980s, and the results can be biased. Also, I omitted the data point for the 1980s from the transition of the rate of sa-Insertion, because the frequency of causative forms in the 1980s is no more than 13, that is insufficient for a reliable analysis.
Taking (5) as an example, the domain of similarity is two CVs in sequences of verb stems and suffixes, in which two consonants and two vowels in different syllables are examined in terms of identity. In (5a), two consonants in preceding and following syllables are identical (two C's); similarly, two vowels in preceding and following syllables are identical (two V's), showing the total identity; while in (5b), the identity does not hold in two consonants (C_i and C_j) although two vowels in preceding and following syllables are identical (two V's). If we compare the degrees of similarity between (5a) and (5b), (5a) is judged to be more similar than (5b), and the occurrence of a form that involves the sequence (5a) would be more severely restricted by OCP than the other form that involves the sequence (5b).

If the OCP is at work in ongoing linguistic changes, then it follows that the change proceeds in the following manner: In contexts where more similar adjacent CV sequences in verb stems and suffixes are involved, the progress of the change would be slower, being reflected in lower probabilities of such innovative forms; while in contexts where less similar adjacent CV sequences in verb stems and suffixes are involved, the progress of the change would be faster, being reflected in higher probabilities of such innovative forms.

### 4 Examination of OCP Effects in Diachronic Contexts

Following the procedure, I examine the OCP effects on the progress of ongoing linguistic changes with the dataset presented above. I present the categorical effects first, and subsequently the gradient effects.

#### 4.1 Categorical Effects

##### 4.1.1 Types of verb stems in sa-Insertion

The categorical effects of OCP can be observed in the types of verb stems in sa-Insertion. As mentioned above, sa-Insertion, that is the innovative variant in causative forms, is restricted to consonant verbs; in other words, no sa-Insertion is found in vowel verbs. This asymmetry can be accounted for in terms of OCP. As exemplified in (6), vowel verbs take the causative suffix sase, as in mi-sase-, and tabe-sase-. If these causative forms are sa-Inserted, the resulting forms would obligatorily involve the sequence sasa, as in mi-sas-ase- and tabe-sas-ase-, in which totally identical CVs are adjacent. On the other hand, consonant verbs can avoid such totally identical CVs as sasa depending on the final consonants of verb stems, as in _kasa (ik-as-ase-)_ and _rasa (hasir-as-ase-)_ in (7).[^1]

<table>
<thead>
<tr>
<th>(6) vowel verbs</th>
<th>a. mi.sa.se</th>
<th>ta.be.sa.se</th>
<th>traditional causative sa-Insertion</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. mi..sa..se</td>
<td>ta.be..sa..se</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>(7) consonant verbs</th>
<th>a. i.ka.se</th>
<th>ha.si.ra.se</th>
<th>traditional causative sa-Insertion</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. i..ka..se</td>
<td>ha..si..ra..se</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[^1]: In consonant verbs, only the stems with s ending would create the totally identical CVs sasa. This issue is discussed in the next section.
Therefore, to block sasa sequences, sa-Insertion cannot occur in vowel verbs. Given that no innovative forms with adjacent identical CVs are observed, we can argue that the categorical effect and the blocking function of OCP are at work in this context.

4.1.2 Stem-final consonants in sa-Insertion

Next, the categorical effects can also be observed in the stem-final consonants in sa-Insertion of consonant verbs. If the verb stems with final s such as tobas- ‘launch, skip,’ and arawas- ‘express, show’ are causativized and sa-Inserted, these stems would render sasa sequences, as in tobas-as-ase- and arawas-as-ase-, in which totally identical CVs are adjacent as exemplified in (8); on the other hand, other stems are less similar, as in ik-as-ase- and hasir-as-ase- restated as (9).

(8) s-final stems
   a. to.ba.sa.se   a.ra.wa.sa.se   traditional causative
   b. to.ba.sa.sa.se   a.ra.wa.sa.sa.se   sa-Insertion

(9) other stems
   a. i.ka.se   ha.si.ra.se   traditional causative
   b. i.ka.sa.se   ha.si.ra.sa.se   sa-Insertion

Thus, the probability of sa-Insertion is hypothesized to be lower in s-final stems than in other stems. The comparison of the probabilities of sa-Insertion in s-final stems and in other stems is shown in Figure 2.

![Figure 2: Probability of sa-Insertion by stem-final consonants (fisher’s exact test: p<0.05)](image)

As Figure 2 shows, although the probability of sa-Insertion amounts to close to three percent in other stems, no sa-Insertion in verb stems with final s was observed. Therefore, to block sasa sequences, sa-Insertion cannot occur in verb stems with final s. The result is consistent with the one in 4.1.1, giving the generalization that the total identity in consecutive CVs is banned by OCP in the change of sa-Insertion; in other words, OCP exerts the common effect/function on both contexts. The categorical effect and the blocking function of OCP are observed again in this context.

4.2 Gradient Effects

4.2.1 Stem-final Syllables in ra-Deletion
The first example of the gradient effects of OCP is observed in the stem-final syllables in ra-Deletion. As exemplified in (10), the traditional potentials in verb stems with final ri or re involve the sequences, in which three identical consonants (r’s) are involved in adjacent syllables, as in kari-rare- ‘can borrow,’ and ire-rare- ‘can insert.’ While ra-Deletions in verb stems with final ri or re involve the sequences, in which two identical consonants are involved, as in kari-re- and ire-re-. Other stems are less similar compared with those with final ri or re, as in tabe-re-, tabe-rare-, mi-re-, and mi-rare- in (11).

(10) ri/re-final stems
   a. ka.ri.ra.re
   b. ka.ri

   i.re.ra.re
   i.re.re

   traditional potential
   ra-Deletion

(11) other stems
   a. ta.be.ra.re
   b. ta.be.re

   mi.ra.re
   mi.re

   traditional potential
   ra-Deletion

The point is that the similarity can be reduced by applying ra-Deletion, as it deletes one of the syllables that would otherwise contribute to the promotion of similarity (the number of identical consonants is n-1 in ra-Deletion). Furthermore, the degree of similarity is higher in ri/re-final stems than in other stems. Thus, the probability of ra-Deletion is predicted to be higher in ri/re-final stems than in other stems. The probabilities of ra-Deletion in ri/re-final stems and in other stems are shown in Figure 3.

![Figure 3: Probability of ra-Deletion by stem-final syllables (χ²(2)=31.32, p<0.01)](image)

As shown in Figure 3, the probability of ra-Deletion is highest in ri-final stems. This suggests that to reduce the degree of similarity, ra-Deletion is more likely in ri-final stems. On the other hand, re-final stems show the lowest probability of ra-Deletion. This can be associated with the following reason: If potential forms with re-final stems are ra-Deleted, the resulting forms would involve rere sequences, as in ire-re-, in which totally identical CVs are adjacent; in other words, ra that intervenes between two re’s and functions as a blocker of total identity in traditional potentials would be lost in ra-Deleted potential forms. Therefore, to avoid rere sequences, ra-Deletion is less likely to apply to re-final stems.

In summary, in ri-final stems ra-Deletion reduces the similarity and is more likely to apply compared with other contexts; while in re-final stems, ra-Deletion would promote the similarity and is therefore less likely to apply. Given that in both cases certain amounts of ra-Deletions (and traditional potentials) are observed, we can argue that the gradient effect as well as the triggering and the blocking functions of OCP are at work in this context.
4.2.2 Following Constituents in *ra*-Deletion

The gradient effects are also found in the following constituent in *ra*-Deletion. Some constituents following potential suffixes have the initial *r*, as in *-ru* (non-past), and *-reba* (provisional) in (12). Thus, the following constituents with initial *r* can promote the similarity by adding an extra *r*, resulting in three identical consonants (*r*'s) in adjacent syllables. On the other hand, as shown in (13) other constituents such as *-nai* (negative), *-masu* (polite non-past), *-te* (gerund), *-tari* (alternative), *-tara* (conditional), *-soo* (presumptive) make no contribution to the similarity, as the initial syllables in these constituents that are adjacent to the final syllables of potential suffixes, begin with other consonants than *r*.

(12) *r*-initial constituents

| a. mi.ɾa.ɾe.ɾu | mi.ɾa.ɾe.ɾe.ba | traditional potential  
| b. mi.ɾe.ɾu | mi.ɾe.ɾe.ba | *ra*-Deletion  

(13) other constituents

| a. mi.ɾa.ɾe.na.i | mi.ɾa.ɾe.ma.su | traditional potential  
| b. mi.ɾe.na.i | mi.ɾe.ma.su | *ra*-Deletion  

If *ra*-Deletion is applied to these examples and one of the syllables that have initial *r* is deleted, the similarity can again be reduced (*n*-1). Furthermore, in either traditional potentials or *ra*-Deletions the degree of similarity is higher in *r*-initial constituents than in other constituents. Thus, the probability of *ra*-Deletion would be higher in *r*-initial constituents than in other constituents. I illustrate the distribution of *ra*-Deletion according to the following constituents in Figure 4.

![Figure 4: Probability of *ra*-Deletion by following constituents (*χ*²(2)=129.15, *p*<0.01)](image_url)

As Figure 4 shows, the probability of *ra*-Deletion is higher in preceding *-ru* and *-reba* than before other constituents. Therefore, the reduction of similarity via *ra*-Deletion is more likely to occur preceding *r*-initial constituents.

Here I consider the gap between *-reba* and *-ru*. The probability of *ra*-Deletion is higher preceding *-reba* than preceding *-ru*. If we compare the potential forms followed by *-reba* or *-ru*, the similarity is higher in *-reba* forms, since *-reba* forms involve totally identical *rere* sequences (the preceding *re* is the final syllable of the potential suffix, and the following *re* is the initial syllable of *-reba*) in addition to the initial *r*. Thus, *-reba* forms are in more urgent need of reducing the similarity by applying *ra*-Deletion than *-ru* forms are. In summary, in both of *r*-initial constituents *ra*-Deletion is more likely to apply compared with other constituents; however, *-reba* forms are more likely to trigger *ra*-Deletion, since the similarity is higher in *-reba* forms with totally identical CVs than in *-ru* forms. In both cases certain amounts of *ra-*
Deletions (and traditional potentials) are observed. Thus, we can observe the gradient effect and the triggering function of OCP.  

### 4.2.3 Conjugation Types of Verbs in ra-Deletion

The third example of gradient effects is found in the conjugation type of verbs in ra-Deletion. The vowel verbs are further classified into two types according to the conjugation types: one type is *i*-stem verbs (*kamiichidan* verbs) that end in *i* vowel; the other type is *e*-stem verbs (*shimoichidan* verbs) that end in *e* vowel.

(14) **i-stem verbs**
- a. mi.ra.re
- b. mi.re

<table>
<thead>
<tr>
<th>traditional potential</th>
<th>ra-Deletion</th>
</tr>
</thead>
<tbody>
<tr>
<td>ka.ri.ra.re</td>
<td>ka.ri.re</td>
</tr>
</tbody>
</table>

(15) **e-stem verbs**
- a. ta.be.ra.re
- b. ta.be.re

<table>
<thead>
<tr>
<th>traditional potential</th>
<th>ra-Deletion</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.ge.ra.re</td>
<td>a.ge.re</td>
</tr>
</tbody>
</table>

Let us turn our attention to the vowels in adjacent syllables (the stem-final vowel and the vowel(s) of the potential suffix). As exemplified in (14) and (15), *i*-stem verbs do not exhibit the vowel co-occurrence both in the traditional potential (*i, a, e*) and in ra-Deletion (*i, e*); while in *e*-stem verbs the vowel co-occurrence is observed in the traditional potential (*e, a, e*) and ra-Deletion (*e, e*). In the traditional potential of *e*-stem verbs, although the verb stem and the potential suffix involve two *e*’s, these vowels are not in adjacent syllables, as the *a* vowel intervenes between two syllables with *e*’s. On the other hand, if these potential forms are ra-Deleted, the resulting forms would involve two *e*’s in adjacent syllables, as in *tabe-re*, and *age-re* ‘can raise’; in other words, the *a* vowel that intervenes between two *e*’s and functions as a blocker of vowel co-occurrence in adjacent syllables would be lost in ra-Deleted potential forms. Thus, in *e*-stem verbs ra-Deletion can promote similarity; and accordingly, OCP may block the application of ra-Deletion. Therefore, we can hypothesize that the probability of ra-Deletion is higher in *i*-stem verbs than in *e*-stem verbs.

![Figure 5: Probability of ra-Deletion by conjugation types of verbs (χ²(1)=74.79, p<0.01)](image_url)

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8 Examination of following constituents in *sa*-Insertion is impossible, because most of the *sa*-Insertions (88%) are followed by *t* initial constituents such as *-teitadak* or *-temorau* (benefactive forms, Okada 2003), and no *s* initial constituent was observed. Therefore, the identity of consonants does not hold in any instances.
In Figure 5, the probability of ra-Deletion is higher in i-stem verbs than in e-stem verbs. Therefore, to avoid the co-occurrence of e in the adjacent syllables, ra-Deletion is less likely to apply to e-stem verbs as expected. In both cases certain amounts of ra-Deletions (and traditional potentials) are observed. We can observe the gradient effect and the blocking function of OCP.

Finally, I consider the relationship between the OCP effects and the development of the change. With the distribution of ra-Deletion by conjugation types of verbs, I illustrate the chronological changes of the probabilities of ra-Deletion in i-stem verbs and in e-stem verbs in Figure 6. The chronological changes of the distribution suggest how the OCP has been affecting the linguistic changes diachronically.

As shown in Figure 6, the probability of ra-Deletion is consistently higher in i-stem verbs than in e-stem verbs, except for two data points: the 1910s where no ra-Deletion is observed, and the 1980s. This suggests that the OCP as a synchronic restriction for each time-period consistently affects the distribution in the same manner; these synchronic patterns accumulate diachronically; and the diachronically accumulated patterns shape the lexicon or the grammar.

**5 Conclusion**

In this paper, I demonstrated two types of OCP effects in diachronic contexts, focusing on two ongoing morphophonological changes in Japanese verbal inflectional paradigm, sa-Insertion and ra-Deletion. The diachronic pattern can be summarized as follows. If adjacent CV sequences in verb stems and suffixes are more similar, then the probabilities of innovative forms are lower (or even zero).

The findings of this research are summarized as follows: 1) OCP is active in shaping novel verbal inflectional forms; 2) OCP is at work not only synchronically, but also diachronically; 3) I attested the strong version and the weak version of OCP effects; 4) OCP functions as a blocker as well as a trigger; 5) The domain of OCP effects is not only within lexical items or morphemes, but also across morphological boundaries.

As for the diachronic process, the following scenario is suggested. The synchronic restriction consistently affects the distribution, resulting in the diachronic patterns, and the patterns shape the lexicon or the grammar. Additionally, there might be a process that maps lexical or grammatical patterns onto synchronic restrictions. If this is the case, then the process would be cyclic.
References


