Predicting Ongoing Global Paradigm Optimization in Voice in Japanese: Corpus-Based OT Analysis

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1. Introduction

In the grammatical category voice in Japanese, an overall morphological change reorganizing the conjugation paradigm is currently underway. The process includes three variable phenomena: *sa*-Insertion, *ra*-Deletion and *re*-Insertion. This paper gives a unified account as well as a prediction of the ongoing global paradigm optimization in Japanese voice, in light of Probabilistic OT (Boersma and Hayes 2001, among others), employing a large-scale corpus. I employed the Corpus of Spontaneous Japanese (Maekawa 2004, henceforth CSJ). Firstly, I characterize the chronological change of the distribution of each phenomenon based on the observed data. Secondly, I formalize the changes in OT terms; in turn, I model and predict the change within the framework of Stochastic OT. The results show that the gradient approximation of the ranking values of each constraint caused the emergence and the gradual increase of innovative forms, and that the overall change in voice can be explained by the dynamic interactions of a small set of constraints.

2. Backgrounds

In this section, I outline some key concepts of the present research. In Section 2.1, I describe three variable forms in Japanese voice. Section 2.2 introduces Stochastic OT.

2.1. The variable phenomena

2.1.1. Sa-Insertion

Sa-Insertion is a variable phenomenon in Japanese causatives (Okada 2003; Sano 2009, 2011). Japanese Causatives are formed by attaching causative suffixes to verb stems. Japanese verbs are classified into two types, according to the stem-ending. One type is a consonant verb, which ends in a consonant (e.g. *nom-* 'drink,' *ik-* 'go'), and the other type is a vowel verb, which ends in a vowel (e.g. *tabe-* 'eat,' *mi-* 'see') (Bloch 1946); *sa*-Insertion is restricted to consonant verbs. The traditional variant of the causative for a consonant verb (henceforth, *sa*-TV) comprises the verb stem and the causative suffix *ase*, yielding single causative constructions; on the other hand, *sa*-Insertion, which is the innovative variant, comprises the verb stem and both the causative suffixes *as* and *ase*, yielding double causative constructions, as shown in (1).

(1) happyoo-o owar-as-ase-te-itadakimasu.
presentation-ACC finish-CAUS-CAUS-TE-AUX.POL.NONP
'Let me finish (my) presentation.' (polite) (A04M0229)[1]

Compared to *sa*-TV, *sa*-Insertion involves an extra causative suffix *as*. This is the crucial difference between these two variants. Importantly, the doubling of causative morphemes and the "benefactive" construction make the meaning of *sa*-Insertion honorific, rather than causative (Okada 2003).

[*] I would like to thank Junko Ito, Armin Mester, Shigeto Kawahara, Haruo Kubozono, Paul Smolensky, and Frank Scott Howell for their help and support on this and earlier versions of this paper. I am also grateful to the participants of WCCFL 29 for their invaluable comments. Any remaining faults are, of course, mine.

[1] 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 Maekawa (2004) for more detail.

 Proceedings of the 29th West Coast Conference on Formal Linguistics, ed. Jaehoon Choi et al., 398-406. Somerville, MA: Cascadilla Proceedings Project.

2.1.2. Ra-Deletion

Ra-Deletion is a variable phenomenon in Japanese potentials (Matsuda 1993; Sano 2009, 2011, among others). Potentials in Japanese are formed by attaching the potential suffix *rare* to verb stems. *Ra*-Deletion is restricted to vowel verbs. The traditional variant of the potential for a vowel verb (henceforth, *ra*-TV) comprises the verb stem and the potential suffix *rare*. In contrast, *ra*-Deletion, which is the innovative variant, comprises the verb stem and the reduced form *re* of the potential suffix *rare*. I present below an example of *ra*-Deletion.

(2) oisii mono-ga tabe-re-ru.
delicious stuff-ACC eat-POT-NONP
'(We) can eat delicious foods.' (S00M0002)

Ra-Deletion is regarded as a segmental deletion within a single suffix, as the segments *ra* are deleted. Crucially, the meaning of *ra*-Deletion is restricted to potential, although the suffix *rare* can have four meanings: potential, passive, honorific, or spontaneous.

2.1.3. Re-Insertion

Similar to *ra*-Deletion, *re*-Insertion is a variable phenomenon of potential forms in Japanese (Inoue and Yarimizu 2002). *Re*-Insertion is predominantly observed in consonant verbs. The traditional variant of the potential for consonant verbs (henceforth, *re*-TV) comprises the verb stem and the potential suffix *e*, yielding single potential constructions. In contrast, *re*-Insertion, which is the innovative variant, comprises a verb stem and two potential suffixes *e* and *re*, yielding double potential constructions as exemplified below.

(3) soko-de sum-e-re-tara.
there-LOC live-POT-POT-COND.PAST
'If (I) can live there.' (S03M0570)

Similar to *sa*-Insertion, *re*-Insertion contains an extra potential suffix *re*. In this sense, *sa*-Insertion and *re*-Insertion are regarded as examples of morpheme insertions. Importantly, the meaning of *re*-Insertion is the strong potential (Inoue and Yarimizu 2002).

2.2. Stochastic OT

In Stochastic OT (Boersma and Hayes 2001, among others), the strength of each constraint is associated with a numerical value, *ranking value*, (henceforth, RV) along a continuous scale of real numbers, rather than a categorical ranking. At every evaluation, the random value, *evaluation noise*, is added to RV and the final value of the constraint is variably determined. Briefly speaking, the closer the RVs of constraints are, the more equal the probabilities of each variable form would be. Stochastic OT is accompanied by a learning algorithm: Gradual Learning Algorithm (GLA). GLA estimates the RVs of each constraint based on 1) the OT grammar that specifies input-output pairs, constraints and violation profiles, and 2) the learning data (observed frequency distribution).

3. Summary of the data

An exhaustive examination of CSJ brought forth a total of 13,375 innovative and traditional forms. The distribution of three variable forms is summarized in Table 1.[2]

[2] For more information about the procedure and the criteria for data extraction as well as the sociolinguistic properties of each variable form, see Sano (2011).

Table 1: Distribution of three variable forms in CSJ.

variant	*frequency*	*variant*	*frequency*	*variant*	*frequency*
sa-Insertion	42	*ra*-Deletion	543	*re*-Insertion	20
sa-TV	1,498	*ra*-TV	7,615	*re*-TV	3,657
rate of *sa*-Insertion (%)	2.73	rate of *ra*-Deletion (%)	6.66	rate of *re*- Insertion (%)	0.54

Among three variables, *ra*-Deletion is the largest in token frequency and the rate of *ra*-Deletion is also relatively high. This again shows that the change of *ra*-Deletion is well under way. The token frequency of *re*-Insertion, conversely, is remarkably small and the rate of *re*-Insertion is quite low. The token frequency and the rate of *sa*-Insertion are in between.

At this point, I illustrate chronological changes of three variable forms in Figure 1, where the rates of each variable form are sorted according to the birth-year of the speakers (grouped every ten years).

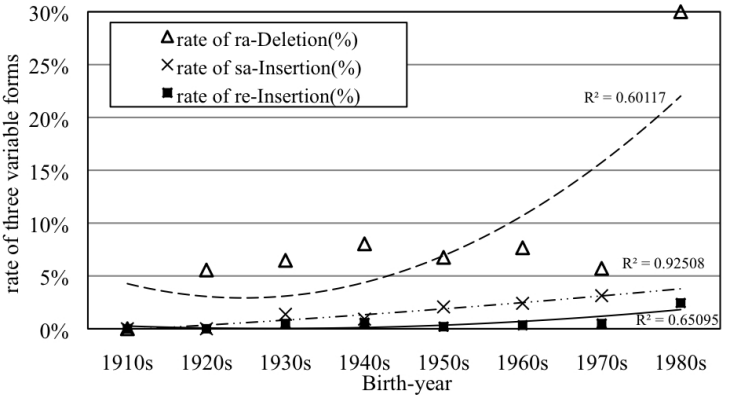

Figure 1: Chronological changes of three variable forms.

As Figure 1 shows, the rate of *ra*-Deletion is consistently the highest, the rate of *re*-Insertion is the lowest, and the rate of *sa*-Insertion is intermediate, across every birth-year decade. In terms of the slope of each fitted curve, the rate of *ra*-Deletion shows a steep ascent; the rate of *re*-Insertion shows a gradual one; the rate of *sa*-Insertion is intermediate.

On the assumption that the change spreads gradually and the rates of each innovative form reflect the degree of progression (the higher the rate of an innovative form, the more advanced the change), the order of the three changes would be as follows: *ra*-Deletion => *sa*-Insertion => *re*-Insertion. This is consistent with the claims of previous studies: *ra*-Deletion was first observed at the end of the 19th century, *sa*-Insertion in 1947, and *re*-Insertion at the end of the 20th century (Matsuda 1993; Inoue and Yarimizu 2002; Sano 2009, 2011, among others). Furthermore, given the observed distribution, we can predict that the changes of three variable forms will proceed in an S-curve manner (Bailey 1973): Figure 1 illustrates the initial phase of the S-curve. I will examine this point in the Probabilistic OT analysis.

4. Standard OT analysis

As preliminaries to the probabilistic OT analysis, I firstly analyze each variable form within the standard OT framework. The following four constraints play a crucial role in the evaluation: OCP (morph) and MAX-IO are against innovative forms, while ALLOCORR and PARCONTRAST are in favor of innovative forms. In this paper, I assume that inputs consist of a verb stem and a set of morphemes that are to be phonologically spelled out in the output such as *yar-ase* or *tabe-rare*.

4.1. Blocking of double causative/potential

Sa-Insertion is a double causative containing two causative suffixes, while *sa*-TV is a single causative (Okada 2003). Traditionally, the double causative is not allowed in Japanese, and one of the causative suffixes is suppressed, yielding a single causative (Shibatani 1973). As a result, double causative and single causative surface as the identical form: single causative. Likewise, *re*-Insertion is a double potential containing two potential suffixes (Inoue and Yarimizu 2002); in contrast, *re*-TV is a single potential. Based on these observations, I firstly introduce Obligatory Contour Principle (morph) (cf. Leben 1973).

(4) OCP (morph):
Assign one violation mark for each pair of two adjacent morphemes with the identical morphosyntactic specifications.

OCP (morph) blocks the occurrence of adjacent identical morphemes. I show how the double causative/potential is suppressed to a single causative/potential in terms of OCP (morph).

(5)[3]

Input: /nom-as-ase/	OCP (morph)
a. no.ma.sa.se (*sa*-Insertion)	*!
☞b. no.ma.se (*sa*-TV)	

(6)

Input: /nom-e-re/	OCP (morph)
a. no.me.re (*re*-Insertion)	*!
☞b. no.me (*re*-TV)	

As shown in (5) and (6), both *sa*-Insertion (5a) and *re*-Insertion (6a) are blocked by OCP (morph), as these are double causative/potential containing two identical suffixes adjacently. Thus, OCP (morph) is shown to be against these two innovative forms.

4.2. Blocking of segment deletion

As I mentioned above, *ra*-Deletion is regarded as a segmental deletion of the potential suffix within a single morpheme, and accordingly MAX-IO comes into play.

(7) MAX-IO:
Every segment in I(nput) has a correspondent in O(utput). (No deletion)

MAX-IO bars the deletion of segments. I show the evaluation of *ra*-Deletion in terms of MAX-IO. In (8), *ra*-Deletion, where the segments *ra* are deleted, is blocked by MAX-IO incurring two violations, showing that MAX-IO is against the innovative form.

(8)

Input: /tabe-rare/	MAX-IO
a. tabe-re (*ra*-Deletion)	*!*
☞b. tabe-rare (*ra*-TV)	

[3] Although other constraints such as IDENT-IO, ONSET, NOCODA, and ALIGN-MORPH-L come into play in determining the phonological shapes of *sa*-Insertion, *ra*-Deletion, and *re*-Insertion in conformity with the CV structure of Japanese, I omit integrated evaluations with these constraints due to limitations of space.

4.3. Analogical leveling

Traditionally, the causative suffix and the potential suffix in Japanese show allomorphy: these suffixes undergo morphological alternations according to verb types to which they attach, either consonant verbs or vowel verbs. Each innovative form plays a role in eliminating the allomorphy by analogical leveling. To capture the analogical leveling in OT terms, I introduce the constraint ALLOCORR. ALLOCORR is categorized as an OO-correspondence constraint (Benua 1997, among others), as it compares and evaluates multiple output forms in a single tableau, unlike the constraints in the IO family.

(9) ALLOCORR (Allomorph Correspondence, Ito and Mester 2004):
Morphs in a relation of allomorphy are identical.

ALLOCORR evaluates the identity between forms within paradigms with respect to segments, and it requires allomorphs to take the identical form. Firstly, I show the evaluation of *sa*-Insertion.

(10)[4]

Candidate paradigms for /nom-/ and /tabe-/			ALLOCORR
☞a. consonant verb:	no.ma.**sa.se**	(*sa*-Insertion)	
vowel verb:	ta.be.**sa.se**	(*sa*-TV)	
b. consonant verb:	no.ma.**se**	(*sa*-TV)	*!**
vowel verb:	ta.be.**sa.se**	(*sa*-TV)	

Paradigm (a), which includes *sa*-Insertion, shows no allomorphy: both the consonant verb and the vowel verb uniformly take the causative suffix *sase*, while paradigm (b), which consists exclusively of *sa*-TV, shows the allomorphy: the consonant verb takes *se*, while the vowel verb takes *sase*, and three segments do not have identical segments as their counterparts, resulting in three violations of ALLOCORR. Thus, *sa*-Insertion is more compatible with ALLOCORR.

(11)

Candidate paradigms for /nom-/ and /tabe-/			ALLOCORR
☞a. consonant verb:	no.me	(*ra*-Deletion)	**
vowel verb:	ta.be.**re**	(*ra*-TV)	
b. consonant verb:	no.me	(*ra*-TV)	***!*
vowel verb:	ta.be.**ra.re**	(*ra*-TV)	

Next, I illustrate the evaluation of *ra*-Deletion. In (11), paradigm (a), which includes *ra*-Deletion, shows less degrees of segmental mismatches among allomorphs: the vowel verb takes *re*; on the other hand, the consonant verb does not, and two segments do not have identical segments as their counterparts, resulting in two violations of ALLOCORR. In contrast, paradigm (b), which consists exclusively of *ra*-TV, shows the allomorphy: the vowel verb takes *rare*, while the consonant verb does not, and four segments do not have identical segments as their counterparts, resulting in four violations of ALLOCORR. Thus, *ra*-Deletion is also shown to be more compatible with ALLOCORR.

Finally, I show the evaluation of *re*-Insertion. In paradigm (a), which includes *re*-Insertion, both the consonant verb and the vowel verb uniformly take the potential suffix *re*, showing no allomorphy, while paradigm (b), which consists exclusively of *re*-TV, shows the allomorphy: the vowel verb takes *re*, while the consonant verb does not, and two segments do not have identical segments as their counterparts, resulting in two violations of ALLOCORR. Thus, *re*-Insertion is again more compatible with ALLOCORR.

[4] In what follows, I conduct the evaluation by ALLOCORR assuming that an initial vowel of the causative/potential suffix for consonant verbs is incorporated into the end of the preceding verb stem (nucleus of the final syllable) in conformity with the phonological structure of Japanese (CV), based on the claim of Inoue (2003).

(12)[5]

Candidate paradigms for /nom-/ and /tabe-/			ALLOCORR
☞a. consonant verb:	no.me.**re**	(*re*-Insertion)	
vowel verb:	ta.be.**re**	(*ra*-Deletion)	
b. consonant verb:	no.me	(*re*-TV)	*!*
vowel verb:	ta.be.**re**	(*ra*-Deletion)	

In summary, in each evaluation, Paradigm (a)s with innovative forms show no allomorphy or less allomorphy; all the innovative forms are more compatible with ALLOCORR.

4.4. Reduction of the amount of ambiguity within a paradigm

Along with the analogical leveling, each innovative form has another function in the optimization of the paradigm: innovative forms contribute to the reduction of the amount of ambiguity within a paradigm. Here, PARCONTRAST comes into play. PARCONTRAST is also categorized as an anti-homophony constraint within a paradigm.

(13) PARCONTRAST (Paradigm Contrast, Ito and Mester 2004):
The cells of a paradigm are pair-wise phonologically distinct.

Briefly, PARCONTRAST requires one-to-one correspondence between form and meaning. Firstly, I present the evaluation of *sa*-Insertion in (14). As mentioned above, the meaning of *sa*-Insertion is honorific, rather than causative (Okada 2003).

In paradigm (a), the meanings "causative" and "honorific" take distinct forms: "casusative" takes *no.ma.se* (*sa*-TV), while "honorific" takes *no.ma.sa.se* (*sa*-Insertion), satisfying one-to-one correspondence between form and meaning. On the other hand, in paradigm (b), "causative" and "honorific" take the identical form; in other words, *no.ma.se* (*sa*-TV) carries two meanings, and one-to-one correspondence is not satisfied. Thus, paradigm (a), which includes *sa*-Insertion, satisfies one-to-one correspondence, and reduces the amount of ambiguity. *Sa*-Insertion is shown to be more compatible with PARCONTRAST.

(14)

Candidate paradigms for /nom-/			PARCONTRAST
☞a. causative:	no.ma.se	(*sa*-TV)	
honorific:	no.ma.sa.se	(*sa*-Insertion)	
b. causative, honorific:	no.ma.se	(*sa*-TV)	*!

Next, I show the evaluation of *ra*-Deletion in (15). The meaning of *ra*-Deletion is restricted to potential, although the suffix *rare* can have four meanings: potential, passive, honorific, or spontaneous. In paradigm (a), "passive," "honorific," and "spontaneous" take *ta.be.ra.re* (*ra*-TV), while "passive" takes *ta.be.re* (*ra*-Deletion); the amount of ambiguity of *rare* decreases, as it carries only three meanings, and one-to-one correspondence is satisfied in "potential." On the other hand, in paradigm (b) four meanings take the identical form *ta.be.ra.re*. In other words, *ta.be.ra.re* carries four meanings. Paradigm (a), which includes *ra*-Deletion, is closer to one-to-one correspondence, and reduces the amount of ambiguity. Thus, we can argue that *ra*-Insertion is more compatible with PARCONTRAST.

(15)

Candidate paradigms for /tabe-/			PARCONTRAST
☞a. passive, honorific, spontaneous:	ta.be.ra.re	(*ra*-TV)	
potential:	ta.be.re	(*ra*-Deletion)	
b. passive, honorific, spontaneous, potential:	ta.be.ra.re	(*ra*-TV)	*!

[5] Based on the fact that the change of *ra*-Deletion is followed by the change of *re*-Insertion, I assume that the potential form for vowel verbs is *ra*-Deletion as in *tabe-re* instead of *ra*-TV as in *tabe-rare*.

Finally, I show the evaluation of *re*-Insertion in (16). The meaning of *re*-Insertion is the strong potential (Inoue and Yarimizu 2002). Paradigm (a) satisfies one-to-one correspondence, as "potential" takes *no.me* (*re*-TV), while "strong potential" takes *no.me.re* (*re*-Insertion); on the other hand, paradigm (b) does not satisfy one-to-one correspondence, as "potential" and "strong potential" take the identical form *no.me*. Paradigm (a), which includes *re*-Insertion, satisfies one-to-one correspondence, and reduces the amount of ambiguity. Thus, *re*-Insertion is also more compatible with PARCONTRAST.

(16)

Candidate paradigms for /nom-/			PARCONTRAST
☞a. potential:	no.me	(*re*-TV)	
strong potential:	no.me.re	(*re*-Insertion)	
b. potential, strong potential:	no.me	(*re*-TV)	*!

In summary, paradigm (a)s with innovative forms reduce the amount of ambiguity, and accordingly, innovative forms are more compatible with PARCONTRAST.

5. Probabilistic OT analysis

Here, I conduct the probabilistic OT analysis. I assume that the chronological change of the distribution of innovative forms can be attributed to the gradient approximation of the RVs of four constraints.

5.1. Estimation of ranking values

I implemented the analysis by means of the Stochastic OT model in Praat (Boersma and Weenink 1992-2008). As shown in Table 2, I classified the observed distribution into three birth-year periods: 1915-39, 1940-59, and after 1960.

Table 2: Observed distributions of three variable forms by birth-year periods.

	1915-39	1940-59	1960-
sa-Insertion	2	8	24
sa-TV	149	428	842
ra-Deletion	23	128	391
ra-TV	350	1,644	5,573
re-Insertion	1	3	12
re-TV	205	858	2,560

Based on the observed frequency distribution, I estimated the RVs of each constraint in three time periods, and derived the chronological transition of the RVs of constraints.[6] The result is shown in Table 3.

Table 3: Chronological transition of the RVs of each constraint.

	1915-39	1940-59	1960-
OCP (morph)	103.299	103.228	103.188
MAX-IO	100.924	100.899	100.899
ALLOCORR	95.777	95.873	95.913
PARCONTRAST	95.777	95.873	95.913

Specifically, the RVs of OCP (morph) and of MAX-IO are gradually decreasing; on the other hand, those of ALLOCORR and of PARCONTRAST are increasing. Thus, the constraints are getting closer along

[6] I set the representative parameters in learning as follows: Decision strategy, Optimality Theory; Initial ranking, 100; Evaluation noise, 2.0; Ranking strategy, symmetric all; Initial plasticity, 1.0; Replications per plasticity, 100,000.

the time-line, showing that the gradient approximation of the RVs of each constraint caused the emergence and gradual increase of innovative forms.

5.2. Prediction by evolOT

The evolOT predicts the transition of the RVs of each constraint over time, based on the OT grammar and the frequency distribution of the phenomena at a particular point, and it further generates a series of frequency distributions, according to the predicted RVs. I illustrate the predicted chronological transitions of the RVs of constraints in Figure 2 and of the frequency distributions in Figure 3.

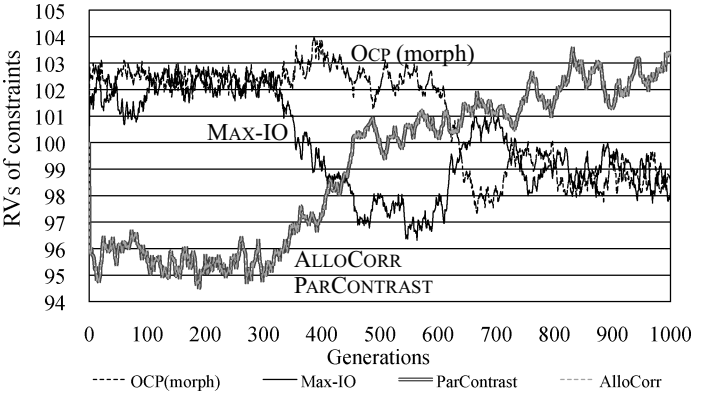

Figure 2: Prediction by evolOT (RVs).

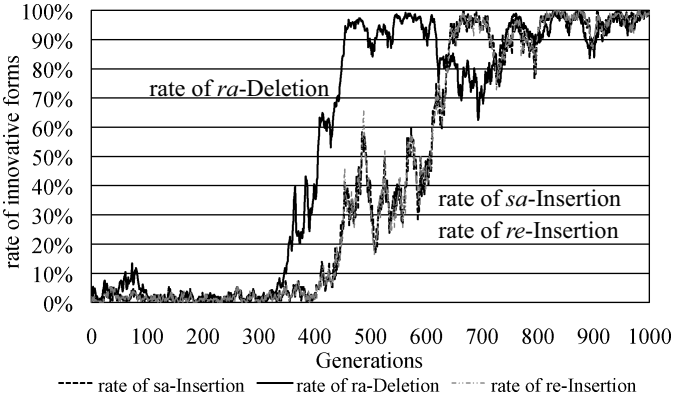

Figure 3: Prediction by evolOT (frequency distributions).

In Figure 2, the RVs of OCP (morph) and of MAX-IO initially are much higher than those of ALLOCORR and of PARCONTRAST. Subsequently, the RVs of four constraints come closer, and finally we can observe the inversion of the RVs of constraints. Importantly, the RV of MAX-IO begins to decline earlier than the one of OCP (morph); accordingly, *ra*-Deletion firstly begins to increase, followed by other innovative forms as shown in Figure 3.

In the beginning, the rates of three innovative forms remain stagnant; subsequently, the rates gradually increase followed by the explosive increase; finally the rates become stable with the highest percentage. This shows that the changes of *sa*-Insertion, *ra*-Deletion and *re*-Insertion would proceed in an S-curve manner as Figure 1 suggests.

In summary, the evolOT predicts that the changes of three variable forms would proceed in an S-curve manner, along with the chronological transition of the RVs of each constraint. The results support the order of the changes of three variable forms. The prediction is consistent with the observed data, in the sense that the observed data corresponds to the initial phase of S-curve.

6. Conclusion

In this paper, I modeled the ongoing morphological changes in voice in Japanese in terms of Probabilistic OT, based on the corpus. GLA detected the chronological transition of the RVs of each constraint, showing that the gradient approximation of the RVs caused the emergence and the gradual increase of three innovative forms. The evolOT illustrated the relationship between the chronological transitions of RVs and those of frequency distributions, and predicted the changes of variable forms in an S-curve manner that are consistent with the observed data. I propose that the mechanisms of these changes can be reduced in principle to the dynamic interaction of the small set of constraints: OCP (morph), MAX-IO, ALLOCORR and PARCONTRAST.

References

Bailey, Charles-James N. (1973) Variation and linguistic theory. Washington DC: Center for Applied Linguistics.

Benua, Laura. (1997) Transderivational identity: Phonological relations between words. Doctoral dissertation, University of Massachusetts.

Bloch, Bernard. (1946) Studies in colloquial Japanese: II Syntax. Language 22, 200-248.

Boersma, Paul and Bruce Hayes. (2001) Empirical tests of the Gradual Learning Algorithm. Linguistic Inquiry 32, 45-86.

Boersma, Paul and David Weenink. (1992-2008) Praat: doing phonetics by computer. Download software and manual. http://www.praat.org. (7 January, 2008.)

Inoue, Fumio. (2003) Nihongo wa nensoku iti-kilo de ugoku. Tokyo: Kôdansya Gendai Shinsyo.

Inoue, Fumio and Kanetaka Yarimizu. (2002) Jiten: Atarashii nihongo. Tokyo: Taisyûkan.

Ito, Junko and Armin Mester. (2004) Morphological contrast and merger: Ranuki in Japanese. Journal of Japanese Linguistics 20, 1-18.

Jäger, Gerhard. (2002) evolOT. Download software and manual <http://wwwhomes.uni-bielefeld.de/gjaeger/evolOT/>

Leben, W. (1973) Suprasegmental Phonology. Unpublished Ph.D. dissertation, MIT.

Maekawa, Kikuo. (2004) Nihongo hanashikotoba kôpasu no gaiyô. Nihongo kagaku 15, 111-133.

Matsuda, Kenjiro. (1993) Dissecting analogical leveling quantitatively: The case of the innovative potential suffix in Tokyo Japanese. Language Variation and Change 5, 1-34.

Okada, Judy. (2003) Recent trends in Japanese causatives: The *Sa*-insertion phenomenon. Japanese/Korean Linguistics 12, 28-39. Stanford: CSLI Publications.

Prince, Alan and Paul Smolensky. (1993) Optimality Theory: Constraint Interaction in Generative Grammar. Rutgers University Center for Cognitive Science Technical Report 2. (Also published 2004 by Blackwell.)

Shibatani, Masayoshi. (1973) Semantics of Japanese causativisation. Foundations of Language 9, 327-373.

Sano, Shin-ichiro. (2009) Real-time demonstration of the change from above/below based on the corpus data: Cases of *sa*-Insertion, *ra*-Deletion, and *re*-Insertion in Japanese. Paper presented at the 38th New Ways of Analyzing Variation (NWAV 38) at University of Ottawa, Canada.

Sano, Shin-ichiro. (2011) Real-time demonstration of the interaction among internal- and external factors in language change: A corpus study. Gengo kenkyû 139, 1-27.

Proceedings of the 29th West Coast Conference on Formal Linguistics

edited by Jaehoon Choi, E. Alan Hogue, Jeffrey Punske, Deniz Tat, Jessamyn Schertz, and Alex Trueman

Cascadilla Proceedings Project Somerville, MA 2012

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ISBN 978-1-57473-451-5 library binding

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Sano, Shin-ichiro. 2012. Predicting Ongoing Global Paradigm Optimization in Voice in Japanese: Corpus-Based OT Analysis. In *Proceedings of the 29th West Coast Conference on Formal Linguistics*, ed. Jaehoon Choi et al., 398-406. Somerville, MA: Cascadilla Proceedings Project. www.lingref.com, document #2726.