Glottal stops in Taiwanese and Japanese : An Optimality Approach

Lin, Chiu-ping

1 The Optimality Theory

In contrast to the traditional rule-based phonology, OT does not have rules but constraints. In OT a hierarchy of mutually ranking constraints will select out from all possible outputs the optimal one as the surface representation. While the constraints are universal, the ranking of them is different from language to language.

In an OT tableau, the input is placed at the top of left cell. The candidates generated from the input by *GEN* appear in the leftmost column. The constraints of interests are at the top of the tableau. The leftmost constraint is highest ranked and the rightmost constraint is lowest ranked. Violations of the constraints are indicated by the symbol *, and the fatal violation is marked by the symbol !. Shaded areas in the tableau indicate constraints that should no longer be considered since a higher ranked constraint has already been violated. A pointing hand ☞ within the tableau marks the candidate that is predicted by the constraints as the optimal output; and a pointing hand outside the tableau, if any, indicates the candidate that that is optimal in reality but fails to be predicted by the constraints set.

2 Correspondence Theory

The constraint that requires a mapping between input and output is *IO-Faith* (Input-Output Faithfulness). Other constraints are listed as below.

(1) Constraints on Correspondence Elements (McCarthy and Prince 1995b: 370-371)

MAX: Every element of S1 has a correspondent in S2.

Domain (ℜ) = S1

DEP: Every element of S2 has a correspondent in S1.

Range (ℜ) = S2

IDENT (F): Let α be a segment in S1 and β be any correspondent of α in S2. If α is [γF], then β is [γF]. (Correspondent segments are identical in feature F .)

{RIGHT, LEFT} –ANCHOR (S1, S2)

Any element at the designated periphery of S1 has a correspondent at the designated periphery of S2.

Let *Edge* (X,{L,R}) = the element standing at the *Edge* = L, R of X.

RIGHT-ANCHOR. If x = Edge (S1 R) and y = Edge (S2 R) then x𝔑y.

LEFT-ANCHOR. Likewise, *mutates mutandis*.

According to Roca and Johnson (1999:600), MAX(IMALITY) requires that every input segment be mapped onto the surface. Therefore, deleting segments violates MAX. On the other hand, DEP(ENDENCY) requires that every surface segment have a lexical correspondent. Thus, epenthesis violates DEP. IDENT(F) is responsible for the identity of features. For example, if segment *x* is in a relation of correspondence to segment *y*, then *x* and *y* must satisfy IDENT(F). ANCHOR constraints deal with the correspondence between the edges of two strings. As McCarthy and Prince (1995b:371) predicts, prefixing reduplication usually satisfies LEFT-ANCHOR, that is, LEFT –ANCHOR ranks over RIGHT-ANCHOR. In contrast, suffixing reduplication usually has to obey RIGHT-ANCHOR, that is, RIGHT-ANCHOR ranks over LEFT-ANCHOR. In the current case, OO correspondence refers to the correspondence between bases or between base and suffix. Note that IO correspondence and OO correspondence constraints are different and separate and they are respectively ranked with respect to the markedness constraints (e.g. phonologically well-formed constraints).

3 Markedness Theory

If we follow Clements and Hume (1995), front vowels are taken as Coronal (least marked). Then the ranking *LAB, *DORS >> *COR of vowels is established by the markedness condition. Coronal means *LAB and *DORS. Therefore, *DORS serves as the relative markedness constraint in the case of Japanese analysis. In addition, other markedness constraints are also importan' in determining the optimal candidate, such as NO-GEMINATE and IDENT-μ. The conception of NO-GEMINATE comes from the conception of OCP (adjacent identical segments are prohibited). IDENT-μ means if y stands in a relation of correspondence with x, then the moraic value of x and y should be identical.

Segmentals change (i.e., the insertion or deletion of glottal stops) due to the relevant rank: : of the constraints on Correspondence with respect to segmental markedness constraints.

4 The glottal stops in Japanes and Tainwanese

4.1 Japanese: epenthesis of glottal stops

◆ bases suffixed by *u* / *ru*

/ utau / -ta → utatta
'sing' 'suffix' 'sang'

/ doru / -ta → dotta
'take' 'suffix' 'took'

◆ bases suffixed by *ku*

/ iku / -ta → itta
'go' 'suffix' 'went'

4.2 Taiwanese: deletion of glottal stops

◆ bases followed by another base (syllable)

/ kwat / -ts'ay → kwa ts'ay
'cut' 'vegetables' 'cut vegetables'

/ pek / -kiw → pe kiw
'white' 'ball' 'whlte ball'

/ tsyok / -kỹã → tsyo kỹã
'borrow' 'mirror' 'borrow a mirror'

◆ bases followed by a suffix

/ tsyog / -a → tsyo a
'pebble' 'suffix' 'pebble'

/ lwag / -a → lwa a
'comb' 'suffix' 'comb'

5.1 ***Japanese: MAX-OO >> NO-GEMINATE***

5.1.1 *ANCHOR-L >> * DORS (V) >> MAX-OO >> NO-GEMINATE*

When followed by *–ta* (the suffix for past tense), / utau / ('sing') changes to *utatta* ('sang') (A glottal stop is inserted and realized as gemination).

Tableau 1: Japanese (utau 'sing' → utatta 'sang')

/ utau / -- ta	ANCHOR-L	*DORS (base vowel)	MAX-OO
☞a. utatta		**	*
b. utauta		***!	
c. itaita	*!	*	**
d. tita	*!		***
e. tatta	*!	*	**
f. tata	*!	*	**

As illustrated in Tableau 1, ANCHOR-L, *DORS (for the vowel of the base), and MAX-OO are the relevant constraints and select *utatta* as the optimal output. ANCHOR-L is ranked highest and *DORS (V) is ranked higher than MAX-OO. The highest ranked constraint ANCHOR-L rejects the candidate c, d, e, f. The rest constraints will determine which candidate is the optimal one. Because the candidate b violates the constraint *DORS (V) three times and incurs a fatal violation in the third violation, it is ruled out. As a result, candidate a *utatta* is selected out as the optimal output. In addition, since the epenthesis of a glottal stop is always taken as gemination, another constraint NO-GEMINATE is also relevant in this case. NO-GEMINATE cannot be ranked higher than *DORS(V), otherwise the optimal candidate *utatta* is ruled out (see Tableau 2). So, NO-GEMINATE must be ranked lowest as illustrated in Tableau 3.

Tableau 2: Japanese (utau 'sing' → utatta 'sang')

	/ utau / -ta	ANCHOR-L	NO-GEMINATE	*DORS(V)	MAX-OO
☞	a. utatta		*!	**	*
	☞b. utauta			***	
	c. itaita	*!		*	**
	d. tita	*!			***
	e. tatta	*!	*	*	**
	f. tata	*!		*	**

Tableau 3: Japanese (utau 'sing' → utatta 'sang')

/ utau / -ta	ANCHOR-L	*DORS(V)	MAX-OO	NO-GEMINATE
☞a. utatta		**	*	*
b. utauta		***!		
c. itaita	*!		**	
d. tita	*!		***	
e. tatta	*!		**	*
f. tata	*!		**	

5.1.2 *IDENT-μ*

These constraints ANCHOR-L, *DORS (V), MAX-OO, and NO-GEMINATE are not able to select out the optimal candidate in the case of *doru* ('take') –*ta* (the suffix for past tense) → dotta ('took') (see Tableau 4).

Tableau 4: Japanese doru 'take' → dotta 'took'

	/doru/ - ta	ANCHOR-L	*DORS(V)	MAX-OO	NO-GEMINATE
☞.	a.dotta			**	*!
	b.doruta		*!		
	☞c.dota			**	
	☞d.dita			**	
	e.ruta	*!	*	**	

So another constraint is required to deal with the difficulty. Consider the epenthesis of a glottal stop. A glottal stop is inserted to preserve the mora of the original position. Therefore, the constraint IDENT-μ has to be added. However, the ranking of IDENT-μ cannot be higher than *DORS(V), or MAX-OO and cannot be lower than NO-GEMINATE, otherwise it cannot function to select out the optimal candidate. So, IDENT-μ is ranked between MAX-OO and NO-GEMINATE. Since whether the relative ranking of MAX-OO and IDENT-μ is MAX-OO >> IDENT-μ or IDENT-μ >> MAX-OO does not affect the selection of the optimal output, MAX-OO and IDENT-μ are ranked at the same level. Therefore, *dotta* ('took') is chosen as the optimal candidate because it violates the lower ranking constraints MAX-OO and NO-GEMINATE (see Tableau 5)

Tableau 5: Japanese doru 'take' → dotta 'took'

/doru/-ta	ANCHOR-L	*DORS(V)	MAX-OO	IDENT-μ	NO-GEMINATE
☞a. dotta			**		*
b. doruta		*!			
c. dota			**	*!	
d. dita			**	*!	
e. ruta	*!	*	**	*	

5.1.3 *DEP*

These constraints are not enough for the case of *iku* ('go'). Another constraint DEP help select out the optimal candidate. For candidate a to be selected as the optimal output, DEP has to be ranked between MAX-OO, IDENT-μ AND NO-GEMINATE (and thus rule out candidate d). In Tableau 6, candidate a violates the lower ranking constraints MAX-OO, DEP, and NO-GEMINATE. Candidate e is ruled out by the highest constraint ANCHOR-L. Candidate b and c are ruled out by the higher ranked constraints *DORS(V). Candidate f is ruled out by the constraints MAX-OO and IDENT-μ. If DEP is not added to the Tableau, these constraints cannot determine candidate a or d as the optimal one.

Tableau 6: Japanese iku 'go' → itta 'went'

/iku/-ta	ANCHOR-L	*DORS(V)	MAX-OO	IDENT-μ	DEP	NO-GEMINATE
☞a. itta			**		*	*
b. ikuta		*!				
c.iguta		*!			*	
d. iyita			**		**!	
e. kuta	*!	*	*	*		
f. ita			**	*!		

In view of the above analysis, the relative ranking of the constraints in Japanese glottal stop is ANCHOR-L >> *DORS (V) >> MAX-OO, IDENT-μ >> DEP >> NO-GEMINATE.

5.2 *Taiwanese: NO-GEMINATE >> MAX-OO*

5.2.1 *ANCHOR-L >> *DORS (V) >> NO-GEMINATE >> MAX-OO*

In the case of glottal stops in Taiwanese, the relevant constraints may be ANCHOR-L, *DORS(V), NO-GEMINATE, and MAX-OO. Take Tableau 7 for illustration. Similar to the case of Japanese, ANCHOR-L is ranked highest and *DORS(V) is ranked below ANCHOR-L. As for MAX-OO and NO-GEMINATE, because the glottal stop (realized as gemination) is deleted when followed by another syllable, NO-GEMINATE should dominate MAX-OO. Therefore, the ranking is ANCHOR-L >> * DORS (V) >> NO-GEMINATE >> MAX-OO.

Tableau 7: Taiwanese kwat 'cut' → kwa ts'ay 'cut vegetables'

/kwat/-ts'ay	ANCHOR-L	*DORS(V)	NO-GEMINATE	MAX-OO
☞a. kwa ts'ay		*		*
b. kwat ts'ay		*	*!	

c. wat ts'ay	*!	*		*
d. a ts'ay	*!	*		***
e. ka ts'ay		*		**!

As illustrated in Tableau 7, because candidate c and d violate the highest ranked constraint ANCHOR-L, they are ruled out. The constraint *DORS(V) cannot rule out any candidate (all candidate violate *DORS), and may be irrelevant or ranked lower than MAX-OO. Candidate b incurs a fatal violation in the violation of NO-GEMINATE. Candidate a is selected out as the optimal one since it violates MAX-OO less than candidate e does. So the actual ranking of glottal stops in Taiwanese should be ANCHOR-L >> NO-GEMINATE >> MAX-OO >> (*DORS).

5.2.2 *DEP*

In the case of glottal stops in Japanese, DEP help determine which is the optimal candidate. However, DEP is irrelevant in glottal stops of Taiwanese. So DEP is not listed in the tableau.

The relative ranking: ANCHOR-L >> NO-GEMINATE >> MAX-OO is able to account for other cases of the deletion of glottal stops in Taiwanese. See Tableau 8, 9, 10 and 11.

Tableau 8: Taiwanese pek 'white' → pe kiw 'white ball'

/pek / -kiw	ANCHOR-L	NO-GEMINATE	MAX-OO
☞a. pe kiw			*
b. pek kiw		*!	
c. ek kiw	*!	*	*
d. e kiw	*!		**

Tableau 9: Taiwanese tsyok 'borrow' → tsyo kỹã 'borrow a mirror'

/tsyok/-kỹã	ANCHOR-L	NO-GEMINATE	MAX-OO
☞a. tsyo kỹã			*
b. tsyok kỹã		*!	
c. yok kỹã	*!	*	*
d. yo kỹã	*!		**

In Tableau 8 and 9, the input is followed by another syllable. Take Tableau 8 for example. Candidate c and d are ruled out by the highest ranked constraint

ANCHOR-L. Then the rest constraints will determine which is the optimal output. Candidate b is ruled out by the higher ranked constraint NO-GEMINATE. So candidate is chosen as the optimal one since it violates the lowest ranked constraint MAX-OO. Tableau 9 is similar to Tableau 8.

Tableau 10: Taiwanese tsyog 'pebble' → tsyo a 'pebble' (a is a suffix)

/tsyog/ --a	ANCHOR-L	NO-GEMINATE	MAX-OO
☞a. tsyo a			*
b. tsyog a		*!	
c. tso a			**!
d. tsog a		*!	*
e. yo a	*!		**
f. yog a	*!	*	*

Tableau 11: Taiwanese lwag 'comb' → lwa a 'comb'

/lwag/ -- a	ANCHOR-L	NO-GEMINATE	MAX-OO
☞a. lwa a			*
b. lwag a		*!	
c. wa a	*!		**
d. wag a	*!	*	*
e. la a			**!
f. lag a		*!	*

In Tableau 10 and 11, the input is followed by a suffix. When followed by a suffix, these constraints still can select out the actual optimal output. As illustrated in Tableau 11, candidate c and d are ruled out by the highest ranked constraint ANCHOR-L. The higher ranked constraint NO-GEMINATE help rule out candidate b and f. Candidate a and e will compete for the optimal output. Because candidate e violates MAX-OO more than candidate a does, candidate e is ruled out. Therefore, the optimal candidate is a.

6 discussion and comparison

6.1 Japanese

In the case of Japanese, the bases can be divided into two groups. In one group (*utau* 'sing' and *doru* 'take'), ANCHOR-L, *DORS (V), MAX-OO, IDENT-μ and NO-GEMINATE are required. In the other group (*iku* 'go'), another constraint DEP has to be added so as to be able to select out the optimal candidate. In section 5.1, the epenthesis of glottal stops in Japanese is introduced and analyzed as the relative ranking of MAX-OO and NO-GEMINATE. In other words, because MAX-OO and IDENT-μ dominate NO-GEMINATE, a glottal stop can be inserted between the base and the suffix (and usually realized as gemination). In addition to these constraints, other constraints are also required to help select out the optimal candidate, such as the highest ranked constraint ANCHOR-L, the higher ranked constraint *DORS (for the vowel of the base) and the lower ranked constraint DEP. With these constraints and their relative ranking (ANCHOR-L >> *DORS(V) >> MAX-OO, IDENT-μ >> DEP >> NO-GEMINATE), the epenthesis of glottal stops in Japanese can be successfully accounted for from the Optimality Theory approach.

6.2 Taiwanese

In the case of Taiwanese, a glottal stop of the base is deleted when followed by a syllable or a suffix, which is contrary to the case of Japanese. ANCHOR-L, MAX-OO and NO-GEMINATE are the relevant constraints responsible for determining which candidate is qualified to be the optimal output. Unlike Japanese, the constraints *DORS (for the vowel of the base) and DEP seem not so influential in the evaluation of the optimal candidate, so they are not listed in the tableau. With these constraints and their relative ranking (ANCHOR-L >> NO-GEMINATE >> MAX-OO), the deletion of a glottal stop between the base and the suffix or between two bases is appropriately explained in terms of the Optimality Theory.

6.3 Similarities

First of all, in the analysis of Japanese and Taiwanese, several constraints involved are shared by both languages, such as ANCHOR-L, MAX-OO and

NO-GEMINATE. In addition, the constraint ANCHOR-L is ranked highest in both Japanese and Taiwanese. Therefore, if one candidate violates the highest ranked constraint ANCHOR-L, it incurs a fatal violation and is deprived of the qualification of being selected out as the optimal output. Once a candidate is ruled out, it is no more evaluated by other constraints (as shown by the gray area of the tableau). And the rest candidates continue to be examined by other constraints. Only when the fewer and the lower ranked constraints are violated by a candidate does it become the optimal output.

6.4 Differences

The major difference lies in that MAX-OO dominates NO-GEMINATE in Japanese while NO-GEMINATE dominates MAX-OO in Taiwanese. Because NO-GEMINATE is ranked lowest (below MAX-OO) in Japanese, a glottal stop is allowed to be inserted (and realized as gemination) between the base and the suffix. However, since NO-GEMINATE dominates MAX-OO in Taiwanese, the glottal stop of the base is deleted (and no more realized as gemination) when followed by a suffix or another base. So the glottal stop of the base is forced to disappear and gemination no longer exists. In addition to the different ranking of constraints in Japanese and Taiwanese, several constraints are unique to a certain language. That is while one constraint is influential in one language, it may not relevant in another language. For example, IDENT-μ plays an important role in the evaluation of the optimal candidate in Japanese, but it is impotent in Taiwanese. Besides, DEP also has the power to determine the optimal candidate in Japanese, but not in Taiwanese. Similarly, while *DORS (for the vowel of the first base), IDENT-μ and DEP are crucial constraints for Japanese, they are nonetheless impotent for Taiwanese. Furthermore, MAX-OO >> NO-GEMINATE in Japanese can be taken as the Correspondence constraints >> the Markedness constraints. And NO-GEMINATE >> MAX-OO can be regarded as the

Makedness constraints >> the Correspondence constraints. According to the Optimality Theory, since all constraints exist in all languages, some are crucial for one language, some are important in another language. The only difference lies in the relative ranking of constraints and that will result in some language-specific phenomenon.

7 Conclusion

The focus of this paper is on the comparison of glottal stops in Japanese and Taiwanese from the Optimality Theory perspective. While the glottal stop of the base is inserted in Japanese, it is deleted in Taiwanese. In the analysis of glottal stops, gemination serves as the frequently employed approach. Therefore, the constraint NO-GEMINATE is influential in both cases of Japanese and Taiwanese. According to the Optimality Theory, although several constraints exist in both language, the ranking among constraints are quite different. Since the ranking of constraints differs in both languages, the epenthesis of glottal stops in Japanese and the deletion of glottal stops in Taiwanese can be appropriately accounted for by the Optimality Theory approach. For example, because NO-GEMINATE is dominated by MAX-OO in Japanese, a glottal stop can be inserted (gemination emerges). On the contrary, NO-GEMINATE dominates MAX-OO in Taiwanese, and therefore the glottal stop of the first base is deleted (gemination no longer exists). In addition, several constraints (such as *DOS (V), IDENT-μ, and DEP for Japanese) play an essential part in the evaluation of the optimal candidate in one language, but not in another language. In other words, those constraints may be ranked lower in a certain language. So, according to the above discussion and comparison, the epenthesis of glottal stops in Japanese and the deletion of glottal stops in Taiwanese can be illustrated appropriately in terms of the relative ranking of constraints in the Optimality Theory.

References

Cheng, Chihjen. 2000. English loanword truncation in Japanese: an optimality theoretic approach. Paper presented at National ChengChi University Graduate Students Conference.

Chung, Raung-fu. 1996. The segmental phonology of Southern Min in Taiwan. Taipei: Crane.

Clements, George N. and Elizabeth Hume. 1995. The internal organization of speech sounds. In John Goldsmith, ed., The handbook of Phonological Theory. Oxford: Blackwell.

Ito, Junco and Armin Mester. 1998. Markedness and word structure: OCP effects in Japanese. Rutgers University Archive, (ROA-255).

Kager, Rene. 1999. Optimality theory. Cambridge: Cambridge University Press.

Lin, Hui-shan. 2000. Strata ordering: an optimality account. Paper presented at Preceedings of the 2000 National Conference on Linguistics.

McCarthy, John and Alan Prince. 1994. The emergence of the unmarked: optimality in prosodic morphology. Rutgers University Archive, (ROA-13).

---. 1995b. Faithfulness and reduplicative identity. University of Massachusetts Occasional Papers in Linguistics 18: Papers in Optimality Theory, ed. By Jill Beckman et al., 249-384. Amherst Mass.: Graduate Linguistic Student Association.

Nelson, Nicole. 1998. Mixed anchoring in French hypocoristic formation. RuLing Papers 1:189-99.

Prince, Alan and Paul, Smolensky. 1993. Optimality theory: Constraint interaction in generative grammar. Manuscript. Rutgers University of Colorado, Boulder.

Roca, Iggy and Wyn Johnson. 1999. A course in phonology. Oxford: Blackwell.

Yip, Moria. 2000. Segmental unmarkedness versus input preservation in reduplication. Rutgers University Archive, (ROA-378). Segmental phonology in Optimality Theory. Cambridge: Cambridge University Press.