Glottal stops in Taiwanese and Japanese : An Optimality Approach

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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 ($\mathfrak{R}$) = S1

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

Range ($\mathfrak{R}$) = 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 x$\Re$y.

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 important 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