

# An Optimality Approach to Southern Min and Spanish Geminataion

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## 1. Introduction

This paper investigates the geminate consonants in Southern Min and Spanish in term of Optimality Theory (Prince and Smolensky 1993, 1994), in which grammar consists of universal constraints that are ranked on a language specific basis. The gemination in Southern Min refers to that the final consonant of the stem is geminated before the suffix /a/, for example, *kan* 'bottle' + nominal suffix *a* = *kanna*, and details are shown in section 2.2 (1). The gemination in Spanish appears in one type of Compound Adjectives, Noun + Adjective. For example, *pelo* 'hair' + *rojo* 'red' = *pelirroxo*, in which the first consonant *r* of adjective is geminated when attaching to the stem. In section two, the consonant gemination of Southern Min is discussed. Section three analyze the geminated *r* in Spanish compound adjectives. Thus, more details will be discussed in the following parts.

## 2. Southern Min

### 2.1 Types of Geminataion

When one sound is pronounced longer, it forms a doubling sound. This doubling sound is known as gemination. There are two kinds of geminate. 1. True geminate: The geminated segment is an inherent part of the morphem. 2. Fake geminate: Combine two morphemes in the situation that the ending segment of the stem is identical to the initial segment of the suffix. The gemination sounds are considered as a strong sound and are easier to make distinction ( Spencer, 1996). However, it is opposite to tendency toward easier articulation.

### 2.2 Geminataion in Southern Min

In Southern Min, the syllabification usually requires an onset. The gemination in Southern Min is that the consonant is geminated before the nominal marker /a/, as in (1).

(1)

kim + a	kimma	'gold'
kan + a	kanna	'can'
kaw + a	kawwa	'dog'

The consonants, /m/, /n/ and /w/, at the end of each stem are geminated before the nominal marker /a/. In segmental phonology, the gemination in (1) is called

spreading. In addition, there is other form of gemination in Southern Min, as in (2).

(2)

ap + a    abba    ‘box’  
tik + a    tigga    ‘bamboo’

The final consonants, /p/ and /k/, of the stem are the result of devoicing in the process of gemination. The status of the consonants, /p/ and /k/, are considered to be the base (output) form. In Southern Min, when consonants, /p/ ,/t/ and /k/, appearing in the coda, they are glottalized and hence, they are perceived as voiceless sounds (Chung, 1996).

2.3 Constraints Related to Gemination in Southern Min

In Southern Min, GEMINATE refers to geminating the final consonant of the stem before the suffix /a/. Since there is an addition (the geminated segment) in the output form, this phenomenon can be accounted by the following constraints (McCarthy and Prince 1995:370-371).

- (2) **MAX**: Every segment in S1 has a correspondent in S2.
- (3) **DEP**: Every segment in S2 has a correspondence in S1.

(4) Southern Min Gemination: DEP >> MAX

Base:	DEP	MAX
[kim] + [a]		
a.    *→ kim]a		
b.→    kim]ma	*!	
c.    *→ki]ma		
d.    ki]a		*

In tableau (4), the candidate (b) violates the fatal constraint, DEP, and thus is rejected at the beginning. Candidate (a) and (c) do not violate both constraints and thus are predicted. Candidate (d) is ruled out by the constraint, MAX. However, candidates, (a) and (c), are the wrong prediction. Therefore, constraints, DEP and MAX, have to be re-ranked to rule out these candidates, as in tableau (5).

(5) Southern Min Gemination: Max >> DEP

Base:	MAX	DEP
[kim] + [a]		
a.    *→kim]a		
b.→    kim]ma		*
c.    *→ki]ma		
d.    ki]a	*!	

In tableau (5), the fatal constraint, DEP, stays a little bit away from candidate (b), however, candidates, (a) and (c), are still predicted. Therefore,



another constraint (McCarthy and Prince, 1995), as in (6), is needed to rule out the candidates, (a) and (c).

(6) **ONS.**: Every syllable has an onset.

(7) Southern Min Gemination: MAX >> ONS. >> DEP

Base:		MAX	ONS.	DEP
[kim] + [a]				
a.	kim]a		*!	
b.→	kim]ma			*
c.	*→ki]ma			
d.	ki]a	*!		

In tableau (7), candidate (a) violates ONS. because it lacks an onset before the nominal marker, /a/. Candidate (b) violates DEP. Candidate (c) is the optimal output in this tableau. Candidate (d) violates MAX because there is no correspondent for the /m/ in the base form and thus, is ruled out. However, the fake optimal output, candidate (b), is not filtered out. Since, constraints in tableau (7) can not predict the optimal outputs, another constraint is needed, as in (8)(Ito, 1998).

(8) **GEMINATE**: The final consonant of the stem is geminated before the suffix /a/.

(9) Southern Min Gemination: MAX >> ONS. >> GEMUNATE >> DEP

Base:		MAX	ONS.	GEMINATE	DEP
[kim] + [a]					
a.	kim]a		*!	*	
b.	→kim]ma				*
c.	ki]ma			*!	
d.	ki]a	*!			
e	kimm]a		*!		*
f.	*→ki]mma				*

In tableau (9), candidate (a) which violates MAX and candidate (d) which violates ONS. are rejected. Although candidate (c) satisfies ONS., it is ruled out by GEMMINATE. Hence, GEMMINATE is an crucial constraint to predict the optimal output in gemination. Candidate (e) satisfies GEMINATE, but it violates ONS and thus is ruled out. Both candidate (b) and candidate (f) are predicted because they satisfy GEMINATE and only violate DEP. However, this tableau can not predict the optimal outputs and can not filter out all the bad candidates. Hence, another constraint is needed, as in (10)(Keger, 1999).

(10) **\*COMPLEX ONS.**: Do not have the complex onset.



(11) Southern Min Gemination: MAX >> ONS.>> GEMUNATE >> \*COMPLEX ONS. >> DEP

Base:	MAX	ONS.	GEMINATE	*COMPLEX ONS.	DEP
[kim] + [a]					
a. kim]a		*!	*		
b. →kim]ma					*
c. ki]ma			*!		
d. ki]a	*!				
e kimm]a		*!			*
f. ki]mma				*!	*

In tableau (11), candidate (a) is rejected by ONS. and candidate (d) is rejected by MAX. Candidate (c) violates GEMINATE. Candidate (e) violates ONS. although it satisfies GEMINATE. Candidate (f) violates \* COMPLEX ONS. because there are two consonants in the onset position and thus, it is ruled out. Therefore, candidate (b) wins.

In addition, there is another form of gemination in Southern Min. When pronouncing /tik/ ‘bamboo’, the final consonant /g/ is glottalized and hence it causes devoicing in the coda position and it is perceived as voiceless consonant /k/, as /tik/. When the final consonant /g/ geminates before the nominal marker /a/, the optimal output will be discussed in tableau (12).

(12) Southern Min gemination: MAX >> ONS. >> GEMINATE >> DEP

Input:	MAX	ONS.	GEMINATE	DEP
[tig] + [a]			*	
a. tig]a		*!	*	
b. →tig]ga				*
c. *→ tik]ga				*
d. ti]a	*!	*	*	

Candidate (a) which violates ONS. and candidate (d) which violates MAX are ruled out. Candidate (b) and candidate (c) violate DEP with lower ranking and thus are predicted. Therefore, the ranking in the following constraints, as in (13) and (14) will predict the optimal output.

(13) **\*VOICED-CODA** (Keger. 1999): Obstruents must not be voiced in coda position.

(14) **AGREE(FEATURE)()**: Geminated segments must agree upon feature.



(15) Southern Min gemination: \*VOICED-CODA >> AGREE (FEATURE)

Input: [tig] + [a]	MAX	ONS.	GEMINATE	*VOICED-CODA	AGREE (FEATURE)	DEP
a.       tig]a		*!	*	*		
b. →     tig]ga				*		*
c.     * → tik]ga					*!	*
d.       ti]a	*!	*	*	*		

In tableau (15), the ranking of \*VOICED-CODA is higher than AGREE (FEATURE). Hence, \*VOICED-CODA rules out candidate (b) and predicts candidate (c). However, candidate (c) is not the optimal output. So, the constraints, \*VOICED-CODA and AGREE (FEATURE) are re-ranked, as in (16).

(16) Southern Min gemination: AGREE (FEATURE) >>\*VOICED-CODA

Input: [tig] + [a]	MAX	ONS.	GEMINATE	AGREE (FEATURE)	*VOICED-CODA	DEP
a.       tig]a		*!	*		*	
b.     →tig]ga					*	*
c.       tik]ga				*!		*
d.       ti]a	*!	*	*		*	

In tableau (16), AGREE (FEATURE) is higher than \*VOICED-CODA. So, AGREE (FEATURE) rules out candidate (C). And, candidate (b) wins.

### 3 Spanish

#### 3.1 The distribution of trill and tap in Spanish

According to Bakovic (1995), the letter [r] in Spanish is pronounced as the tap [r] or trill [rr].<sup>1</sup> The tap is caused by the tip of the tongue, which moves up to touch the dental or alveolar region of the mouth. In a trill, Ladefoged (1993) states: “The tip of tongue is set in motion by the current of air.” The distinction between tap and trill is that a trill continues the motion. It is a lengthening of the tap.

In Spanish, the tap and trill contrast intervocally. Otherwise, the tap and trill is complementary distribution. The trill takes place word-initially and after nasals and laterals. The tap is elsewhere. The distribution is presented in (17) (Bakovic, 1995).

<sup>1</sup> In IPA (revised to 1989), the symbol of trill is transcribed as /r/. In this paper, the symbol of trill /r/ is replaced by the symbol of /rr/.



(17)

V ____ V	[pero] 'but'
	[perro] 'dog'
# ω ____	[rroto] 'broken'
N/L ____	[onrra] 'honor'
C ____	[kreo] 'I believe'
____ C	[martes] 'Tuesday'
____ # ω	[ir] 'to go'

### 3.2 Spanish compound adjectives

There are different kinds of compound types in Spanish. One of them is compound adjectives. In general, there are two types of Spanish compound adjectives. One is composed of Adj. + Adj. and the other is comprised of N. + Adj. For examples, we can see the structures as follows: /*estuktural*/ (Adj. structural) + /*fun* } *ə*nal/ (Adj. functional) = /*estuktural-fun* } *ə*nal/ (functional structural). Here, this paper focuses on the type of [[N. + Adj.]] in (18) (Lang, 1990).

(18) Compound adjectives [[N. + Adj.]]

- a. /kue~~ɲ~~o/ (neck) + /erkuido/ (lift) = /kue~~ɲ~~ierguido/<sup>1</sup>
- b. /kara/ (face) + /redondo/ (round) = /carirredondo/
- c. /pelo/ (hair) + /roxo/ (redish) = /pelirroxo/<sup>2</sup>
- d. /sabio/ (scholar) + /ondo/ (profound) = /sabiondo/

In the structure of N. + Adj., the final vowel [o] or [a] of N. will become [i] in the output form such as (18a, b). Besides, [o] or [a] will be deleted when they are the final diphthong [io] or [ia] of N in (18d). That is, The type requires vowel adjustment in [i] at juncture. Moreover, /r/ is geminated when the first segment of Adj. is [r]. In order to preserve the trill at juncture, [r] is geminated like (18b, c).

### 3.3 Optimality Theory approach

Based on Correspondence Theory, Spanish compound adjectives are analyzed by the constraints as follows:

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

**MAX:** Every element of S<sub>1</sub> has a correspondent in S<sub>2</sub>.

**DEP:** Every element in S<sub>2</sub> has a correspondent in S<sub>1</sub>.

**CONTIGUITY:** The output is a contiguous parse of the input string.

If the analysis only relied on the three constraints, the optimal candidate can not be predicted in tableau (20).

<sup>1</sup> In Spanish, double L is pronounced as palatal lateral sound and is symbolized as /λ/ in this paper.

<sup>2</sup> The velar voiceless fricatives is transcribed as /x/.



(20) Spanish compound adjectives: MAX >> DEP >> CONTIGUITY

Base: [cuello] + [erguido]	MAX	DEP	CONTIGUITY
a. * → cuello]erguido			
b. → cuelli]erguido			
c. cuell]erguido	*!		*
d. cuelli]errguido		*!	*

Candidates (20a, b) are chosen as optimal output by the constraints MAX, DEP, and CONTIGUITY. However, only candidate (20b) is the optimal output. Candidate (20c) violates MAX, for /o/ is deleted. In candidate (20d), /r/ has no correspondent in base form and the n violates DEP. Therefore, the constraint is not enough. Some language specific constraint in Spanish has to be added.

In this phenomenon, it requires vowel adjustment in /i/ at juncture. The constraint \*[+back]V is defined in (21).

(21) **\*[+back]V**: The vowel changes from /o/ or /a/ to /i/ in the right most edge of the stem noun.

In tableau (22), after adding the constraint \*[+back]V, the correct output is produced.

(22) Spanish compound adjectives: \*[+back]V >> MAX >> DEP >> CONTIGUITY

Base: [cuello] + [erguido]	*[+back]V	MAX	DEP	CONTIGUITY
a. cuello]erguido	*!			
b. → cuelli]erguido				
c. cuell]erguido	*!	*		*
d. cuelli]errguido		*!	*	*

Candidate (22a) violates the higher-ranked constraint \*[+back]V, because the vowel at juncture has to be /i/ instead of /o/. As a result, candidate (22b) rather than candidate (22a) is selected as optimal output.

Another example is shown in tableau (23).

(23) Spanish compound adjectives: \*[+back]V >> MAX >> CONTIGUITY

Base: [Sabio] + [ondo]	*[+back]V	MAX	CONTIGUITY
a. sabio]ondo	*!		
b. → sabi]ondo		*!	*
c. sabio]ndo	*!	*!	*

Candidates (23a, c) violates \*[+back]V at juncture. Although the pronunciation of candidates (23a, c) is the same, the output form is different. Finally, candidate (23b) is the optimal output, which violates the lower-ranked constraint MAX for deleting



/o/.

In Spanish, the tap /r/ and trill /rr/ are distinct intervocalically. In order to preserve the thrill sound, /r/ is geminated. The constraint is stated as following:

(24) **GEMINATE-[r]**: [r] is geminated at the first position of the stem Adj.

(Ito, 1999).

In tableau (25), candidate (25a) violates \*[+back]V and GEMINATE-[r], for the back vowel /a/ and /r/ is not geminated. Candidate (25c) is ruled out by violating the crucial constraint \*[+back]V in Spanish. Candidate (25d) violates GEMINATE-[r] and MAX. Candidate (25e) violates GEMINATE-[r]. Consequently, candidate (25b) is the optimal output.<sup>1</sup>

(25) Spanish compound adjectives: \*[+back]V >> GEMINATED-[r] >> MAX >> DEP

Base: [cara] + [redondo]	*[+back]V	GEMINATE-[r]	MAX	DEP
a. cara]redondo	*!	*		
b. → cari]rredondo				*
c. cara]rredondo	*!	*		*
d. car]redondo		*!	*	
e. cari]redondo		*!		

In tableau (26), candidates (26a, c) are ruled out by violating the crucial constraint \*[+back]V. Candidates (26d, e) violate GEMINATE-[r]. Then, candidate (26b) wins finally.

(26) Spanish compound adjectives: \*[+back]V >> GEMINATED-[r]MAX >> DEP

Base: [pelo]+[roxo]	*[+back]V	GEMINATE-[r]	MAX	DEP
a. pelo]roxo	*!	*		
b. peli]rroxo				*
c. pelo]rroxo	*!			*
d. pel]roxo		*!	*	
e. peli]roxo		*!		

In Spanish, GEMINATE-[r] is a language specific constraint. The optimal outputs appear as a result of a the constraint hierarchy: \*[+back]V >> GEMINATE-[r] >> MAX >> DEP.

#### 4. Comparison

<sup>1</sup> The ranking of the constraint CONTIGUITY in Spanish is in low position and not crucial . Therefore, it is ignored in following discussion.



In Optimality Theory (Prince & Smolensky 1993), constraints are universal but violable, because they are language-particularly ranked. For GEMINATE constraint, in Southern Min, the final consonant of the stem is geminated before the suffix /a/. In Spanish, only the first consonant /r/ of the adjective is geminated when it is combined with the noun. In both Southern Min and Spanish, although the optimal outputs of GEMINATE satisfy MAX constraint, they violate DEP constraint. Therefore, DEP is ranked lowly in order to preserve the optimal outputs of GEMINATE. Hence, GEMINATE is highly ranked than DEP.

In Southern Min, one of the geminate consonant is in the coda position and the other is in the onset position of the suffix /a/. Thus, ONS constraint is important to the optimal output of geminate. So that, ONS is highly ranked. As to other form of geminate of Southern Min, the devoicing final consonant is contrast to AGREE (FEATURE) constraint. When \*VOICED-CODA is highly ranked than AGREE (FEATURE), it will predict a output with geminate consonants, which one is voiceless and the other is voiced. In the input form, the final consonant is voiced and the geminate consonants of the optimal output must be agreed with feature. After reranking the constraints: AGREE (FEATURE) >> \*VOICED-CODA, the optimal output is selected. In Spanish, the constraint \*[+back]V is a language specific constraint to preserve the vowel /i/ at juncture.

## 5. Conclusion

Based on Optimality Theory, this paper explores the constraint --- GEMINATE between Southern Min and Spanish. First of all, Southern Min gemination is analyzed with a set of constraints, including MAX constraint, ONS constraint, GEMINATE constraint, DEP constraint, and AGREE (FEATURE) constraint, \*VOICED-CODA constraint. The constraint ranking is: MAX >> ONS >> GEMINATE >> AGREE (FEATURE) >> \* VOICED-CODA >> DEP. On the other hand, Spanish compound adjectives are analyzed by MAX constraint, DEP constraint, GEMINATE-[r] constraint and \*[+back]V constraint. Moreover, the optimal candidate is chosen according to the constraint hierarchy: \*[+back]V >> GEMINATE-[r] >> MAX >> DEP. Finally, the status of GEMINATE and MAX is compared in this paper. In Southern Min, the ranking of MAX is higher than the ranking of GEMINATE. Otherwise, the ranking of GEMINATE-[r] is higher than the ranking of MAX in Spanish. In both languages, DEP is ranked lowly to select the optimal output of gemination.



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