San Sebastián del Monte Mixtec Nasalization in Optimality Theory: Spreading from Nasal Vowels

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1. Goals of this talk[1]

- Give an account of the unusual pattern of nasal spreading[2], which is bidirectional, noniterative, and triggered by nasal vowels only, found in San Sebastián del Monte Mixtec (SSdMM);
- Propose an Optimality Theory (OT) analysis of the nasalization process

2. Background on SSdMM

- A language of the Mixtecan family, Otomanguean stock (Rensch 1976).
- Spoken by about 2,000 people living in San Sebastián del Monte, a town in the Santo Domingo Tonalá municipality of Oaxaca State, Mexico, in the district of Huajuapan, approximately 45 kilometer southwest of Huajuapan de León (Mantenuto 2018).

San Sebastián del Monte, Oaxaca State, Mexico

[1] I would like to thank Iara Mantenuto, Prof. Shu-hao Shih, Beth Sturman, Meng Yang, Prof. Bruce Hayes, and Canaan Breiss for their guidance and suggestions. Many thanks to my two consultants, Félix and Adrian, for their recordings and generous help. Any mistake in this work is my own.

[2] I will use the terms nasalization, nasal spreading, and nasal assimilation interchangeably here, but they can be different in their strict definitions.

2.1. Phonological inventory

- As shown in (1), SSdMM has a standard five vowel system, /i, e, a, o, u/, with contrast in nasality (Mantenuto & Roberts 2018)

(1) *Vowel inventory*

	Oral		**Nasal**	
	Front	**Back**	**Front**	**Back**
High	i	u	ĩ	ũ
Mid	e	o	ẽ	õ
Low	a		ã	

- The consonant inventory is given in Appendix.
- This is a tonal language with three different levels: high /á/, mid /a/, and low /à/, as shown in (2).

(2) *Tones (Mantenuto 2018)*

High	**Mid**	**Low**
[ⁿdáva] 'fly.CONT[3]'	[ⁿdava] 'fly.POT'	[ⁿdàva] 'fly.COMP'
[ɲoó] 'night'	[ɲoo] 'mix.POT'	[ɲoò] 'town'

- Minimal word requirement: a non-functional word must have at least 2 morae.

2.2. Basic Morphology and Syntax related to the nasalization process

- The basic word order is VSO, as exemplified in (3).

(3) [kwɛ́ɛ́ líʒà ʃìtà]
buy.POT Liya tortilla
'Liya will buy a tortilla.'

2.2.1. Pronoun clitics

- Pronouns in SSdMM have two forms, the full form and the reduced form.

[3] Abbreviations: CL = clitic, COMP = completive, CONT = continuative, HUM = human, M = masculine, POT = potential, PL = plural, SG = singular

- The reduced forms appear as clitics, morphemes that have syntactic characteristics of a word, but are phonologically bound to another word (SIL International 2003), as exemplified in (4).

(4) *Subset* of *pronouns in the reduced form*

Pronoun	Reduced form[4]
CL.HUM.1SG	=ì
CL.HUM.2SG	=o
CL.HUM.3SG.M	=ɾà
CL.HUM.3SG.M.FORMAL	=si
CL.MAN.3	=tì
CL.HUM.1PL	=ʒó
CL.THING.3	=Ṽ

- they have to attach onto a host, which in this case is any word that appears linearly on its left (see Appendix for examples). The pronoun clitic and its host together form a prosodic word.

3. Nasal spreading pattern in SSdMM

3.1. What is nasal spreading?

- A phonological phenomenon where a nasal segment triggers the nasalization of an adjacent string of segments
- E.g. in Warao /nao/ → [nãõ] ‘come!’ (McCarthy 2008)

3.2. General pattern

- Typologically, nasal spreading is usually triggered by a nasal consonant (Ohala 1994)
  - In SSdMM, nasal spreading is triggered by a nasal vowel
- When a pronoun clitic is attached to a host word, if either the final vowel of host or the beginning vowel of the clitic is nasal, the other becomes nasalized.
- the pronoun clitics for first and second person singular surface as oral in most cases:

(5) [kaka =ì]
walk.POT =CL.HUM.1SG
‘I will walk.’

(6) [kaka =o]
walk.POT =CL.HUM.2SG
‘You will walk.’

[4] Also referred to as clitic form.

- When the preceding verb ends with a nasal vowel, the clitic is realized as nasal:

(7) /kaʔà̰ =ì/ → [kaʔà̰=**ĩ̀**]
speak.POT =CL.HUM.1SG
'I will speak.'

(8) /kaʔà̰ =o/ → [kaʔà̰=**õ**]
speak.POT =CL.HUM.2SG
'You will speak.

3.2 Bidirectionality

- Typologically, nasal spreading is most commonly perseveratory, i.e. from left to right (Ohala 1994)
  - In SSdMM, nasal spreading is bidirectional
- While the nasalization in the examples given above takes place from left to right, it can also happen from right to left, when the clitic is underlyingly nasal.
- For instance, the following verbs are underlyingly oral:

(9) [sàso]
eat.COMP
'ate'

(10) [kásáʔá]
begin.CONT
'begin(s)'

- The third person pronoun clitic for inanimate things is an underlyingly nasal vowel /V̰̀/
  - It nasalizes the final vowel in the preceding verb:

(11) /ʒòʔó sàso =V̰̀/ → [ʒòʔó sàs**õ**=ò̰]
HUM.2SG eat.COMP =CL.THING.3
'You ate it'

(12) /kásáʔá =V̰̀/ → [kásáʔ**á̰**=à̰]
begin.CONT =CL.THING.3
'It begins.'

3.3 Domain of spreading

- Spreading of nasalization not only takes place between a verb and a clitic, but between a clitic and any host that it attached onto, i.e. within a prosodic word:

(13) *Spreading takes place regardless of the part of speech of the host*

a. Verb+clitic (from (5))
[kaka =ì]
walk.POT =CL.HUM.1SG
'I will walk.'

b. Noun+clitic
/sàsi lízà =V̀/ → [sàsi lízə̀ǎ=ǎ]
eat.COMP Liya =CL.THING.3
'Liya ate it'

c. Full pronoun+clitic
[kwɛ́ɛ́ ʒì =V̀] → [kwɛ́ɛ́ ʒɨ̀=è]
buy.POT HUM.1SG =CL.THING.3
'I will buy it.'

d. Preposition+clitic
/titõõ̀ sí =V̀/ → [titõõ̀ sɨ́-ì̀]
star of =CL.THING.3
'its star'

e. Adverb+clitic
/kásáʔá jéʔé =V̀/ → [kásáʔá jéʔɛ́=è]
begin.CONT secretly =CL.THING.3
'It begins secretly.'

- In contrast, spreading does not take place outside of this structure:

(14) *Verb+full noun*
[kaʔǎ̀ #[5] ìsò]
speak.POT rabbit
'The rabbit will speak.'

(15) *Verb+noun phrase*
[kaʔǎ̀ # òkò tjaa]
speak.POT twenty man
'Twenty men will speak.'

(16) *Verb+adverb*
[kaʔǎ̀ # iʔvì =ɾà]
speak.POT difficulty =CL.HUM.3SG.M
'He will speak difficultly.'

[5] The pound sign signals a prosodic word boundary.

- Hence, the domain of spreading is prosodic word
    - Notice: the prosodic word is a constituent in the prosodic hierarchy, which does not have to match with a syntactic constituent (Inkelas 2018).

3.3 Blocking by consonants

- The process is blocked by intervening consonants, as exemplified in (17)-(20):

(17) [kaʔǎ =s̲i]
speak.POT =CL.HUM.3SG.M.FORMAL
'He (formal) will speak.'

(18) [kaʔǎ =r̲à]
speak.POT =CL.HUM.3SG.M
'He will speak.'

(19) [kaʔǎ =ʒ̲ó]
speak.POT =CL.HUM.1PL
'We will speak.'

(20) [kaʔǎ =t̲ì]
speak.POT =CL.MAN.3
'He will speak.'

- Since spreading only takes place within the domain of prosodic word, only limited consonants can be tested for their blocking effect.
- However, lexical items also give evidence for blocking of other consonants
    - For example, if /ʔ/ does not block nasal spreading, we would expect to see *[k**ãʔ̃**à] instead of [kaʔà] (as shown in (20)), as the surface form of 'speak.POT'. See Appendix for more examples.

- Hence I will assume a blocking effect by all consonants.

4. An analysis in OT

- What is Optimality Theory
    - The central idea: surface forms of language are the results of the optimal satisfaction of competing constraints
    - Two types of constraints
        - Faithfulness constraints prohibit differences between input and output
        - Markedness constraints specify certain criteria on structural well-formedness that output forms need to satisfy
- Nasal spreading is generally analyzed as the spreading of the feature specification [+nasal]
- The spreading constraint I propose to use is the alignment constraint, as defined in (21).

(21) ALIGN-L/R([+nasal], PrWd) (henceforth ALIGN-L/R)
Assign one violation mark for every segment that intervenes between the left/right edge of the [+nasal] feature and the left/right edge of the prosodic word.

- Since spreading is bidirectional, both ALIGN-L and ALIGN-R should be taken into consideration.
- A common faithfulness constraint to consider is the identity constraint which forbids change of feature specifications of corresponding segments, as defined in (22).

(22) IDENT-IO([nasal])
Assign one violation mark for every segment that changes its value for the feature [nasal] between input and output.

- To allow spreading, the alignment constraints need to dominate, i.e. rank above, IDENT-IO([nasal]).
- To account for the blocking of consonants, I propose the nasal markedness constraint *NAS-CONSONANT[6], as defined in (23).

(23) *NAS-CONSONANT (henceforth *C̃)
Assign one violation mark for every obstruent stop that has the feature [+nasal].

- To successfully block spreading, the blocking constraint needs to dominate ALIGN-L/R.
- (24) shows that, with only the constraints above, we cannot yet get the correct output.

(24) *Incorrect output for the input* /kaʔã̀ + ì/

/kaʔã̀ + ì/	*C̃	ALIGN-R	IDENT-IO([nasal])
N |\ ☹ (a) ka.ʔà.ì			*
N | (b) ka.ʔà.ì		*!	
N /|\ (c) ka.ʔà.ì	*!		**
💣 (d) ka.ʔà.ì			*

[6] Since I assume that all consonants block nasal spreading in SSdMM, this generalized constraint is used instead of a set of ranked constraints proposed by Walker (2003), which more accurately represent the typology: *NAS-OBSTRUENTSTOP >> *NAS-FRICATIVE >> *NAS-LIQUID >> *NAS-GLIDE. The ranking is based on a typological observation that certain consonants are less likely to be nasalized and thus more likely to block nasalization. In any attested language, if glides are blockers of nasal spreading, then pharyngeals will also block spreading; if liquids are blockers, then glides and pharyngeals will also be blockers, so on and so forth.

- The problem with (24d) is that the underlyingly nasal vowel is denasalized. To avoid this, I propose another faithfulness constraint, as defined in (25).

(25) MAX-LINK([+nasal]) (henceforth MAX-LINK)
Assign one violation mark for every instance where a link between the feature [+nasal] and a segment in the input is deleted in the output.

- With the new faithfulness constraint, the correct output is produced, as illustrated in (26).

(26) *Correct output for the input* /kaʔà̃ + ì/

/kaʔà̃ + ì/	MAX-LINK	*C̃	ALIGN-R	IDENT-IO([nasal])
N |\ ☞(a) ka.ʔà.ì				*
N | (b) ka.ʔà.ì			*!	
N /|\ (c) ka.ʔà.ì		*!		**
(d) ka.ʔà.ì	*!			*

5. Noniterativity and problem with ALIGN-L

5.1. Noniterative spreading from clitic to host

- As seen in previous examples, nasalization can spread from a clitic to its host
- However, when the final syllable of the host is bimoraic, it is only partially nasalized
- For example, the following verbs are underlyingly oral:

(27) [kúú]
be.CONT
'is/am/are'

(28) [tjàa]
write.COMP
'wrote'

- When the third person pronoun clitic for inanimate things /V̀/ is attached, only the first mora to the left is nasalized, but not the one preceding it, as shown in (29) and (30).

(29) /líʒà kúú =V̀/ → [líʒà kú**ṹ**=ù̃]
Liya be.CONT =CL.THING.3
'Liya is it ('it' referring to a stone).'

(30) /xwãã tjàa =V̀/ → [xwãã tjà**ã**=ã̀]
Juan write.COMP =CL.THING.3
'Juan wrote it.'

- Here the spreading appears to be noninterative, i.e. it takes place only once.

5.2. Problem with ALIGN-L

- In this case, ALIGN-L will favor spreading all the way to the left until a consonant is met, and thus give the wrong output, as shown in (31).

(31) *Incorrect output for the input* /...kuu-V̀/ *given by* ALIGN-L

/...kuu-Ṽ/	MAX-LINK	*C̃	ALIGN-L	IDENT-IO([nasal])
N /\ ☹ (a) kuu.ù			**!	*
N \ (b) kuu.ù			**!*	
N /|\ 💣 (c) kuu.ù			*	**
N / /| \ (d) kuu.ù		*!		***
(e) kuu.ù	*!			*
N /| (f) kuu.ù	*!		*	***

6. The Positional Licensing analysis

- Kaplan (2008) proposed to analyze the noniterative process of vowel harmony in Lango with Positional Licensing, claiming that "the driving force behind Lango's harmony is a need for suffix ATR features to be linked to a prominent position, namely the root."
- Here I adopt a similar analysis, and claim that the spreading of nasalization takes place because the [+nasal] feature needs to be linked to a host, which is more prominent than the clitic
- Since spreading just once satisfies the licensing requirement, no more spreading is needed
- The licensing constraint is defined as follows:

(32) LICENSE-[+nasal]/Prominence (henceforth LICENSE)
Assign one violation mark for every feature specification [+nasal] that is not linked to a segment in a prominent syllable.

- Using LICENSE instead of ALIGN-L produces the correct output, as shown in (33).

(33) *Correct output for the input* /...kuu-Ṽ̀/ *given by* LICENSE

/...kuu-Ṽ/	MAX-LINK	*C̃	LICENSE	IDENT-IO([nasal])
N /\ ☞(a) kuu.ù				*
N \ (b) kuu.ù			*!	
N /|\ (c) kuu.ù				**!
N / /| \ (d) kuu.ù		*!		***
(e) kuu.ù	*!			*
N /| (f) kuu.ù	*!			***

7. Conclusion and further issues

- Nasal spreading in SSdMM is bidirectional, triggered by nasal vowels only;
- The domain of spreading is the prosodic word;
- The spreading process is blocked by all testable consonants;
- Spreading from left to right can be analyzed in OT using the alignment constraint;
- Spreading from right to left shows noniterativity and thus may not be analyzed using the same constraint:
    - This seemingly noniterativity is a coincidence;
    - The true driving force is the licensing requirement;
    - Thus the process should be analyzed using the licensing constraint;
- For a more accurate and quantitative analysis, more data should be collected to perform a phonetic measurement of nasality;
- Further research may look into compounding in SSdMM, which is a highly productive process, and whether spreading occurs between two lexical items within a compound.

8. References

Bakovic, E. (2007). Local assimilation and constraint interaction. *The Cambridge handbook of phonology*, 335-352.

Boersma, P. (2003). Nasal harmony in functional phonology. *Amsterdam Studies in the Theory and History of Linguistic Science Series 4*, 3-36.

Borowsky, T. (2000). Word-faithfulness and the direction of assimilations. *The Linguistic Review*, 17(1), 1-28.

Clements, G. N., & Osu, S. (2003). Ikwere nasal harmony in typological perspective. *Typologie des langues d'Afrique et universaux de la grammaire*, 2, 70-95.

Clitic (Grammar). (2015). *SIL Glossary of Linguistic Terms*. Retrieved 10 May 2019, from https://glossary.sil.org/term/clitic-grammar

Gainor, B., Lai, R., & Heinz, J. (2012). Computational characterizations of vowel harmony patterns and pathologies. In *The Proceedings of the 29th West Coast Conference on Formal Linguistics* (pp. 63-71).

Inkelas, S. (2018). *Prosodic Constituency in the Lexicon*. London: Routledge.

Kaplan, A. (2008). Noniterativity is an Emergent Property of Grammar. PhD Dissertation, University of California, Santa Cruz.

McCarthy, J. J. (2008). *Doing Optimality Theory: Applying Theory to Data.* Malden, MA: Blackwell Publishing.

McCarthy, J. J. (2011). Autosegmental spreading in Optimality Theory. *Tones and Features*. doi:10.1515/9783110246223.195

Mantenuto, I. (2018). The Double Nature of Additive Ga in San Sebastián del Monte Mixtec. *Encuentro Internacional de Lingüística en el Noroeste*. Hermosillo, Mexico.

Mantenuto, I., & Roberts, B. (2018). The Morphophonology of Aspect in San Sebastián del Monte Mixtec. *The Society for the Study of the Indigenous Languages of the Americas* (SSILA 2018). Salt Lake City, Utah

Ohala, J. J. (1994). Towards a Universal, Phonetically-Based, Theory of Vowel Harmony. *The Third International Conference on Spoken Language Proceeding.* Yokohama, Japan.

Rensch, C. R. (1976). *Comparative Otomanguean phonology*. Bloomington: Indiana University.

Rose, S., & Walker, R. (2011). Harmony systems. *The handbook of phonological theory, 2*, 240-290.

Walker, R. (2003). Reinterpreting transparency in nasal harmony. *The Phonological Spectrum Current Issues in Linguistic Theory,* 37-72.

Walker, R. (2011). Nasal Harmony. In M. van Oostendorp, C. J. Ewen, E. V. Hume & K. Rice (Eds.), *The Blackwell Companion to Phonology* (1838-1865). Malden, MA: Wiley-Blackwell.

9. Appendices

Appendix A: Consonant inventory

		Bilabial	Dental	Postalveolar	Palatal	Velar	Glottal
Stop	**Unaspirated**	p*	t			k~g	ʔ
	Prenasalized	ᵐp*	ⁿt~ⁿd				
Nasal		m	n		ɲ		
Flap			ɾ				
Fricative		b~β~ʋ	s	ʃ ʒ~ʝ~j		x	
Affricate				t͡ʃ			
Approximant		(w)			j	(w)	
Lateral approximant			l				

- Consonants marked by an asterisk only occur in loanwords.
- [ⁿt~ⁿd], [ʒ~ʝ~j], and [b~β~ʋ] are in free variation.

Appendix B: Pronoun clitics can attach onto words of different parts of speech

a. Verb+clitic
[kaka =ì]
walk.POT =CL.HUM.1SG
'I will walk.'

b. Noun+clitic
[sinì t͡ʃút͡ʃì =o]
see.COMP Chuchi CL.HUM.2SG
'Chuchi saw you.'

c. Preposition+clitic
[láa si =ɾà]
bird of CL.HUM.3SG.M
'his bird'

d. Manner adverb+clitic
[sísi jé'é =ʒó]
eat.CONT secretly CL.HUM.1PL
'We eat secretly.'

Appendix C: Lexical items from which blocking can be inferred

(34) [t͡ʃĩ̀ĩ̀kì] 'acorn'
(35) [pɛ̌t͡ʃe] 'orphan'
(36) [káxõ] 'toast'
(37) [ⁿdíkwĩ̀ĩ̀] 'tiger'

Appendix D: Problems with an alternative analysis using AGREE

- Another common way to analyze nasal spreading is to use the agreement constraint (Baković 2007), which can be defined as below:

(38) AGREE(Nasal)
Assign one violation for every two adjacent segments that do not have the same value for the feature [nasal].

- However, this constraint has a "sour-grape" effect - it would favor either spreading all the way or no spreading at all, as shown in the tableau below

(39) *Incorrect output using* AGREE

/...kuu-Ṽ/	MAX-LINK	*C̃	AGREE(Nasal)	IDENT-IO([nasal])
N /\ ☹ (a) kuu.ù			*	*!
N \ 💣 (b) kuu.ù			*	
N /|\ (c) kuu.ù			*	*!*
N / /| \ (d) kuu.ù		*!		***
(e) kuu.ù	*!			*
N /| (f) kuu.ù	*!		*	***