Segment-to-syllable alignment and vocalization in Chilean Spanish*

Carlos-Eduardo Piñeros
University of Iowa
Phone: 319-335-2988 Fax: 319-335-2990 E-mail: carlos-pineros@uiowa.edu

While it is clear that vocalization entails changing a [+consonantal] segment into a [-consonantal] one, it is not evident why certain languages resort to this particular process in order to avoid the appearance of consonantal segments in syllable-final position. Languages that want to avoid syllable-final consonants without losing or gaining entire segments are forced to find alternatives to deletion and epenthesis. In Chilean Spanish, the offending segment is allowed to have a featurally unfaithful correspondent provided that this segment is not consonantal. Interestingly, a voiced stop followed by a liquid consonant also vocalizes despite the fact that the output correspondents of these two segments could combine under a licit complex onset. In such case, vocalization appears not to follow from the drive to avoid syllable-final consonants, but to avoid a certain type of onset. In this paper, I analyze vocalization as a strategy to rid output forms of consonantal segments that may not be aligned with the left edge of a syllable, the position that is most harmonious with consonants. This approach to vocalization allows a unified account of the two vocalizing patterns exhibited by Chilean Spanish and it provides strong support for segment-to-syllable alignment constraints as the true factor behind the tendency exhibited by many languages to restrict the type of consonants that may act as syllable codas (Itô and Mester 1994). This study reveals that vocalization arises from a drive to obtain a more harmonious association between consonantal segments and syllabic positions.

1. Vocalization of stops in Chilean Spanish

Dialectal varieties of Chilean Spanish exhibit a process of vocalization that turns syllable-final stops into the vocoids [u̯] or [i̯]. Through this process, the coronals, /d̪/ and /t̪/, become [i̯], whereas the labials, /b/ and /p/, and the dorsals, /g/ and /k/, may become either [u̯] or [i̯].[1] The examples in (1) show that as a result of this vocalization process, stop consonants may never be syllable codas. Lenz (1940), Oroz (1966) and Martínez-Gil (1996, 1997) are the sources of these data.

(1) Coronal

/d/ → [i̯]			/t/ → [i̯]		
ad̪kirir	→	a[i̯.]kirir	et̪niko	→	e[i̯.]niko
‘to acquire’			‘ethnic’		
ad̪bertir	→	a[i̯.]bertir	et̪setera	→	e[i̯.]setera
‘to warn’			‘etcetera’		
ad̪mirar	→	a[i̯.]mirar	at̪mosfera	→	a[i̯.]mosfera
‘to admire’			‘atmosphere’		

b. Labial

/b/ → [u̯] / [i̯]			/p/ → [u̯] / [i̯]		
ab̲surdo	→	a[u̯.]surdo	kap̲tura	→	ka[u̯.]tura
‘absurd’		a[i̯.]surdo	‘capture’		ka[i̯.]tura

a<u>b</u>solusion	→	a[u̯.]solusion	conse<u>p</u>to	→	konse[u̯.]to
'absolution'		a[i̯.]solusion	'concept'		konse[i̯.]to
o<u>b</u>serbar	→	o[u̯.]serbar	rese<u>p</u>sion	→	rese[u̯.]sion
'to observe'		o[i̯.]serbar	'reception'		rese[i̯.]sion

c. Dorsal

/g/	→	[u̯] / [i̯]	/k/	→	[u̯] / [i̯]
do<u>g</u>ma	→	do[u̯.]ma	kore<u>k</u>to	→	kore[u̯.]to
'dogma'		do[i̯.]ma	'correct'		kore[i̯.]to
ma<u>g</u>nifiko	→	ma[u̯.]nifiko	kole<u>k</u>sion	→	kole[u̯.]sion
'magnificent'		ma[i̯.]nifiko	'collection'		kole[i̯.]sion
ma<u>g</u>dalena	→	ma[u̯.]dalena	perfe<u>k</u>to	→	perfe[u̯.]to
'proper name'		ma[i̯.]dalena	'perfect'		perfe[i̯.]to

Additionally, voiced stops also vocalize when they appear between a vowel and a liquid consonant (e.g. [kwai̯.ro] < /kwadro/ 'wall picture', [r̄eu̯.la] < /regla/ 'ruler'). As a consequence of this, voiced stops may only participate in complex onsets when preceded by a pause, or by another consonant (e.g. [dra.ma] < /drama/ 'drama', [om.bre] < /ombre/ 'man'). In this case, vocalization appears to act as a strategy to avoid a particular type of complex onset. This, however, may not be in response to a ban against complex onsets per se because voiceless stops may participate in complex onsets whether they are

preceded by a vowel or not (e.g. [e.g. [li.tro] < /litro/ ‘litter’, [aŋ.kla] < /ankla/ ‘anchor’). The vocalization of voiced stops in this context is rather unexpected because the output correspondent of a voiced stop could be syllabified as a syllable onset given that [stop + liquid] sequences are licit complex onsets in Spanish. In most Spanish dialects, for example, even when voiced stops are the target of spirantization, their output correspondents are allowed to participate in complex onsets (e.g. [kwa.ð̞ro] < /kwadro/ ‘wall picture’, [r̄e.ɣ̞la] < /regla/ ‘ruler’). The different treatment given to postvocalic sequences of [voiced stop + liquid] and [voiceless stop + liquid] is illustrated by the examples in (2).

(2) a. Labial

/bL/ → [u̯.L]		/pL/ → [.pL]	
ne<u>b</u>lina	→ ne[u̯.l]ina	a<u>p</u>likar	→ a[.pl]ikar
‘fog’		‘to apply’	
a<u>b</u>lar	→ a[u̯.l]ar	a<u>p</u>lakar	→ a[.pl]akar
‘to speak’		‘to appease’	
li<u>b</u>ro	→ li[u̯.r]o	re<u>p</u>resa	→ re[.pr]esa
‘book’		‘dam’	

b. Coronal[2]

/dL/ → [i̯.L]			/tL/ → [.tL]		
la<u>d</u>rar	→	la[i̯.r]ar	le<u>t</u>ra	→	le[.tr]a
‘to bark’			‘letter’		
ma<u>d</u>re	→	ma[i̯.r]e	ka<u>t</u>re	→	ka[.tr]e
‘mother’			‘cot’		
pe<u>d</u>ro	→	pe[i̯.r]o	me<u>t</u>ro	→	me[.tr]o
‘proper name’			‘meter’		

c. Dorsal

/gL/ → [u̯.L]			/kL/ → [.kL]		
a<u>g</u>ricultor	→	a[u̯.r]ikultor	a<u>k</u>riliko	→	a[.kr]iliko
‘farmer’			‘acrylic’		
bina<u>g</u>re	→	bina[u̯.r]e	sa<u>k</u>ro	→	sa[.kr]o
‘vinegar’			‘sacred’		
re<u>g</u>la	→	re[u̯.l]a	te<u>k</u>la	→	te[.kl]a
‘ruler’			‘key’		

I demonstrate below that behind the apparent dual function of vocalization there is a single motivation for this process. It is not the case that in addition to avoiding closed syllables; vocalization is also intended to prevent voiced stops from participating in complex onsets. This is only a side effect. In actuality, the aim of this process is to

minimize the number of consonantal segments in the output form that are not properly aligned with the left edge of a syllable.

2. Syllable-to-segment and segment-to-syllable alignments

Itô and Mester (1994) build on a proposal made by McCarthy and Prince (1993) to reformulate the syllable well-formedness constraints ONSET and NO-CODA as alignment conditions. Within this approach, ONSET requires every syllable to be left-aligned with a consonant, (3), whereas NO-CODA requires every syllable to be right-aligned with a vowel, (4).

(3) ALIGN-L(σ,C): Every syllable must have a consonant at its left edge.

(4) ALIGN-R(σ,V): Every syllable must have a vowel at its right edge.

In Spanish, both ALIGN-L(σ,C) and ALIGN-R(σ,V) are dominated. The fact that Spanish tolerates syllables deprived of an onset as well as syllables closed by a consonant (e.g. *a.mor* 'love') indicates that ALIGN-L(σ,C) and ALIGN-R(σ,V) are outranked by the faithfulness constraints MAX(seg) and DEP(seg). Otherwise, it would be possible to avoid marked syllables through epenthesis and/or deletion.

(5) MAX(seg): Every segment in the input must have a correspondent in the output.

(6) DEP(seg): Every segment in the output must have a correspondent in the input.

Tableau (7) illustrates the effect of the ranking MAX(seg), DEP(seg) >> ALIGN-L(σ,C), ALIGN-R(σ,V). All candidates that attempt to repair marked syllables through deletion, (7a,b), or epenthesis, (7d,e), are doomed because the Spanish grammar prioritizes faithfulness over syllable well-formedness. Despite its two marked syllables, candidate (7c) is optimal because it is the only output form that remains completely faithful to the input.

(7) MAX(seg), DEP(seg) >> ALIGN-L(σ,C), ALIGN-R(σ,V)

	Input: /amor/	MAX(seg)	DEP(seg)	ALIGN-L (σ,C)	ALIGN-R (σ,V)
	a. mo	*!*			
	b. a.mo	*!		*	
☞	c. a.mor			*	*
	d. Ta.mor		*!		
	e. Ta.mo.rA		*!*		

Itô and Mester (1994) point out that by reformulating syllable well-formedness constraints as alignment conditions it is possible to perceive an important asymmetry in the organization of this constraint family. This asymmetry becomes evident when two other syllable well-formedness constraints, CODACONDITION and NODIPHTHONG, are reintroduced in terms of alignment as the constraints ALIGN-L(C,σ) and ALIGN-R(V,σ).

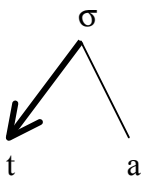
(8) ALIGN-L(C,σ): Every consonant must sit at the left edge of a syllable.

(9) ALIGN-R(V,σ): Every vowel must sit at the right edge of a syllable.

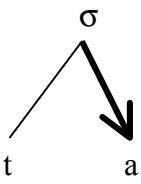
Whereas ALIGN-L(σ,C) and ALIGN-R(σ,V) are syllable-to-segment alignment constraints (e.g. downwards alignment), ALIGN-L(C,σ) and ALIGN-R(V,σ) are instances of segment-to-syllable alignment (e.g. upwards alignment). The latter are indeed the upwards-alignment counterparts of the former. These asymmetric relations are illustrated by the opposite direction of the arrows in the representations in (10a,b) and (11a,b).

(10) Downwards alignment

a. ALIGN-L(σ,C)

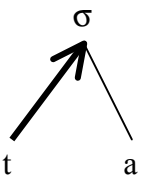


b. ALIGN-R(σ,V)

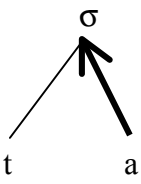


(11) Upwards alignment

a. ALIGN-L(C,σ)



b. ALIGN-L(V,σ)



Within this approach, CV-syllables are unmarked because they abide by all four alignment constraints, (12b). All other syllable types are of greater markedness because they fall in violation of at least one of these constraints. Onsetless syllables run afoul of ALIGN-L(σ,C) because their leftmost segment is not consonantal, (12a). Closed syllables are even more marked because the presence of the syllable-final consonant gives rise to violations of ALIGN-L(C,σ), ALIGN-R(σ,V), and ALIGN-R(V,σ), (12c).

(12) ALIGN-L(σ,C), ALIGN-L(C,σ), ALIGN-R(σ,V), ALIGN-R(V,σ)

		ALIGN-L (σ,C)	ALIGN-L (C,σ)	ALIGN-R (σ,V)	ALIGN-R (V,σ)
a.	V	*!			
☞ b.	CV				
c.	CVC		*!	*	*

It is important to note that although ALIGN-L(σ,C) and ALIGN-R(σ,V) correspond to the familiar constraints ONSET and NOCODA, ALIGN-L(C,σ) and ALIGN-R(V,σ) are not exactly identical to CODACONDITION and NODIPHTHONG. This is revealed by the contrast between tableaux (13) and (14), where the members of each pair of constraints are compared in the marks they assign to different syllable types. Note that ALIGN-L(σ,C) penalizes exactly the same structural configuration sanctioned by ONSET, (13). Likewise, ALIGN-R(σ,V) prohibits the same syllable type barred by NOCODA. By contrast, ALIGN-L(C,σ) and ALIGN-R(V,σ) not only ban those syllable types disfavored by CODACONDITION and NODIPHTHONG but also prohibit syllable types that do not run afoul of those constraints, (14).

(13) ALIGN-L(σ,C) = ONSET; ALIGN-R(σ,V) ≠ NOCODA

	ALIGN-L (σ,C)	ONSET	ALIGN-R (σ,V)	NOCODA
a. V	*	*		
b. CV				
c. CVC			*	*
d. CVV				
e. CCV				

(14) ALIGN-L(C,σ) ≠ CODACONDITION; ALIGN-R(V,σ) ≠ NODIPHTHONG

	ALIGN-L (C,σ)	CODA CONDITION	ALIGN-R (V,σ)	NO DIPHTHONG
a. V				
b. CV				
c. CVC	*	*	*	
d. CVV			*	*
e. CCV	*			

Crucially, whereas CODACONDITION only sanctions syllables that do not have a suitable coda consonant, (14c), ALIGN-L(C,σ) penalizes not only these but also syllables containing a complex onset, because the second consonant of the cluster is not aligned with the left edge of a syllable, (14e). Similarly, while NODIPHTHONG only bars syllables that contain two vocoids, (14d), ALIGN-R(V,σ) also prohibits closed syllables, (14c), because the syllable-final consonant precludes the alignment of the vowel.

This double functionality of the upwards-alignment constraints as opposed to the single function of downwards-alignment constraints follows from the fact that each downwards-alignment constraint is concerned with one particular edge of the syllable, and syllables have only one left and one right edge. By contrast, upwards alignment constraints are concerned with the distribution of segments within the syllable, and there may be more than one consonant and/or more than one vowel within a single syllable.

Since ALIGN-L(C,σ) not only rules against syllable-final consonants but also penalizes the second consonant of a complex onset, it seems appropriate to replace the constraints CODACONDITION and *COMPLEX(Onset) with ALIGN-L(C,σ). Similarly, given that ALIGN-R(V,σ) not only sanctions syllables that contain a diphthong but also syllables closed by a consonant, it seems desirable to replace the constraints NODIPHTHONG and NOCODA with ALIGN-R(V,σ). This would have the advantage of reducing the number of constraints, and thereby gain greater generality. Although quite appealing, this idea may not be implemented because, in addition to the alignment constraints, an independent principle regulating the complexity of syllable position nodes is also necessary in order to account for the greater markedness of syllables that contain complex onsets, complex nuclei, or complex codas. For instance, to account for a language that prohibits complex onsets but tolerates codas (e.g. Tibetan), the grammar must contain a constraint independent of alignment, *COMPLEX(Onset), that favors the structure CVC over CCV, despite a misaligned consonant in both syllables. Likewise, languages that reject diphthongs but accept syllable codas, require an independent constraint, *COMPLEX(Nucleus), that favors the structure CVC over CVV, despite a misaligned vowel in both syllables. Based on these facts, one must conclude that in

addition to the syllable-to-segment and segment-to-syllable alignment constraints, the projection of syllable structure is also governed by a universal constraint that disapproves of complex syllable position nodes, *COMPLEX, as proposed by Prince and Smolensky (1993).

(15) *COMPLEX: No more than one segment may associate to any syllable position node.

*COMPLEX serves to capture the greater markedness of more complex syllable types such as CVV, CCV and CVCC, as illustrated by tableau (16). All syllables that contain two adjacent vocoids or two adjacent consonants receive an extra mark because in addition to introducing a misaligned segment, this new element adds to the structural complexity of the syllable, (16d-f). Note again that CV is the only syllable type that abides by all syllable well-formedness constraints, (16b), hence its total unmarkedness and greater frequency in the languages of the world.

(16) ALIGN-L(σ,C), ALIGN-L(C,σ), ALIGN-R(σ,V), ALIGN-R(V,σ), *COMPLEX

		ALIGN-L (σ,C)	ALIGN-L (C,σ)	ALIGN-R (σ,V)	ALIGN-R (V,σ)	*COMPLEX
a.	V	*!				
☞ b.	CV					
c.	CVC		*!	*	*	
d.	CVV				*!	*
e.	CCV		*!			*
f.	CVCC		*!*	*	*	*

For a language to have closed syllables, the downwards-alignment constraint ALIGN-R(σ,V) must be dominated. Such type of language, however, may still restrict the type of consonant that is allowed to appear in syllable-final position through the upwards-alignment constraint ALIGN-L(C,σ). Spanish for example, exhibits a tendency to avoid non-continuant obstruents in syllable final position. This is evinced by the fact that most modern dialects of Spanish have weakening and/or deletion processes that modify or get rid of non-continuant obstruents in the coda (e.g. *a̯imirar* < *almirar* < *að̯mirar* < *admirar* 'to admire'). The vocalization of stop consonants exhibited by Chilean Spanish is a weakening process that contributes to the progression of the grammar in this direction.

Although syllable codas are not totally disallowed in Chilean Spanish, complex codas are absolutely barred. Consonant sequences that form complex codas in Standard Spanish are simplified in Chilean Spanish through deletion.[3] As the examples in the rightmost column in (17) show, it is the more sonorous of the two coda consonants that is retained (Oroz 1966:146-147).

(17)	Input		Standard	Chilean
	konste	→	kons.te	kon.te
	'let it be clear that...'			
	instruktor	→	ins.truk.tor	in.tru.tor
	'instructor'			
	inspektor	→	ins.pek.tor	im.peu̯.tor
	'inspector'			

obstakulo	→	obs.ta.ku.lo	os.ta.ku.lo
‘obstracle’			
obstante	→	obs.tan.te	os.tan.te
‘nevertheless’			
ekstraktro	→	eks.trak.to	es.trau̯.to
‘extract’			

These data reveal that the anti-deletion constraint, MAX(seg), is dominated by *COMPLEX(Coda), a specific version of *COMPLEX. Furthermore, given that only certain consonants may appear in the syllable coda, a segment-to-syllable alignment constraint must also be at large in this Spanish dialect. Following Itô and Mester (1994), I propose that the relevant constraint is ALIGN-L(Stop,σ), which requires all stop consonants to be syllable initial.

(18) ALIGN-L(Stop,σ): Every stop consonant must be aligned with the left edge of a syllable.

ALIGN-L(Stop,σ) is part of a universal hierarchy of consonant-to-syllable alignment constraints, (19). The ranking of the various consonant-to-syllable alignment constraints with respect to one another is intrinsic. It follows from the sonority hierarchy (Itô and Mester 1994).

(19) Universal consonant-to-syllable alignment hierarchy

ALIGN-L(Stop,σ) >> ALIGN-L(Fricative,σ) >> ALIGN-L(Nasal,σ) >> ALIGN-L(Approximant,σ)

The tendency exhibited by Chilean Spanish to preserve the more sonorous of two consonants, when preserving both of them would run afoul of *COMPLEX(Coda), follows from the universal hierarchy in (19). Because *COMPLEX(Coda) dominates MAX(seg), both consonants may not be preserved, (20a). Disposing of only one of the consonants, however, is enough to satisfy this well-formedness condition. Candidate (20d) is discarded because it incurs an unnecessary violation of MAX(seg). The decision falls then onto the consonant-to-syllable alignment hierarchy, which favors the candidate that violates the lower-ranking alignment constraint, (20b). Note that MAX(seg) must dominate the consonant-to-syllable alignment hierarchy because proper left alignment of all consonants may not be obtained at the expense of deleting the consonant of a simplex coda, (20d).

(20) *COMPLEX(Coda) >> MAX(seg) >> ALIGN-L(Stop,σ) >> ALIGN-L(Fricative,σ) >> ALIGN-L(Nasal,σ) >> ALIGN-L(Approximant,σ)

	Input: /konste/	*COMPL (Coda)	MAX (seg)	ALIGN-L (Stop,σ)	ALIGN-L (Fric,σ)	ALIGN-L (Nas,σ)	ALIGN-L (Appr,σ)
	a. kons.te	*!			*	*	
☞	b. kon.te		*			*	
	c. kos.te		*		*!		
	d. ko.te		**!				

But even though Chilean Spanish tolerates simplex codas, when the output correspondent of a stop consonant may not be incorporated into a syllable onset, parsing it as a syllable coda is not an option (e.g. *[di.rek.to] < /direkto/ 'direct'). The data in (1) show that in such case, underlying stop consonants are allowed to have an output correspondent provided that it is not a consonantal segment (e.g. [di.reu̯.to] < /direkto/ 'direct'). This indicates that ALIGN-L(Stop,σ) dominates the featural faithfulness constraint IDENT(Feature), (21). The rest of the consonant-to-syllable alignment constraints must be outranked by IDENT(Feature) since they do not cause other segments to vocalize.

(21) IDENT(Feature): Correspondent segments must have identical feature specifications. (McCarthy and Prince 1995)

Tableau (22) illustrates the evaluation of an input that contains a stop consonant that may not be parsed as a syllable onset. Parsing such segment as a syllable coda runs afoul of ALIGN-L(Stop,σ) because this consonant is not leftmost within the syllable, (22a). Candidates (22b) and (22c) represent two different alternatives to remedy this situation. The output form may be completely unfaithful to the stop consonant in the input form by depriving it of a correspondent, (22c). Alternatively, it may be partially unfaithful to it by assigning it a non-identical correspondent, (22b). The latter solution is preferred because it allows a greater degree of faithfulness in compliance with MAX(seg).

(22) MAX(seg), ALIGN-L(Stop,σ) >> IDENT(Feature) >>ALIGN-L(Fricative,σ) >> ALIGN-L(Nasal,σ) >> ALIGN-L(Approximant,σ)

	Input: /direkto/	MAX (seg)	ALIGN-L (Stop,σ)	IDENT (Feature)	ALIGN-L (Fric,σ)	ALIGN-L (Nas,σ)	ALIGN-L (Appr,σ)
	a. di.rek.to		*!				
☞	b. di.reu̯.to			*			
	c. di.re.to	*!					

This constraint ranking also explains why vocalization is the process chosen to deal with unwanted syllable-final stop consonants in Chilean Spanish. Whereas spirantization, (23b), nasalization, (23c), or lateralization, (23d), would still leave the output form with a misaligned consonant, vocalization is the only process that fixes the problem of having a consonantal segment that is not leftmost within the syllable without being radically unfaithful, (23e). Although deletion, (23d), also serves to dispense of the misaligned consonant, it is more costly because it entails giving up the entire segment.

(23) MAX(seg) >> ALIGN-L(Stop,σ) >> IDENT(Feature) >> ALIGN-L(Fricative,σ) >> ALIGN-L(Nasal,σ) >> ALIGN-L(Approximant,σ)

	Input: /direkto/	MAX (seg)	ALIGN-L (Stop,σ)	IDENT (Feature)	ALIGN-L (Fric,σ)	ALIGN-L (Nas,σ)	ALIGN-L (Appr,σ)
	a. di.rek.to		*!				
	b. di.rex.to			*	*!		
	c. di.reŋ.to			*		*!	
	d. di.reʟ.to			*			*!
☞	e. di.reu̯.to			*			
	f. di.re.to	*!					

Nonetheless, vocalization as a strategy to avoid syllable-final consonants does not erase all marked syllable structure because a complex nucleus is formed. This means that the constraint *COMPLEX(Nucleus) is outranked by the segment-to-syllable alignment hierarchy. The full ranking responsible for the vocalization of syllable-final stops in Chilean Spanish is illustrated in (24).

(24) ALIGN-L(Stop,σ) >> IDENT(Feature) >> ALIGN-L(Fricative,σ) >> ALIGN-L(Nasal,σ) >> ALIGN-L(Approximant,σ) >> *COMPLEX(Nucleus)

	Input: /admiro/	ALIGN-L (Stop,σ)	IDENT (Feature)	ALIGN-L (Fric,σ)	ALIGN-L (Nas,σ)	ALIGN-L (Appr,σ)	*COMPLEX (Nucleus)
a.	ad.mi.ro	*!					
b.	að.mi.ro		*	*!			
c.	am.mi.ro		*		*!		
d.	al.mi.ro		*			*!	
☞ e.	aɪ̯.mi.ro		*				*

Despite its violations of IDENT(Feature) and *COMPLEX(Nucleus) the vocalizing candidate, (24e), is superior to all contenders because it does not contain any misaligned consonants. In other words, consonant-to-syllable alignment is favored over featural faithfulness and the structural complexity of the syllable nucleus.

By contrast, when *COMPLEX(Nucleus) outranks the consonant-to-syllable alignment hierarchy, vocalization may not take place. This explains why other Spanish dialects do not use vocalization to avoid syllable-final stop consonants. Instead, they rely on processes such as lateralization, (25d), which does not give rise to a complex nucleus,

and although a consonant remains misaligned, it is only in violation of the lowest-ranking alignment constraint.

(25) *COMPLEX(Nucleus) >> ALIGN-L(Stop,σ) >> IDENT(Feature) >> ALIGN-L(Fricative,σ) >> ALIGN-L(Nasal,σ) >> ALIGN-L(Approximant,σ)

	Input: /admiro/	*COMPLEX (Nucleus)	ALIGN-L (Stop,σ)	IDENT (Feature)	ALIGN-L (Fric,σ)	ALIGN-L (Nas,σ)	ALIGN-L (Appr,σ)
a.	ad.mi.ro		*!				
b.	að.mi.ro			*	*!		
c.	am.mi.ro			*		*!	
☞ d.	al.mi.ro			*			*
e.	a̯i̯.mi.ro	*!		*			

Continuing with our focus on Chilean Spanish, the reason why coronals vocalize to [i̯], whereas labials and dorsals may vocalize to either [u̯] or [i̯], has to do with featural faithfulness. Decomposing IDENT(Feature) into specific featural faithfulness constraints allows us to understand these patterns.

(26) IDENT(Stricture): Correspondent segments must have identical specifications for stricture.

(27) IDENT(Place): Correspondent segments must have identical specifications for place.

The ranking between IDENT(Stricture) and IDENT(Place) cannot be determined at this point but it will be revealed in tableau (37) below. The reason to split IDENT(Feature) here is to show that although this constraint may be violated in order to comply with ALIGN-L(Stop,σ), the optimal form must avoid incurring unnecessary violations of featural faithfulness.

When the input contains a coronal stop, vocalization to [i̯] is optimal because this segment also bears a [coronal] specification, which results in total place identity (e.g. [coronal] = [coronal]), (28b). The strongest contender, (28c), is ruled out by IDENT(Place) because the [coronal] specification of /t/ does not match either of the place specifications of [u̯], ([coronal] ≠ [dorsal, labial]).

(28) ALIGN-L(Stop,σ) >> IDENT(Stricture), IDENT(Place)

	Input: /etniko/	ALIGN-L (Stop,σ)	IDENT (Stricture)	IDENT (Place)
	a. et.ni.ko	*!		
☞	b. ei̯.ni.ko		*	[**cor**] / [**cor**]
	c. eu̯.ni.ko		*	[cor] / [dor, lab]!

When the input contains a labial or dorsal stop, the optimal output form cannot help falling in violation of IDENT(Place). Given that [i̯] is neither [labial] nor [dorsal], and that [u̯] is not exclusively [labial] or [dorsal], a correspondence relationship between a labial or dorsal stop and either of these vocoids may not result in perfect place identity. Let us consider first the case of an input that contains a labial stop. This case is

illustrated by tableau (29) below. Candidate (29c) is an obvious violation of IDENT(Place) since the [labial] specification of /p/ differs from the [coronal] specification of [i̯]. Candidate (29b) is not much better. Note that one of the place specifications of [u̯] matches the place specification of /p/, (e.g. [labial] = [labial]). Nonetheless, /p/ and [u̯] are not identical in place because the latter has a place specification (e.g. [dorsal) that the former lacks, hence the violation of IDENT(Place). Because candidates (29b) and (29c) tie with respect to all constraints, they are equally optimal, which explains why both forms are attested in Chilean Spanish. However, the observation made by Oroz (1966:144) that vocalization to [u̯] is more commonly heard is not pointless. It follows from the fact that [u̯], being doubly specified for place, is able to remain partially identical in place to an underlying labial stop, whereas [i̯] completely fails to do so.

(29) ALIGN-L(Stop,σ) >> IDENT(Stricture), IDENT(Place)

		Input: /kaptura/	ALIGN-L (Stop,σ)	IDENT (Stricture)	IDENT (Place)
	a.	kap.tu.ra	*!		
✓ ☞	b.	kau̯.tu.ra		*	[**lab**] / [dor, **lab**]!
☞	c.	kai̯.tu.ra		*	[lab] / [cor]!

A similar situation arises when the input contains a dorsal stop. Candidate (30c) is a clear violation of IDENT(Place) because whereas /k/ is dorsal, [i̯] is coronal. Candidate (30b) does not satisfy IDENT(Place) either. Note that although both [u̯] and /k/

are dorsal, the former has a [labial] specification that the latter lacks. Strictly speaking, both vocalizing candidates, (30b) and (30c), fail to comply with IDENT(Place) as well as IDENT(Stricture). Since they tie with respect to all constraints, they are both selected as optimal. However, the candidate that vocalizes to [u̯], (30b), has the slight advantage that one of the place specifications of [u̯] agrees with the place specification of the dorsal consonant. This is the reason why Chilean speakers more often use this form than the alternative vocalization to [i̯].

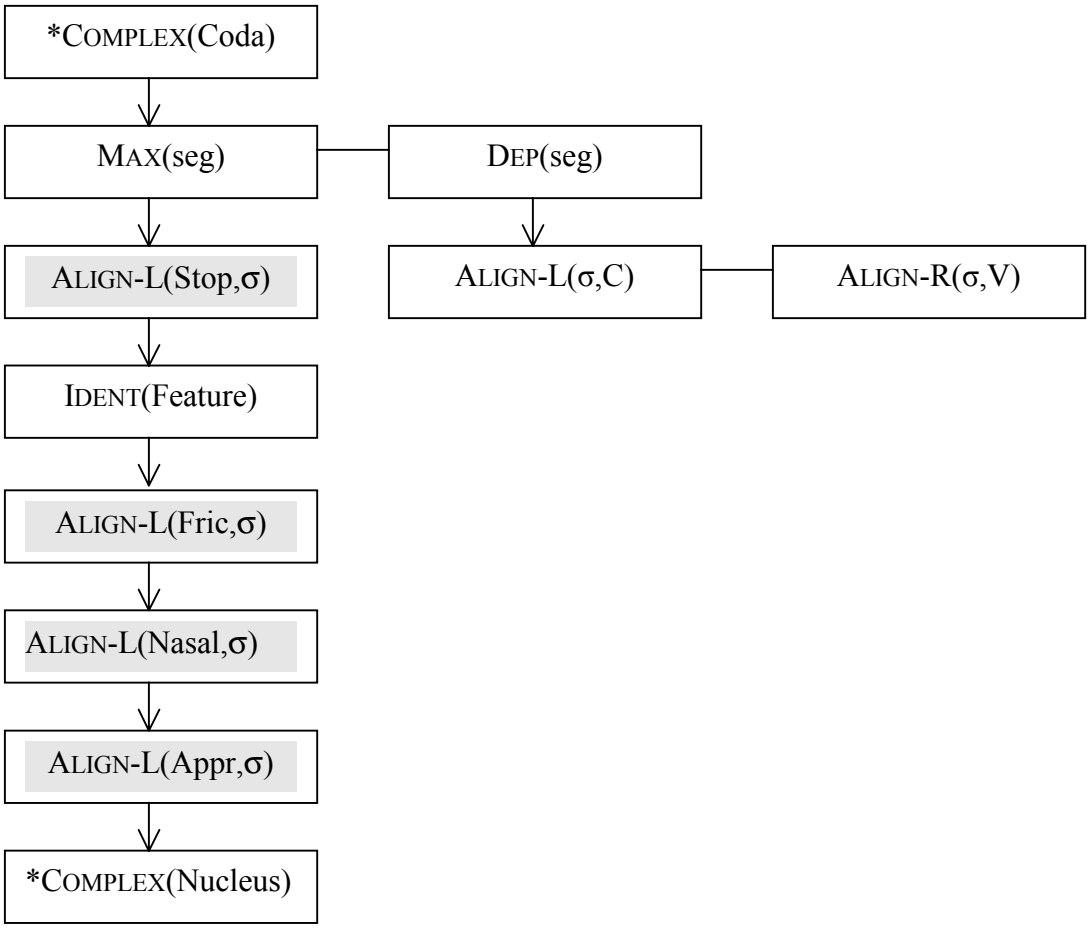
(30) ALIGN-L(Stop,σ) >> IDENT(Stricture), IDENT(Place)

		Input: /korekto/		ALIGN-L (Stop,σ)	IDENT (Stricture)	IDENT (Place)
		a.	ko.rek.to	*!		
✓	☞	b.	ko.reu̯.to		*	[**dor**] / [**dor**, lab]!
	☞	c.	ko.rei̯.to		*	[dor] / [cor]!

I conclude that vocalization is used in Chilean Spanish to improve the well-formedness of output forms by reducing the number of misaligned consonants without having to deprive input segments of an output correspondent. This output correspondent is considerably unfaithful because it represents a major change in stricture, but it is optimal because it holds the position of the underlying stop and it strives to maintain its place of articulation. Vocalization, however, is not effective in erasing all markedness in syllable structure because it gives rise to a complex nucleus. This process may be better viewed as a shift in markedness from the syllable coda to the syllable nucleus. The

constraints responsible for these patterns and their organization in the grammar of Chilean Spanish are summarized in the following hierarchy. The consonant-to-syllable alignment constraints appear in shaded boxes to indicate that they belong to the same constraint family and that they are intrinsically ranked with respect to one another.

(31) Interim constraint ranking for Vocalization in Chilean Spanish



3. Vocalization and spirantization

Having concluded that vocalization serves to avoid closed syllables, it is not clear why voiced stops should vocalize when they appear between a vowel and a liquid consonant.

Given that the output correspondent of a voiced stop could combine with a following liquid under a licit complex onset (e.g. [ma.ð̞re] < /madre/ ‘mother’), the unfaithfulness that comes with changing the voiced stop into a vocoid seems completely unnecessary (e.g. [maɪ̯.re] < /madre/ ‘mother’). However, behind this apparently gratuitous unfaithfulness lies the fact that vocalization in this particular context also serves to minimize the number of consonants that are not syllable initial. I demonstrate below that segment-to-syllable alignment is also responsible for the vocalization of voiced stops when flanked by a vowel and a liquid consonant.

In order to be able to appreciate the benefit that vocalization brings about in this particular context, it is necessary to take into account that Spanish voiced stops, /b, d, g/, are also the target of a spirantization process that turns them into approximant consonants, [β̞, ð̞, ɣ̞][4], when preceded by a [+continuant] segment. There is one exception to this generalization: the voiced coronal stop fails to spirantize when preceded by the liquid /l/ (Harris 1969, 1984, Cressey 1978, Mascaró 1984, 1991, among others). The data in (32) show that voiced stops only surface as such when preceded by a pause or a nasal, and in the special case of /d̪/, when preceded by /l/.

(32) *Spirantization of voiced stops*

	Labial	Coronal	Dorsal
‖ ___	[b]ono	[d̪]atos	[g]rito
	‘bonus’	‘data’	‘cry’

N ___	un [b]ono	un [d̪]ato	un [g]rito
	‘a bonus’	‘a datum’	‘a cry’
L ___	el [β̞]ono	el [d̪]ato	el [ɣ̞]rito
	‘the bonus	‘the datum’	‘the cry’
C ___	los [β̞]onos	los [ð̞]atos	los [ɣ̞]ritos
	‘the bonuses’	‘the data’	‘the cries’
	dar [β̞]onos	dar [ð̞]atos	dar [ɣ̞]ritos
	‘to give bonuses’	‘to give data’	‘to cry out’
V ___	ese [β̞]ono	ese [ð̞]ato	ese [ɣ̞]rito
	‘that bonus’	‘that datum’	‘that cry’

Building on proposals by Kirchner (1994, 1995) and Widdison (1997), Piñeros (2000) analyzes this process as a strategy to achieve articulatory ease in the production of segments that require an intensification of muscular effort in order to maintain vocal-fold vibration while an oral closure takes place (e.g. voiced stops). In essence, spirantization serves to reduce the effort necessary to articulate such segments by reducing the degree of their oral closure. This results in a decrease of supralaryngeal pressure that allows the vocal folds to remain in motion without intense muscular effort. This strategy to achieve articulatory ease comes at the cost of being unfaithful to the stricture of the input segment but it is tolerated because the constraint LAZY(VdStp) outranks IDENT(Stricture).

(33) LAZY(VdStp): Reduce muscular effort in the articulation of segments that are intended to have complete oral closure with simultaneous vocal-fold vibration.

When the context that precedes the voiced stop provides an oral closure (e.g. a pause or a homorganic consonant), spirantization does not have to apply because no major effort needs to be made in order to achieve the complete closure of the voiced stop. However, if no oral closure precedes the voiced stop (e.g. vocoids), sustaining vocal-fold vibration while the oral closure is attained requires an intensification of muscular effort to prevent voicing from dying out. Because this is sanctioned by the dominant constraint LAZY(VdStp), spirantization must take place. For a complete discussion of this and other constraints that are active in Spanish spirantization, the reader is referred to Piñeros (2000). The crucial ranking for spirantization is LAZY(VdStp) >> IDENT(Stricture).

(34) LAZY(VdStp) >> IDENT(Stricture)

	Input: /bend̪igo/	LAZY(VdStp)	IDENT(Stricture)
	a. ben̪.d̪i.go	*!	
☞	b. ben̪.d̪i.ɣ̞o		*
	c. ben̪.ð̞i.ɣ̞o		**!
	d. β̞ en̪.ð̞i.ɣ̞o		**!*

Candidate (34a) is ruled by LAZY(VdStp) because the segment [g] is in post-vocalic position; which requires intense muscular effort in order to sustain vocal-fold vibration while the complete oral closure for [g] occurs. All of the remaining candidates

abide that LAZY(VdStp). Note that the segment /d/ does not have to spirantize because it may be co-articulated with the preceding homorganic nasal resulting in a considerable reduction of muscular effort. Co-articulation also explains why /d/ fails to spirantize when preceded by /l/ (e.g. [fa̪l̪.d̪a] < /falda/ 'skirt'). Since Spanish laterals only assimilate in place to a following coronal consonant, the sequence /ld/ may be co-articulated, but the sequences /lb/ or /lg/ may not. Consequently, the articulation of /d/ after a homorganic lateral does not require intense muscular effort; hence the possibility for this segment to remain faithful and retain its stricture in this context. To finish the survey of the candidates in (34), it is important to note that the segment /b/ does not have to spirantize because it is preceded by a pause, which is equivalent to an oral closure (e.g. the rest position), from which only minor effort is necessary to reach the exact target of /b/. The final decision is made by IDENT(Stricture), which favors the candidate that remains the most faithful without investing intense muscular effort to produce voiced stops, (34b).

Given that all postvocalic voiced stops fall prey of LAZY(VdStp), their output correspondents may never surface as stop segments. Piñeros (2000) accounts for the fact that spirantization does not give rise to voiced fricatives either because the markedness constraint *[IV2, CS2], which militates against segments that are marked in both voicing and stricture, is also high-ranking in Spanish (e.g. Spanish does not have voiced fricative phonemes as a result of this universal constraint). With this state of affairs, approximants are the best way to reconcile the drive to reduce articulatory effort and the need to remain faithful to the input, without generating segments that are extremely marked (e.g. voiced fricatives).

Due to LAZY(VdStp), when the input contains a voiced stop that is flanked by a vowel and a liquid, the constraint ALIGN-L(Stop,σ) is irrelevant because the voiced stop may not have an output correspondent that has complete oral closure, (35a). Given the dominated status of IDENT(Feature), an approximant may act as the output correspondent of the voiced stop, in which case it may form a complex onset with the following liquid, (35b), or it may be parsed as the coda of the preceding syllable, (35c). Either of these alternatives represents a violation of the constraint ALIGN-L(Approximant,σ) because if the two adjacent approximants are parsed into a complex onset, the second of them is not syllable initial, (35b). If the first one is parsed as a syllable coda, then only the second one is syllable initial, (35c). Because the consonant-to-syllable alignment hierarchy dominates ALIGN-R(V,σ), the optimal candidate is the one that chooses to use a vocoid as the output correspondent of the voiced stop, (35d). This candidate manages to avoid all misaligned consonants at the affordable cost of forming a diphtong. According to these results, consonant-to-syllable alignment is the constant factor that lies behind this vocalization process in Chilean Spanish.

(35) LAZY(VdStp) >> ALIGN-L(Stop,σ) >> IDENT(Feature) >> ALIGN-L(Fricative,σ) >> ALIGN-L(Approximant,σ) >> *COMPLEX(Nucleus)

	Input: /logro/	LAZY (VdStp)	ALIGN-L (Stop,σ)	IDENT (Feature)	ALIGN-L (Fric,σ)	ALIGN-L (Appr, σ)	*COMPLEX (Nucleus)
a.	lo.gro	*!				*	
b.	lo.ɣ̞ro			*		*!	
c.	loɣ̞.ro			*		*!	
☞ d.	lo̯u̯.ro			*			*

Now that we have established that postvocalic underlying voiced stops have permission granted by LAZY(VdStp) to have output correspondents that are unfaithful in stricture, we can determine the exact ranking of the constraints IDENT(Stricture) and IDENT(Place), which compose the macro constraint IDENT(Feature). Given that the output correspondent of a postvocalic voiced stop may not be consonantal, even if this means assigning it a correspondent that is not identical in place (e.g. [lo̯u̯.ro] < /logro/ 'achievement'), all of the consonant-to-syllable alignment constraints must also outrank IDENT(Place). However, because vocalization only affects stop consonants, ALIGN-L(Stop,σ) must be the only consonant-to-syllable alignment constraint that dominates IDENT(Stricture). This ranking also explains why syllable-final non-stop consonants fail to vocalize in Chilean Spanish.

(36) LAZY(VdStp) >> ALIGN-L(Stop,σ) >> IDENT(Strict) >> ALIGN-L(Fricative,σ) >> ALIGN-L(Approx,σ) >> IDENT(Place), *COMPLEX(Nucleus)

Input: /absurdo/	LAZY (VdStp)	AL-L (Stp,σ)	ID (Str)	AL-L (Fric, σ)	AL-L (App, σ)	ID (Pl)	*COMPL (Nucl)
a. ab.sur.do	**!	*			*		
b. aβ̞.sur.do	*!		*		**		
c. aβ̞.sur.ð̞o			**		**!		
☞ d. au̯.sur.ð̞o			**		*	[b ≠ u̯]	*
e. au̯.su̯i.ð̞o			***!			[b ≠ u̯]	**

In this evaluation, candidates (36a) and (36b) are quickly dismissed by LAZY(VdStp) because they contain voiced stops in post vocalic position, which require

intense muscular effort in their articulation. In order to avoid falling in violation of this top-ranking constraint, the output correspondents of the underlying voiced stops must be unfaithful in stricture. By becoming either approximants or vocoids, these segments may comply with LAZY(VdStp) at the cost of violating IDENT(Stricture). Candidates (36c), (36d) and (36e) illustrate three different ways to do this. Candidate (36c) opts to spirantize both voiced stops. This strategy helps it comply with LAZY(VdStp), but it leaves it at odds with ALIGN-L(Approximant,σ) because the segments [β̞] and [r] are not in syllable-initial position. Candidates (36c) and (36d) choose to vocalize the voiced stop that cannot be aligned with the left edge of a syllable and spirantize the one that can; but note that the latter further vocalizes the underlying approximant, /r/, which cannot be aligned with the left edge of a syllable, either. In vocalizing /b/ to [u̯] both of these candidates run afoul of IDENT(Place) because [u̯] is labiodorsal whereas /b/ is plain labial. The crucial difference between them is that candidate (36d) resolves to vocalize all misaligned consonants regardless of what their input correspondent is, whereas candidate (36c) only vocalizes misaligned consonants provided that they belong to the class that has the maximal degree of stricture (e.g. stops). In other words, candidate (36c) defeats (36d) for being faithful to the stricture of non-stop segments, which are not as disharmonious with the right edge of the syllable as stops are.

Returning to the discussion of why underlying voiced stops vocalize when flanked by a vowel and a liquid consonant, whereas voiceless stops do not, it is important to note that voiceless stops are immune to LAZY(VdStp) because their articulation does not require forcing the vocal folds to vibrate during their oral closure. Since LAZY(VdStp) has no power over voiceless stops, this class of segment may have an

output correspondent that is identical in all feature specifications. The output correspondent of a voiceless stop may be incorporated into a complex onset, (37a), or it may be parsed as a syllable coda, (37b). Parsing it as a syllable onset comes at the cost of leaving the following liquid consonant misaligned, a violation of ALIGN-L(Approximant,σ). However, parsing it as a syllable coda is more costly because, ALIGN-L(Stop,σ) is universally ranked above ALIGN-L(Approximant,σ). Compliance with the higher ranking constraint requires the parsing of voiceless stops as syllable initial over the alignment of any other consonantal segments of higher sonority. All candidates that provide an unfaithful correspondent for the underlying voiceless stop incur unnecessary violations of IDENT(Stricture), which are fatal, (37c,d). In brief, voiceless stops do not have to vocalize when flanked by a vowel and a liquid consonant because, unlike voiced stops, nothing forces them to lose their stricture value in that context. Furthermore, they are sponsored by a universally high-ranking segment-to-syllable alignment constraint that ensures that they be parsed in syllable-initial position even when this is detrimental to the alignment of other consonantal segments.

(37) LAZY(VdStp) >> ALIGN-L(Stop,σ) >> IDENT(Strict) >> ALIGN-L(Fricative,σ) >> ALIGN-L(Approx,σ) >> IDENT(Place), *COMPLEX(Nucleus)

Input: /likra/	LAZY (VdStp)	AL-L (Stp,σ)	IDENT (Strict)	AL-L (Fric, σ)	AL-L (Appr, σ)	IDENT (Place)	*COMPL (Nucl)
☞ a. li.kra					*		
b. lik.ra		*!					
c. li.xra			*!		*		
d. liu̯.ra			*!			[k ≠ u̯]	*

When voiced or voiceless stops are flanked by vowels, neither of them has to vocalize. Voiced stops, however, have to spirantize under duress by LAZY(VdStp). The optimal candidate in tableau (38) must provide an unfaithful correspondent for the underlying voiced stop in order to comply with top-ranking LAZY(VdStp), but it does not have to undergo vocalization because all consonants are properly left aligned, (38b). Vocalization may not be optimal in this case because it does not contribute to improve the alignment between any consonantal segments and left syllables edges, (38d).

(38) LAZY(VdStp) >> ALIGN-L(Stop,σ) >> IDENT(Strict) >> ALIGN-L(Fricative,σ) >> ALIGN-L(Approx,σ) >> IDENT(Place), *COMPLEX(Nucleus)

Input: /logo/	LAZY (VdStp)	AL-L (Stp,σ)	IDENT (Strict)	AL-L (Fric, σ)	AL-L (Appr, σ)	IDENT (Place)	*COMPL (Nucl)
a. lo.go	*!						
☞ b. lo.ɣ̞o			*				
c. loɣ̞.o			*		*!		
d. lo̯u̯.o			*			[g ≠ u̯]!	*

When it is a voiceless stop that is flanked by vowels, no unfaithfulness is necessary and perfect alignment is possible, (39a). Parsing the output correspondent of the voiceless stop as a syllable coda runs afoul of ALIGN-L(Stop,σ), (39b), and changing it into a different type of segment does not serve any purpose either, (39c,d).

(39) LAZY(VdStp) >> ALIGN-L(Stop,σ) >> IDENT(Strict) >> ALIGN-L(Fricative,σ) >> ALIGN-L(Approx,σ) >> IDENT(Place), *COMPLEX(Nucleus)

Input: /loko/	LAZY (VdStp)	AL-L (Stp,σ)	IDENT (Strict)	AL-L (Fric, σ)	AL-L (Appr, σ)	IDENT (Place)	*COMPL (Nucl)
☞ a. lo.ko							
b. lok.o		*!					
c. lo.xo			*!				
d. lo̯u̯.o			*!			[k ≠ u̯]!	*

Finally, I turn to consider the only case in which a voiced stop flanked by a vowel and a liquid consonant does not vocalize. This is in word-initial position when the preceding word ends in a vowel, as illustrated by the following examples.

(40)	esa broma	→	esa [.β̞ r]oma	'that joke'
	esa droga	→	esa [.ð̞r]oga	'that drug'
	ese grito	→	ese [.ɣ̞r]ito	'that cry'

Martínez-Gil (1997) has offered a principled explanation for this pattern. Whether they are preceded by a vowel or not, voiced stops fail to vocalize word initially because in this context, they are subject to an alignment constraint that requires the left edge of the morphological word to coincide with the left edge of a syllable.

(41) ALIGN-L(MWd,σ): The left edge of a morphological word must be aligned with the left edge of a syllable.

There is independent evidence for the active role of this constraint in the Spanish grammar. Despite the general tendency of this language to syllabify the output correspondents of most [stop + liquid] sequences as complex onsets (e.g. [su.β̞.li.me] < /sublime/ 'sublime'), whenever a [stop + liquid] sequence arises from the juncture of a word whose leftmost segment is a liquid consonant and a prefix whose rightmost segment is a stop consonant, the output correspondents of these segments are parsed heterosyllabically (e.g. [su.β̞.lu.nar] < /sublunar/ 'earthly'). This syllabification pattern follows form the fact that by placing the syllable boundary immediately before the word-initial consonant, it is possible for the left edge of the morphological word to match the left edge of a syllable.

Because ALIGN-L(MWd,σ) outranks the segment-to-syllable alignment hierarchy, no consonantal segment may become syllable initial at the expense of sacrificing the alignment between the left edge of the morphological word and the left edge of a syllable, (42c). The voiced stop, however, must still spirantize in compliance with LAZY(VdStp), since this does not preclude satisfaction of ALIGN-L(MWd,σ), (42b). The broken line indicates non-crucial ranking between ALIGN-L(MWd,σ) and LAZY(VdStp), whose demands do not conflict.

(42) ALIGN-L(MWd,σ), LAZY(VdStp) >> ALIGN-L(Stp,σ) >> IDENT(Strict) >> ALIGN-L(Fric,σ) >> ALIGN-L(Approx,σ) >> IDENT(Place), *COMPLEX(Nucleus)

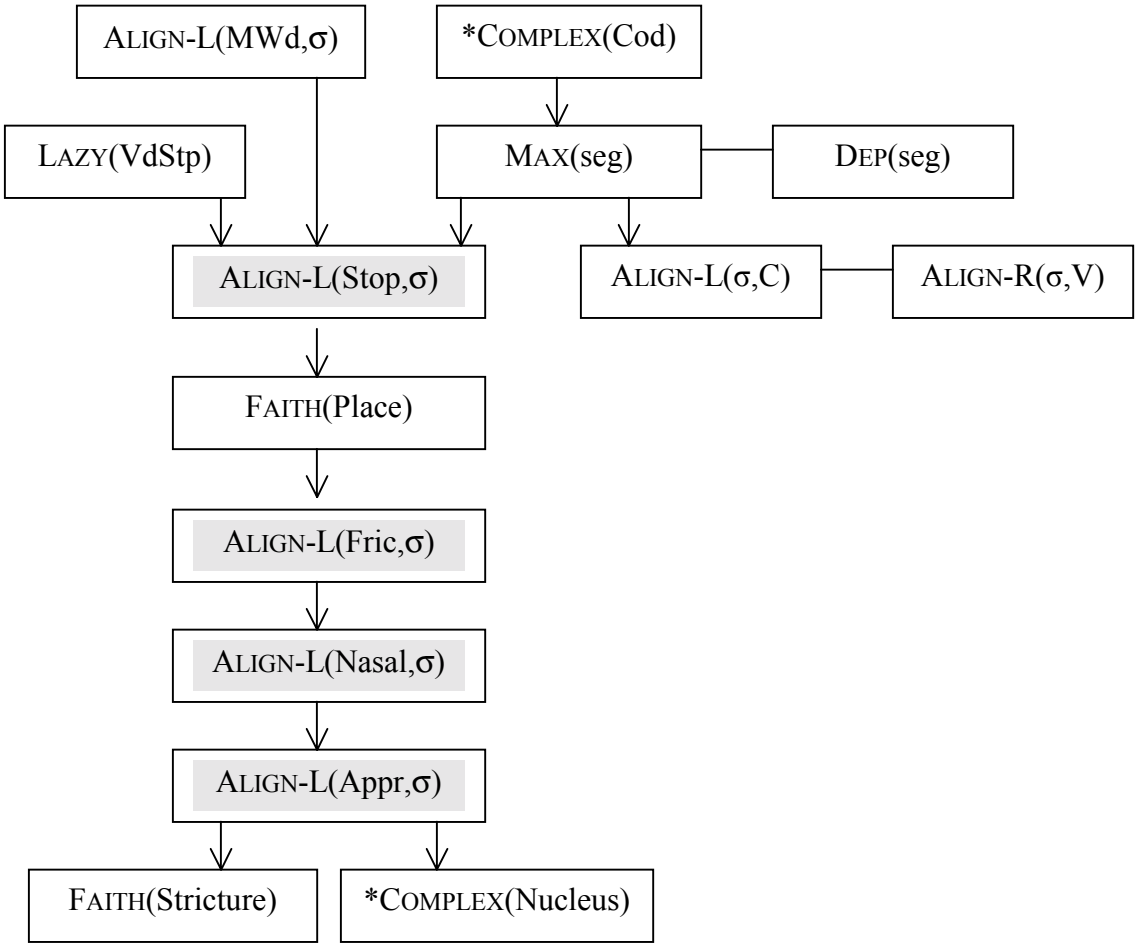
Input: /ese grito/	ALIGN-L (MWd,σ)	LAZY (VdStp)	AL-L (Stp,σ)	ID (Str)	AL-L (Appr,σ)	ID (Pl)	*COMPL (Nucl)
a. e.se.gri.to		*!					
☞ b. e.se.ɣ̞ri.to				*	*		
c. e.seu̯.ri.to	*!			*		[g ≠ u̯]	*

Summing up, vocalization of stop consonants is used in Chilean Spanish to reduce the number of consonantal segments that are not syllable initial. Whether they are voiced or voiceless, when they may not be incorporated into a syllable onset, stop consonants must vocalize in order to avoid falling in violation of ALIGN-L(Stop,σ), (see 23e & 24e). Despite ridding the output form of syllable codas, vocalization does not result in a simplification of syllable structure because it gives rise to branching nuclei. This is a direct consequence of the dominated status of the constraint *COMPLEX(Nucleus), which could block vocalization if it outranked the consonant-to-syllable alignment constraints. Although they could be incorporated into a syllable onset, post-vocalic voiced stops also vocalize when followed by a liquid consonant because, in order to comply with LAZY(VdStp), they must reduce the degree of their stricture. By becoming approximants, the output correspondents of voiced stops manage to satisfy LAZY(VdStp) but they become featurally unfaithful. Since this unfaithfulness is already granted, an unfaithful correspondent that is not consonantal is preferred because it manages to escape the demands of all of the consonant-to-syllable alignment constraints,

(see 35d). Through vocalization, the output correspondent of the voiced stop frees a syllable-initial position that is used to align the following liquid. This, however, is only possible when spirantization prevents the voiced stop from surfacing as a stop segment. Despite this possibility, a voiced stop may not vocalize if it is the lefmost segment of a morphological word because this would preclude the alignment between the left edge of this morphological constituent and the left edge of a syllable, (see 42b).

This analysis accounts for all cases of stop vocalization in Chilean Spanish. By adding the independently motivated constraints LAZY(VdStp) and ALIGN-L(MWd,σ) to the hierarchy in (31), it is revealed that the unexpected vocalization of postvocalic voiced stops before a liquid consonant is due to the same factor that causes stop consonants to vocalize elsewhere: the drive to avoid consonantal segments that may not be aligned with the left edge of a syllable. The final constraint ranking is presented in (43) below.

(43) Final constraint ranking for Vocalization in Chilean Spanish

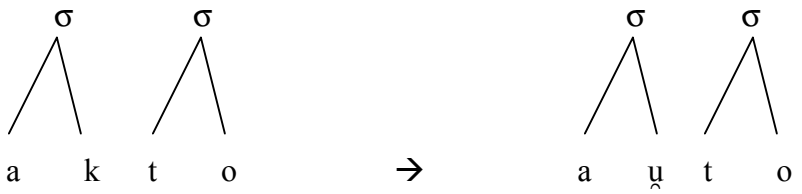


4. Conclusion

In this paper I have demonstrated that the motivation behind the vocalization process that affects stop consonants in Chilean Spanish is to reduce the number of consonantal segments that may not surface in absolute syllable-initial position. There are two distinct cases in which vocalization contributes to this goal. First, this process serves to dispense of stop consonants that may not be incorporated into syllable onsets and whose only chance to survive is as syllable codas (e.g. [au̯.to] < [ak.to] < /akto/ ‘act’).

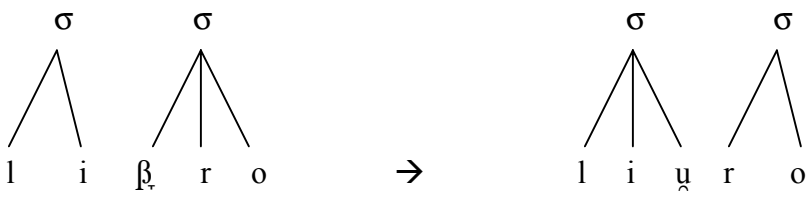
By turning the stop consonant into a vocoid, a type of segment that is most harmonious with the left edge of the syllable is not forced to appear at the right syllable edge.

(44) Avoidance of misaligned stops



Secondly, when a post-vocalic voiced stop is followed by a liquid consonant, vocalization also reduces the number of consonantal segments that are not syllable initial. Given that in a post-vocalic context, a voiced stop may not retain its complete oral closure due to an independent process of spirantization, the underlying [voiced stop + liquid] cluster would have to surface as two adjacent approximants, only one of which could be syllable initial. Since the unfaithfulness of the output correspondent of the voiced stop has already been granted, this segment may as well vocalize to escape the demands of the consonant-to-syllable alignment hierarchy and thereby allow the liquid consonant to surface in syllable-initial position.

(45) Avoidance of misaligned approximants



This analysis of vocalization as a strategy to optimize segment-to-syllable alignment unveils the very nature of this process. Consonants become vocoids because it is the only way for them to escape the alignment constraints that require consonantal segments to be aligned with the left edge of a syllable. This is a principled motivation for the change [+consonantal] → [-consonantal] that analyses that do not take segment-to-syllable alignment into account fail to reveal.

Although vocalization involves an increase in the complexity of the syllable nucleus and a considerable degree of unfaithfulness to the featural composition of an input segment, it is the best alternative available to grammars that do not want to lose or gain entire segments in order to avoid placing consonants in structural positions where they are not harmonious. As a general tendency, vocalization does not affect consonants that may surface as syllable initial because they are already in the structural position where they are most harmonious. In this regard, the Chilean data is interesting because it presents a case of segments that vocalize despite the fact that they could surface as syllable initial. However, even in this case, vocalization still works in favor of optimizing segment-to-syllable alignment by taking advantage of the fact that the segment that would usually be assigned to the syllable-initial position must be featurally unfaithful, and its being licensed to be unfaithful can be used to achieve the proper alignment of another consonantal segment.

This alignment approach to vocalization also reveals that complex-onset simplification is not an exclusive effect of the constraint *COMPLEX(Onset) but may also be caused by consonant-to-syllable alignment constraints. Indeed, relying on *COMPLEX(Onset) to account for why the output correspondents of underlying [voiced

stop + liquid] sequences are parsed heterosyllabically in Chilean Spanish would give rise to a paradox because this constraint would have to be both top and bottom ranking in order to preclude the emergence of tautosyllabic [spirant + liquid] clusters, (e.g. *[ɾ̄e.ɣ̬la] < /regla/ ‘ruler’) and at the same time allow other tautosyllabic consonant clusters (e.g. [te.kla] < /tekla/ ‘key’; [a.fri.ka] < /afrika/ ‘Africa’). The analysis proposed here demonstrates that the reason why Chilean Spanish avoids complex onsets consisting of a [spirant + liquid] has nothing to do with the constraint *COMPLEX(Onset). The actual reason why such type of complex onset fails to arise is because of the glitch in the faithfulness to voiced stops caused by spirantization, which allows the kind of improvement in segment-to-syllable alignment illustrated in (45).

References

Cressey, William. 1978. *Spanish phonology and morphology: a generative view*. Washington, D.C.: Georgetown University Press.

Harris, James. 1969. *Spanish phonology*. Cambridge: MIT Press.

Harris, James. 1984. La espirantización en castellano y la representación fonológica autosegmental. *Working Papers in Linguistics*. Universitat Autonoma de Barcelona.

Ito, Junko and Armin Mester. 1994. Reflections on CodaCond and Alignment. In Jason Merchant, Jaye Padgett and Rachel Walker (eds.), *Phonology at Santa Cruz* III. 27-46.

Kirchner, Robert. 1994. Lenition in phonetically based Optimality Theory. Ms., Berkeley, CA.

Kirchner, Robert. 1995. Contrastiveness is an epiphenomenon of constraint ranking. Rutgers Optimality Archive, 51-0295.

Lenz, Rodolfo. 1940. El español en Chile. Buenos Aires: Imprenta de la Universidad de Buenos Aires (*Biblioteca de Dialectología Hispanoamericana*, 6.)

Lipski, John. 1994. Spanish stops, spirants and glides: from consonantal to [vocalic]. In Michael Mazzola (ed.), Issues and Theory in Romance Linguistics, 67-86. Washington, D.C.: Georgetown University Press.

Martínez-Celdrán, Eugenio. 1984. *Fonética*. Barcelona: Editorial Teide.

Martínez-Gil, Fernando. 1996. El principio de la distancia mínima de sonoridad y el problema de la vocalización consonántica en el español dialectal de Chile. *Hispanic Linguistics,* 8:2. 201-246.

Martínez-Gil, Fernando. 1997. Obstruent vocalization in Chilean Spanish: a serial versus a constraint-based approach. *Probus,* 9. 167-202.

Mascaró, Joan. 1984. Continuant spreading in Basque, Catalan and Spanish. In M. Aronoff and R.T. Oehrle (eds.) Language sound structure. Cambridge: MIT Press.

Mascaró, Joan. 1991. Iberian spirantizatin and continuant spreading. In Albert Branchadell, Blanca Palmada, Josep Quer, et al. (eds.), *Catalan Working Papers in Linguistics*. Universitat Autonoma de Barcelona. 167-179.

McCarthy John and Alan Prince. 1993. Generalized alignment. *Yearbook of Morphology*, 79-153.

McCarthy, John and Alan Prince. 1995. Faithfulness and reduplicative identity. University of Massachusetts Occasional Papers 18, 249-384.

Oroz, Rodolfo. 1966. *La lengua castellana en Chile*. Santiago de Chile: Imprenta de la Universidad de Chile.

Piñeros, Carlos-Eduardo. 2000. Markedness and laziness in Spanish obstruents. *Rutgers Optimality Archive*, 399-06100. 39 p.

Prince, Alan and Paul Smolensky. 1993. Optimality theory: constraint interaction in generative grammar. Ms., Technical Report # 2 of the Rutgers Center for Cognitive Science, Rutgers University.

Widdison, Kirk A. 1997. Physical parameters behind the stop-spirant alternation in Spanish. Southwest Journal of Linguistics, 16. 73-84.

Notes

* I am grateful for the comments provided by an anonymous reviewer, which contributed to the improvement of this paper. Any errors that remain are my own.

1 In regards to the fact that dorsal and labial stops may turn into either [u̯] or [i̯], Oroz (1966:144) points out that vocalization to [u̯] is far more common.

2 While [tr] and [dr] are acceptable complex onsets, most Spanish dialects tend to parse [tl] and [dl] heterosyllabically.

3 Spanish only allows complex codas that contain /s/ as the rightmost segment within the syllable.

4 I use the IPA lowering symbol to indicate that [β̞, ð̞, ɣ̞] are not fricatives but approximants.