PHONOTACTIC CONSTRAINTS ON SYLLABLE STRUCTURE

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1. Introduction

Phonotactic constraints are restrictions over sequences of segments allowed in a particular language. They are generally stated in syllabic terms because they hold over over syllables and syllabic components: for example, the ill-formedness of the hypothetical Spanish word **muersto* can only be explained as the result of an excessive number of segments in the rhyme (three being the maximum), given that /ue/ and /rs/ are by themselves licit strings (Harris 1983: 9-10; Colina 2012). In this paper, I will assume the syllable structure in Figure 1.

[Figure 1 here]

Fig. 1 presents an N-bar model of syllable structure, selected for ease of presentation. I make no theoretical claims as to its superiority versus other possible representations, such as the moraic version of Fig. 1, seen in Figure 2. In this mora-based representation of syllabic structure, the nucleus and the coda are dominated by a mora and the onset, being non-moraic, is attached directly to the syllable node (Figure 2)

[Figure 2 here]

All syllables have a nucleus (N), which in Spanish must be vocalic. The onset (O) and coda (C) are optional, with a maximum of two segments in the onset and three in the coda (if the last one is /s/). In addition, segmental (feature) and sonority restrictions apply to specific segments and to segmental combinations within each syllabic constituent.

Phonotactics drive syllabification and the repair mechanisms that apply when illegal sequences arise through morpheme concatenation, borrowing, or other reasons. The focus of this article is on phonotactic constraints, rather than on syllable structure. Syllable structure will be referred to in connection with phonotactic constraints, as needed. Regarding its organization, the current chapter reviews general phonotactic facts of Spanish that apply over the syllabic level, i.e. the sonority contour in Section §2, followed by phonotactic restrictions that affect the segmental or featural level (Section §3). It also presents in further detail two related topics that have recently captured the attention of researchers, namely the syllabic affiliation of prevocalic glides and the level of representation at which the sonority generalization on complex onsets applies (Complex Onset Condition, Martínez Gil 1997, 2001, Colina 2009). Additionally, these topics introduce the issue of dialectal variation in phonotactics and within-language variation in phonotactic restrictions.

2. Phonotactics and the sonority contour

A large number of phonotactic restrictions are driven by sonority, a complex notion that loosely described corresponds to perceptual prominence and/or degree of stricture.

Syllables exhibit a contour based on the universal sonority scale according to which the syllable rises in sonority towards the nucleus, the sonority peak, and then decreases towards the coda (*Sonority Sequencing Principle*, Clements 1990). The rise tends to be maximal from the onset to the nucleus, and minimal in the transition from the nucleus to the coda. Phonotactic restrictions on segments and sequences of segments respond to the need to conform to this sonority contour.

The universal sonority scale consists of a hierarchy (1), where phonological classes are given a ranking by means of a relative sonority index:

(1) Stops < Fricatives < Nasals < Liquids < Glides < Vowels
1 2 3 4 5 6

While the relative sonority of one phonological class versus another is universal (e.g., vowels are always more sonorous than glides, glides are more sonorous than liquids, etc.), the number of sonority-based classes in the sonority scale varies cross-linguistically. For Spanish, Harris (1989a, 1989b) proposes a sonority hierarchy with three sonority classes for consonants: obstruents, nasals and liquids, while Martínez-Gil (2001) defends a subset of distinctions that separates obstruents into stops and fricatives on the basis of the phonotactics of onset clusters. More recently, Colina (2016) has argued that yet a finer distinction is needed to account for a Chilean dialect of Spanish in which obstruents in a onset cluster surface as coda glides, while /f/ remains unaffected (Figure 3).

[Figure 3 here]

Sonority also plays a crucial role in the well formedness of onset and coda clusters: generally, in Spanish two onset consonants must exhibit the maximal sonority distance possible among consonants (see §3.2, the Complex Onset Condition, Martínez-Gil 2001). For coda clusters, however, the ideal configuration does not present such a sharp contrast in sonority, with a preference for a more gradual decrease that often consists of a glide and a consonantal sonorant or a consonantal sonorant and /s/: glide + sonorant, [béjn̪].te 'twenty'; sonorant + /s/, *pers.pec.tive* 'perspective', *ins.taurar* 'institute', *sols.ticio* 'solstice'; and less commonly a glide + obstruent [awk.sí].*lio* 'help' or an obstruent + /s/, *abs.tener* 'abstain', *ads.cribir* 'ascribe.' In the case of singleton codas, glides or sonorants are preferred over obstruents, again due to the tendency toward a more gradual decrease in sonority observed for postnuclear segments: *man.ta* 'blanket', *tren* 'train', *cal.do* 'broth', *pa.pel* 'paper', *peine* 'comb', *hay* 'there is', *muer.te* 'death', *mar* 'sea', *e.clip.se* 'eclipse', *stop* 'stop', *dog.ma* 'dogma.'

3. Phonotactics and segmental features

In addition to the restrictions associated with the sonority contour of the syllable, phonotactic constraints often hold over specific segments and their featural make-up. In some cases, phonotactic restrictions are related to the affinity between a syllabic position and the sonority contribution made by a specific feature (e.g., the onset position favors more consonantal, less sonorous segments). In other instances, it is the affinity among the

features themselves that explains phonotactic restrictions, such as the fact that coda nasals do not have their own point of articulation, or in other words, that nasal point of articulation is not licensed by the coda position. One common strategy to circumvent licensing restrictions on the coda (e.g., point of articulation for nasals and laterals, sonority and continuancy for obstruents) is to parse the potentially ill-formed feature through the following onset, resulting in well-known phenomena, such as nasal/lateral assimilation or voice assimilation. Consequently, coda restrictions tend to refer to the surrounding segments and are formulated as phonotactic generalizations affecting more than one segment, such as: "nasals in the coda have the same point of articulation as the following heterosyllabic consonant," or "/s/ is [z] when followed by a voiced consonant." (cf. § 3.3 and 3.4. for more on this topic).

3.1 Onset

Almost all non-vocalic segments in the phonological inventory of Spanish can appear in the onset. Some restrictions apply to the allophonic realizations of a few phonemes, which, as mentioned above, are frequently explained as a result of the high sonority of the illegal allophone. For instance, rhotic taps do not occur in word-initial onset position; rather, the trill allophone is the only alternant that surfaces in this position, *caro* [kaɾo] 'expensive' carro [káro] 'cart', but *roto* [roto] *[ɾoto] 'broken.' Since an onset tap appears in word-internal position, it must be concluded that this is not entirely related to the onset position, but to the combined effect of onset and word-initial parsing, as they are both considered prominent locations that favor stronger, less sonorous segments.

Similar restrictions apply to onset glides, which in many dialects are banned from the onset. In these dialects a non-syllabic high vocoid exhibits non-consonantal [j, w] and consonantal allophones [j̟, gw] that alternate depending on syllabic position, i.e, nucleus or onset respectively. The consonantal allophones range from a fricative to a stop or affricate depending on variable degree of constriction [j̟, c, tʃ, dʒ, gw]. Unlike what happens in the case of word-initial taps, the onset ban on glides applies also word internally in intervocalic position.

(2)	a. perd-er	'to lose'	perd-[j̟é]ron	'they lost'
	b. com-er	'to eat'	com-[j̟é]ron	'they ate'
	c. cre-er	'to believe'	cre-[j̟é]ron	'they believed'
	d. o-ir	'to smell'	o-[j̟é]ron	'they smelled'
	(Colina 2010)			

It has been proposed that the exclusion of glides from the onset is motivated by the sonority of glides that are too sonorous for the onset in most Spanish dialects (Hualde 1989a, 1991, 1997, Harris & Kaisse 1999, Colina 2009). Thus, the process in (2c-d) has been explained in a derivational model through a rule of *onset strengthening* or *glide consonantization* which turns a [-consonantal] segment into [+consonantal]. A non-derivational account highlights the affinity between the onset and a consonantal segment, thus the preference for consonantal allophones of the glides (Colina 2009): more specifically, the consonantization facts are explained as the violation of an IDENT faithfulness constraint imposed by the satisfaction of the highly ranked ONSET and

*ONSET/glide which require onsets and ban glides in the onset respectively; IDENT is violated because the [–consonantal] specification of the input does not match that of the output [+consonantal] (Colina 2009). It should be noted that derivational approaches, because of their serial nature, face an important dilemma: does the vocoid start in the nucleus and then move to the onset as a result of consonantization or does it originate in the onset and then become a consonant (Hualde 1989, Martínez-Gil 2016)? It is clear that a parallel conceptualization of the problem that references phonotactics and the affinity between segmental sonority and syllabic position provides a better understanding of the phenomenon.

Although the sonority-based restriction on onset glides applies to most dialects of Spanish, onset glides occur in a few varieties of Spanish, such as Sonoran Spanish (spoken in Sonora, Mexico). This fact poses an interesting question regarding the phonotatics of complex onsets in this dialect (and others). If glides are acceptable as single onsets, are postconsonantal glides also in the onset, resulting in a complex onset cluster? In principle, this should be possible, as the sonority of the glide is higher than that of a liquid, thus improving on the sonority contour of an obstruent + liquid complex onset. To date, however, I am not aware of any study that provides empirical evidence connected with this issue. I will return to this issue in section §4.

3.2 Complex onsets

Onset clusters in Spanish consist of a voiceless or voiced stop /p, t, k, b, d, g/ or /f/, as the first member of the cluster, and a liquid /l, r/ as the second. This generalization is known as the *Complex Onset Condition* (Harris 1983, Martínez-Gil 2001, Hualde 2005, Colina 2009, 2016, among many others). (3) contains some examples of well-formed onset clusters in word-initial and word-medial position.

(3)	a. blanco	‘white’	platicar	‘to talk’
	b. broma	‘joke’	presión	‘pressure’
	c. adrelanina	‘adrenaline’	atracar	‘to hold up’
	d. glotón	‘glutton’	clavo	‘nail’
	e. inglés	‘English’	aclarar	‘clarify’
	f. granada	‘granade’	cresta	‘crest’
	g. egresar	‘to graduate’	increpar	‘to reprimand’
	h. fluido	‘fluid’	frente	‘front’
	i. afligir	‘to afflict’	sufrir	‘to suffer’

Exceptions to this generalization include the coronals /t, d/. /dl/ is always ill formed and /tl/ is acceptable only in some varieties, mostly under the influence of languages that have this sequence, like Nahuatl.

/tl / is a lateral alveolar affricate in Nahuatl. Examples of Nahuatl borrowings in Mexican Spanish are *Tlacuache* ‘opposum,’ *Tlaxcala* ‘place name.’

These facts are generally attributed to co-occurrence restrictions on two adjacent coronals, and also on voice in the case of /dl/ (Harris 1983: 33). Varieties in which */tl/ is ill formed have a more restrictive filter that rules out a sequence of two [-continuant] and [+coronal] segments in the onset, irrespective of their voice specification.

It must be noted that the restrictions on /tl/ and /dl/ in onset clusters are frequent in many languages (Parker 2012: 151). More recently, phonetic evidence has shown that these clusters present issues of perceptibility, in particular it is difficult to discriminate auditorily between /tl/ /dl/, on the one hand, and /kl/ /gl/, on the other (Flemming 2002, 2007).

As mentioned above, the relevant descriptive generalization for onset clusters in a majority of Spanish varieties is quite straightforward: complex clusters consist of an obstruent (C1) and a liquid or /f/ (C2). One issue that has remained unexplained until recently is why /f/ is well-formed as the first member of the cluster, but no other fricative is. In other words, what does /f/ have in common with the stops? Martínez-Gil (2001) and later Colina (2016) argue that what these sounds have in common is the absence of the feature [+continuant] in their phonological representation, because they contain the opposite specification (i.e., [-continuant] in the case of voiceless stops) or because they have no specification at all (i.e., voiced stops and /f/). In this analysis, [+continuant] is the feature that contributes to sonority among consonants. Given the absence of [+continuant] in their representation, /p, t, k, b, d, g/ and /f/ possess, as a group, lower sonority than the rest of the obstruents. /f/ is argued to be underspecified for continuancy because it is the only labiodental obstruent (i.e., it does not contrast [-continuant] and [+continuant] and therefore it is predictably [+continuant]). While it is uncontroversial that voiceless stops are [-continuant], the absence of [+continuant] in voiced stops and in particular in /f/ needs to be justified. The underspecification of voiced obstruents is consistent with phonetic studies that show a great degree of variation in voiced obstruents with regard to aperture, ranging from an open approximant to a fricative (Cole, Iskarous, & Hualde 1999; Ortega Llebaria 2004; Colantoni and Marinescu 2010; Eddington 2011; Simonet at al. 2012); and that there is a gradient distinction rather than bimodal (Carrasco, Hualde & Simonet 2012). Gradient variation supports the view that voiced obstruents are underspecified at the output of the phonology because they are realized variably and gradiently in the phonetic component, depending on the adjacent segments (Colina 2016).

Unless word-initial or post-nasal, voiced obstruents are realized as approximants, thus violating the Complex Onset Condition at least on the surface. This raises the question of the point of application of the phonotactic restrictions on onset clusters. Martínez-Gil (2001), under a derivational framework, proposes that the Complex Onset Condition is operative at the level of the underlying representation, where the voiced obstruents would be stops, at least in some analyses (Harris 1969). Such proposal does not offer a definitive solution, since it does not work for those analyses in which the stops are underlyingly approximants (Hammond 1976; Bakovic 1994; Barlow 2003). In addition, defining the Complex Onset Condition as a restriction on the input is problematic for non-serial, surface-true approaches such as Optimality Theory (OT) that prohibit restrictions on the form of the input. OT analyses (Martínez-Gil 1997, Colina 2009) argue that the condition, formulated as the Maximal Sonority Distance (MSD) constraint, is violated under domination by more highly ranked constraints that determine the realization of voiced obstruents as approximants. In a more recent proposal in which voiced obstruents are underspecified at the output of the phonology, Colina (2016) argues that phonotactic constraints apply to outputs, specifically at the output of phonology

before entering the phonetic module, and thus the MSD is not violated. This is consistent with optimality-theoretic analyses in which constraints apply to outputs.

Data from some Chilean dialects pose some potential problems for the account that says that the onset condition applies at the output of the phonology (Colina 2016). In these dialects, underlying oral stops are vocalized in a syllable coda, becoming glides e.g., *ap.to a*[w].*to* 'apt'; *ét.ni.co é*[j].*niko* 'ethnic' *ac.to a*[j].*to, a*[w].*to* 'act' (Lenz, Bello & Oroz 1940; Oroz 1966; Martínez-Gil 1997). Underlying voiced stops also undergo vocalization when followed by a tautosyllabic liquid in word-medial position (a-c), but not across words (d). Voiceless stops in onset clusters are not vocalized (e-g).

(4) Chilean vocalization

a.	po[w].re	*po.[β]re	'poor'
b.	ma[j].re	*ma.[ð]re	'mother'
c	vi.na[j].re	*vi.na.[ɣ] re	'vinegar'
d.	la.[ðr]o.ga	*la [j].ro.ga	'the drug'
e.	le.[p]ra	*le[w].ra	'leprosy'
f.	le.[t]ra	*le[j].ra	'letter'
g.	sa.[k]ro	*sa[j].ro, *sa[w].ro	'holy'

Martínez-Gil (1997) convincingly shows that voiced obstruents vocalize and are subsequently parsed in the coda, in order to improve the sonority contour of the Complex Onset Condition avoiding an approximant as the first member of the cluster. This explains why only voiced (not voiceless) onset obstruents vocalize, namely, because voiceless obstruents do not have an approximant allophone that compromises the sonority rise of the onset cluster. In other words, since voiceless stops do not have approximant allophones, they do not vocalize in an onset cluster (only in the coda). As seen in (d), vocalization does not take place across words in an effort to avoid misalignment of syllables and word boundaries.

The Chilean phenomenon above presents an apparent obstacle for the analysis of complex onset phonotactics in Colina (2016) because, if voiced obstruents lack the feature [+continuant] at the output of the phonology, sonority restrictions (Complex Onset Condition) are not violated and therefore the prediction is that there would be no vocalization. The explanation to this apparent difficulty lies in the behavior of /f/ once again. Colina (2016) argues that /f/ patterns differently from the voiced obstruents in onset clusters, exhibiting no vocalization. This is evidence that in this dialect the feature that makes voiced obstruents more sonorous than /f/ is [+voice]. In other words, Chilean requires one additional sonority class that divides the least sonorous class of voiceless, voiced obstruents and /f/ (those without [+continuant] in their phonological representations) into two, [-voice] and [+voice] (Fig. 4).

[Figure 4 here]

With a sonority scale like the one in Figure 4, the Complex Onset Condition for these Chilean dialects only allows segments in class 1 and 5 (e.g. voiceless stops and /f/, and l, ɾ). At first glance, the scale may appear problematic, because /f/ is above the voiced stops. However, Figure 4 does not place a voiceless labiodental fricative over the voiced stops, rather a voiceless obstruent that lacks a continuant specification and cannot therefore be considered a fricative at the point of application of the sonority generalization. Colina argues that it is reasonable to assume that language specific adjustments to the scale will depend on the sound inventory of the language (including language-specific featural specifications) and point of application. Furthermore, it is to be expected that dialectal variation will affect sonority scales and other aspects of phonotactics as it does segmental phonology (see section 4 for another example of dialectal variation in Spanish phonotactics).

Perhaps the best known phonotactic restriction affecting Spanish onsets is the one that bans /s/+ obstruent clusters, *stop* **stop*. Sonority offers a clear explanation for it since /s/ does not provide enough of a sonority rise with respect to the following obstruent. Accounting for the repair mechanism selected (i.e. epenthesis) when this sequence arises, usually in loans, is not so straightforward. While the resulting heterosyllabic cluster, [es.top] is an improvement in terms of sonority, it is not quite as clear why this is preferred to deletion, [top]. A minimality requirement must be ruled out, since epenthesis applies across the board, regardless of the number of syllables in a word. Furthermore, the fact that other languages with the same restriction (e.g., Farsi) tend to repair the cluster in a similar way point towards the phonetic make-up of the segments involved. The acoustic saliency of /s/ is likely a factor involved in /s/ retention and the selection of epenthesis, rather than deletion, to repair the cluster. Furthermore, as it will be seen below in connection with codas, /s/ is known to hold a special status as well in the coda, as an additional appendix permitted beyond coda restrictions. This generalization applies across languages, e.g. English *sixths*, 3 segment coda + /s/.

3.3 Coda

As mentioned in §2, some coda phonotactics are related to sonority, such as the preference for sonorants over obstruents. Other phonotactic restrictions affecting the coda can be observed at the segmental and featural levels: for instance, in word-final position, most varieties of Spanish allow rhotics, and nasals and laterals with a neutralized point of articulation (usually coronal, but some varieties have velar or bilabial nasals instead); among sonorants, and among the obstruents, the coronals, /d/ and /s/ are possible, *hotel, amar, camión, virtud.* /d/ can be realized as a continuant voiced or voiceless [ð] [θ] or a stop [d] [t] in some Peninsular varieties. Other obstruents are rare, e.g. /x/ y /t/: *reloj, cénit.*

There is a clear asymmetry between word-internal and word-final phonotactics as to the number of segments permitted in these positions, which are more restricted in the latter. In word-internal position, nasals and laterals exhibit additional allophones that are the result of assimilation to the point of articulation of the following segment, *campo, te*[ŋ]*go, ca*[l̪]*do*. Similarly, more obstruents are possible word-internally than in word-final position, often exhibiting neutralization of continuancy and voice contrasts, *ob* [p/b/β/ɸ] *sesión, dig*[k/g/x/ɣ]*no, ét*[t/d/θ/ð]*nico*. One strong reason for the smaller numbers of

word-final obstruents in the patrimonial lexicon has to do with the history of the Spanish language which in its evolution from Latin repaired ill-formed word-final codas through epenthesis; a consequence of that process is that in present-day Spanish word-final coda obstruents are generally followed by -e, *nube, mate, toque* (Menéndez Pidal 1968). In contrast, in word-internal position epenthesis was prevented so as not to break up a morpheme. Latin prefixes (which often ended in obstruents *ob, ad*) are another factor contributing to higher numbers of obstruents in word-internal position in the patrimonial lexicon.

In general, restrictions in consonantal codas are due to the preference for CV syllables (i.e., the dispreferred or marked status of codas), also understood by some as the preference for consonants to be aligned with the left edge of the syllable and for vowels with the right edge (Piñeros 2006). While deletion and epenthesis of complete segments are ways to create/favor unmarked CV syllables, less radical strategies include partial parsing or deletion of specific features in the phonological output, such as featural neutralization and parsing of features through other syllabic positions. Examples of these are voice assimilation in obstruents and place assimilation in sonorants, on the one hand, and continuancy and voice neutralization in obstruents, on the other, as seen in the examples above. Onset parsing of a coda feature, such as point of articulation (through a shared association line in an autosegmental representation) allows the licensing of said feature through the onset, preserving it and avoiding its presence in the coda. Neutralization of features means that a feature is unspecified at the output of the phonology and then realized in the phonetic component. This accounts for its gradient nature and variability, as can be observed with regard to the aperture ([continuancy]) of obstruents in the coda; for instance, *eclipse*, can be realized in many varieties of Spanish as [eklib.se] [ekliβ.se] [ekliβse] with various degrees of aperture.

The above phonotactic facts refer to features and syllabic position, but more specifically they relate to the affinity between specific natural classes and features. Notice, for instance, that obstruents retain their point of articulation, while their continuancy and voice specifications become non-contrastive. For sonorants (nasals and laterals) it is the point of articulation that becomes unspecified. This affinity is generally grounded in acoustics and perceptibility of featural combinations.

3.4 Complex Codas

Spanish allows coda clusters consisting of a consonant or glide plus /s/ (i.e., a coda consonant plus /s/), *abstracto, biceps, vals, transporte, perspectiva.* As is well known, /s/ has a special status cross-linguistically as an appendix both in the coda and in the onset, being the only segment that can be attached at syllable edges often in apparent violation of the sonority contour.

Permissible clusters that do not have /s/ as the second member consist of a glide and a consonant, *auxilio* [au̯k.si.lio], *veinte* [bei̯n̪.te]. Liquid + nasal clusters are not allowed, given that they are too close on the sonority scale. While the phenomena discussed in §3.3 with regard to codas (e.g. neutralization of obstruents, assimilation) are also operative in coda clusters, obstruents (other than /s/) are frequently deleted in coda clusters in casual speech, regardless of their position in the cluster, *auxilio* [au̯.si.lio], *abstracto* [as.trak.to]. Thus, one can conclude that coda obstruent deletion is generally

driven by sonority since the least sonorous element of the cluster is generally the one targeted for deletion. However, nasals are often deleted in a nasal + /s/ cluster, while liquids are more generally retained, *vals* [bals], *transporte* [tras.por.te]*, perspectiva* [pers.pek.ti.βa]. It is reasonable to assume that some degree of nasality is preserved in the vowel in the first case (thus avoiding full deletion) and that the sibilant is once again maintained due to its acoustic saliency.

No geminates are permitted in Spanish. When they arise through morpheme concatenation, in latinisms or other types of cultisms and borrowings, they are realized as singletons in casual speech, and only as two identical heterosyllabic segments in careful and formal speech, *innato,* [in.na.to] [i.nato] 'innate', *perenne* [peren.ne] [pere.ne] 'perennial.' In varieties with nasal velarization, the first nasal in a fake geminate is sometimes a velar [iŋ.na.to] or a velar partially assimilated to the point of articulation of the following nasal [i‿ŋn‿na.to].

3.5 Nuclei

Like their consonantal counterparts, vocalic geminates are not permissible in Spanish. This restriction applies when two identical vowels arise as the result of morpheme concatenation (which tend to be reduced to one segment) *una amiga* [u.na.mi.ɣa] 'a friend', as well as to a sequence of a glide and a vowel that differ only in syllabic status ([+/-vocalic]). In other words, the sequences *wu, *ji are ill-formed sequences (as well as *uw and *ij). The fact that the glides [w] and [j] cannot be in the same nucleus with the corresponding high vowel (Hualde 2014: 200) has been used to argue for the parsing of prevocalic glides in the onset in Spanish. In addition, Spanish does not allow long diphthongs, e.g., a diphthong made up of two fully syllabic vowels, i.e., CVV *[kie]; [kje].

4. Case Study: Dialectal variation and onset phonotactics

In this section I expand on recent and ongoing work on Chicano Spanish that is pertinent to the phonotactics of vocoid sequences and to dialectal variation in phonotactics (Martínez-Gil 2000; Bakovic 2006; Colina 2009; Martínez-Gil 2016). We consider glides in onset, intervocalic position as well as in postconsonantal position in onset strengthening varieties like Peninsular Spanish and in non-onset strengthening ones like Mexican Spanish from Sonora (henceforth Sonora Spanish, also referred to by some as Chicano Spanish).

It must be noted that Spanish varieties that ban high glides in intervocalic onset position (i.e., onset-strengthening varieties such as Peninsular Spanish) allow them, however, when they are the result of across-the-word resyllabification. In derivational terms, onset glides are ill-formed lexically (5), but they are permitted postlexically (6). In (5a) onset [j] in *leyes* *[le.jes] is ill formed, but it is possible when it is the result of across-the-word resyllabification (6a) of the components in (5b). To further support this contrast between lexical and postlexical phonotactics of [j], compare the minimal pair in (5c) and (6b). As expected, onset [j] is possible when it is the result of postlexical resyllabification (6b); yet it is ill formed when it is in the onset of a lexical word (5c).

(5) Word level (lexical)

a.	ley	[lej]	‘law’	leyes	[le.ʝes] *[le.jes]	‘laws’
b.	hay	[aj]	‘there is’	una	[u.na]	‘one’
c.	ayuna	[a.ʝu.na] *[a.ju.na]	‘h/she fasts’			

(6) Across the word (postlexical)

a.	ley alguna	[le.jal.ɣu.na]	‘some law’
b.	hay una	[a.ju.na]	‘there is one’

In casual speech, a sequence of two vowels within or across words surfaces as a glide + vowel or vice versa, as one of the vowels loses its mora and becomes a glide. This phenomenon, also known as vowel merger, is common to most varieties of Spanish; there is, however, variation in the target of gliding. While in Peninsular dialects it is the least sonorous vowel (regardless of position in the sequence), Sonora Spanish glides the first of the two vowels (8-9). In all varieties two identical vowels are reduced to one (7). Sonora Spanish vowel merger data are discussed now because they are pertinent to the discussion of the phonotactics of glides, and in particular of postconsonantal glides (i.e. prevocalic postconsonantal glides).

(7) Two identical vowels reduced to one

a.	lo odio	[lo.ðjo]	‘hate-1SG it/him’
b.	mi hijo	[mi.ho]	‘my son’

As mentioned above, in a sequence of two vowels, the first one loses its mora. Furthermore, if the first vowel is low it is deleted (8).

(8) Low vowel deleted when followed by #V2

a.	la iglesia	[li.ɣlesja]	‘the church’
b.	paga Evita	[pa.ɣe.βita]	‘Evita pays’
c.	casa humilde	[ka.su.milde]	‘humble home’
d.	niña orgullosa	[ni.ɲoɾ.ɣu.josa]	‘proud girl’

Cf. Peninsular: [laj.ɣlesja] [pa.ɣaẹ.βita] [ka.saw.milde] [ni.ɲaọɾ.ɣu.ʝosa]

If the first vowel is mid and the second disagrees only in height, only the high vowel surfaces. Martínez-Gil (2000, 2016) interprets this as the demorification and elevation of the mid vowel (G1 + V2), which is then deleted in contact with an identical vocoid to a high vowel.

(9) V1 is mid, V2 disagrees in height only: high vowel only

se hinca	[siŋka]	‘kneels’
como uvitas	[komuβitas]	‘like grapes-DIM.’

Cf. Peninsular: [sejŋka], [ko.mow.βitas]

In all remaining cases, when the first vowel is high and the second vowel differs from it in a feature other than height, the first vowel surfaces as a high glide (10). The same happens when the first vowel is mid (11). The second vowel is never a glide in Sonora Spanish.

(10) High V1 is a glide when followed by any vowel

mi última	[mjúl.tima]	'my last one-FEM.'
mi hebra	[mjé.βɾa]	'my thread'
mi obra	[mjó.βɾa]	'my deed'
mi árbol	[mjáɾ.βol]	'my tree'
tu hijo	[twí.ho]	'your son'
tu época	[twé.po.ka]	'your time'
su Homero	[swo.mé. ɾo]	'your Homer'
tu alma	[twál.ma]	'your soul'

Peninsular: same outputs

(11) Mid V1 is a high glide when followed by any V

me urge	[mjuɾ.he]	'it is urgent to me'
pague ocho	[pa.ɣjo.tʃo]	'that s/he pay eight'
porque aveces	[poɾ.kja.βeses]	'because sometimes'
tengo hipo	[teŋ.gwj.po]	'I have the hiccups'
como Eva	[ko.mwe.βa]	'like Eva'
lo habla	[lwa.βla]	'speaks it'

Peninsular: [meu̯ɾ.xe], [pa.ɣe̯o.tʃo], [poɾ.ke̯a.βe.θes], [teŋ.goj.po], [ko.mo̯e.βa], [lo̯a.βla].

One phonotactic generalization to be drawn from the data in (9-11) is that mid glides are not allowed in Sonora Spanish (Colina 2009), in contrast with other varieties like Peninsular Spanish that have both mid and high glides (This also suggests a preference for a complex nucleus over a complex onset). In other words, as seen in §3.5, like Peninsular Spanish, Sonora Spanish does not have true diphthongs (two syllabic vocoids in one syllable); yet, unlike Peninsular Spanish, mid vocoids can only be fully syllabic (i.e., vowels, rather than glides). Martínez-Gil (2016) argues that the motivation behind this phenomenon and behind the selection of the first vocoid as the target of demorification is that the glides are parsed as a second member of the onset and therefore must be high. While Colina does not consider the complex onset option, Martínez-Gil does not mention sonority considerations (i.e., the preference for high glides over mid ones) as a possible factor driving glide selection in the nucleus. In sum, the relevant phonotactic issue is whether the dialectal differences respond to variation in onset parsing of the high vocoid or to a preference/ban of some glides. Determining whether postconsonantal homosyllabic glides are parsed in the onset (vs. the nucleus) is important because onset parsing would suggest unreported cross-dialectal variation in the syllabic affiliation of prevocalic glides. Moreover, on a theoretical level, dialectal variation in the syllabic affiliation of prevocalic glides in Spanish (the finding that prevocalic glides can be parsed in the onset and in the nucleus, depending on the dialect) would bear out the predictions of an optimality-theoretic factorial typology in which constraint re-ranking predicts possible patterns of variation.

One piece of evidence presented by Martínez-Gil in favor of the onset parsing of glides is that glides must be in the onset because they undergo strengthening–a phenomenon that only affects this syllabic position. However, strengthening does not demonstrate that glides are in the onset, since glides never surface in the onset position in

strengthening dialects, at least lexically; furthermore, the strengthening argument is framework specific, presupposing a derivational account in which a glide is first in the onset and then becomes an obstruent. Nonetheless, this particular argument is not needed to support Martínez-Gil's position, as the (non-)acceptability of onset glides in glide strengthening dialects such as Peninsular is not necessarily relevant for Sonoran Spanish. Phonotactics can reflect dialectal variation, like other phonological components, and that glides cannot be in the onset in Peninsular Spanish (within the word) does not imply that the facts are the same for Sonoran Spanish. In fact, as mentioned above, Sonoran Spanish does allow onset glides, minimally for singletons (Canfield 1981, Alvar 1996), thus *creyendo* 'believing' is realized [kre.jen.do], with a glide instead of a fricative consonant. Although glides are parsed in the onset when no other onset is available (i.e., intervocalically), as in [kre.jen.do], that does not necessarily entail that they will be parsed in the onset, in a cluster, when there is an onset present (i.e., in postconsonantal, prevocalic position); yet, it is reasonable to hypothesize that, if glides are allowed in a single onset, they may also be well-formed as the second member of an onset cluster, as they are the most sonorous single onset permitted in this variety (just like liquids are in Peninsular and other varieties with onset strengthening).

Colina et al. (in preparation) is an example of a study that sets out to test the above hypothesis empirically. The authors designed two sets of stimuli (1-2) according to two (sub)hypotheses. The first relies on a well-known restriction on the Spanish rhyme, namely that Spanish only allows a maximum of three rhyme segments (Harris 1983). Thus, if a sequence of CGVGC (Consonant + Glide + Vowel +Glide + Consonant) is allowed (e.g., nonce word *la.ca.puais.to*) the postconsonantal glide should be in the onset, because otherwise the rhyme would contain four segments and would be illicit. Stimuli in this group consisted of four-syllable nonce words that contained a postconsonantal high vocoid followed by a triphthong (i.e., a four-segment rhyme or complex onset + three segment rhyme). Four syllable words were created to avoid a glide + vowel sequence too close to the beginning or end of the word, positions known to favor hiatuses in some dialects (Hualde 1999, 2005). The second set of stimuli was designed around the (sub)hypothesis that, if the glide is in the onset, there should be onset co-occurrence restrictions, namely, only some combinations of consonant + glide should be possible as complex clusters. For instance, a palatal consonant + homorganic glide [j] (e.g., **ch*[j]*llaba)* should be disallowed because their articulations are too similar. For the second set of stimuli, subjects were also given a grammaticality judgment task. Oral data were collected from 10 speakers of Sonoran Mexican Spanish (with limited English proficiency) using two tasks: an oral recorded phrase reading (e.g. "Digo ___ porque sí") and an oral syllable division task. Stimuli in both tasks consisted of 23 nonce words (alongside 23 fillers) containing the relevant stimuli. Oral production data were analyzed by two judges first impressionistically and then acoustically according to duration and F1/F2 values. Preliminary results suggest that... (include results as soon as they become available, around September)

Empirical evidence in support of the theoretical proposal that glides in Chicano Spanish are parsed as the second member of a complex onset (as well as a single onset) would suggest the need for more studies on cross-dialectal variation in phonotactics, as having accurate dialectal data has implications for research on monolingual and bilingual acquisition and on acquisition errors (e.g., language learning, speech pathology, etc.), and

would advise caution about drawing generalizations based on phonological descriptions that could be inaccurate or inapplicable to all varieties and speakers. It is important to also consider the possibility that phonotactic variation can also exist depending on other syllabic conditions (cf., Colina & Simonet 2014, for Galician).

Galician is a language that does not have coda clusters, but that allows 'ns' in the plural /mans/; Colina & Simonet (2014) argue that there is no epenthesis *[manes] because the nasal is a velar glide that can be parsed in the nucleus, rather than in its normal coda position when required by higher ranking constraints.

5. Conclusions

This paper has presented a review of phonotactic constraints on Spanish syllable structure. The presentation was divided in two major types of constraints: first those that driven by sonority, a factor that plays an important role in determining the sequencing of segments in and within syllabic constituents; and then those that refer to specific segments and their featural make-up, often reflecting the affinity or lack of it between a specific feature and a syllabic position. The discussion on the phonotactics of segments and features focused on the phonotactics of the onset, nucleus and codas, both simple and complex explaining that some phonological processes in Spanish (e.g. nasal assimilation, obstruent coda neutralization) are ultimately a consequence of segmental and featural phonotactics. In addition, this paper summarizes recent work pertinent to dialectal variation in phonotactics, in connection with complex onsets in some varieties of Chilean Spanish and prevocalic postconsonantal glides in Sonoran Mexican Spanish. Arguments and preliminary experimental results are introduced regarding the proposal that glides could be part of a complex onset in this variety (instead of the nucleus, as it is in most varieties of Spanish).

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Word Count: 7165

Key Words: phonotactics, syllabification, syllable, sonority, dialectal variation, Chilean Spanish, Sonoran Spanish, complex onsets, vowel merger, palatal obstruents, glides

Bionote:
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