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On onset clusters in Spanish: voiced obstruent underspecification and /f/

Abstract: Onset clusters in Spanish consist of an obstruent or /f/ plus a liquid, with the exception of /tl/ and /dl/ which are ill formed in some dialects (*tl) and or in all (*dl). While this descriptive generalization is uncontroversial, the phonological account of onset clusters has been a topic of debate amongst phonologists for decades now. Most agree that the main factor driving the onset generalization and the well-formedness of the cluster is sonority; yet, it is not entirely clear why /f/ is the only fricative grouped with the obstruents. This paper contributes to our understanding of onset clusters by: (i) presenting additional evidence regarding the sonority of /f/, in support of the proposal in Martínez-Gil (2001); (ii) introducing refinements to the onset cluster generalization/condition (OC) (Martínez-Gil 2001; Colina 2009), most importantly with regard to point of application. The current proposal rests on input and output underspecification of voiced obstruents.

0 Introduction

Onset clusters in Spanish consist of an obstruent or /f/ plus a liquid, e.g., *blanco* 'white', *egresar* 'to graduate', *sufrir* 'to suffer', with the exception of /tl/ and /dl/ which are ill formed in some dialects (*tl) and/or in all (*dl). While this descriptive generalization is uncontroversial, the phonological account of onset clusters has been a topic of debate amongst Spanish phonologists for several decades now (Harris 1983, Harris 1989a, 1989b, Martínez-Gil 1997, Martínez-Gil 2001, Colina 2009a). Most analyses agree that the main factor driving the onset generalization and the well-formedness of the cluster is sonority. Yet, it is not entirely clear why /f/ is the only fricative grouped with the obstruents. Onset clusters cannot be fully understood without an account of the behavior of /f/ in this syllabic position. This paper contributes to our phonological understanding of onset clusters in Spanish by: (i) presenting additional independent evidence regarding the sonority of /f/ and of voiced stops in Spanish, supporting the proposal in Martínez-Gil (2001); (ii) highlighting the implications of this account for the rest of the phonology, specifically with regard to phonemic inventory and

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underspecification and voiced obstruent alternations (iii) introducing refinements to the onset cluster generalization/condition (OC) (Martínez-Gil 2001; Colina 2009a), most importantly with regard to the point at which the generalization applies. The proposal put forth here – which argues that voiced stops are underspecified in the input and output of the phonology – also contributes to the phonological literature on the topic of output (perseverant) underspecification.

The paper is organized as follows: the data is presented in section 1; section 2 focuses on existing attempts to account for onset cluster generalizations, including a review of the literature in Spanish and the problems to be addressed in this paper; in section 3 the account that voiced obstruents are underspecified is developed, including the data and literature on voiced obstruent alternation (3.1), the evidence, and the formal analysis (3.2). Finally, section 4 introduces the matter of the point of application of the complex cluster generalization, and how the current proposal addresses it, including some relevant Chilean data. Section 5 presents an overview of the paper and some conclusions.

1 Onset clusters in Spanish: the data

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, ɾ/ as the second (1). The generalization applies in word-initial position as well as word-medially.

(1)

blanco	'white'	*platicar*	'to talk'
emblema	'emblem'	*aplaudir*	'to applaud'
broma	'joke'	*presión*	'pressure'
abrir	'to open'	*apretar*	'to squeeze'
dragón	'dragon'	*tracción*	'traction'
adrenalina	'adrenaline'	*atracar*	'to hold up'
glotón	'glutton'	*clavo*	'nail'
inglés	'English'	*aclarar*	'clarify'
granada	'granade'	*cresta*	'crest'
egresar	'to graduate'	*increpar*	'to reprimand'
fluido	'fluid'	*frente*	'front'
afligir	'to afflict'	*sufrir*	'to suffer'

Exceptions to the generalization include the coronals /t, d/. /dl/ is always ill formed and /tl/ is acceptable only in some varieties, mostly under the influence

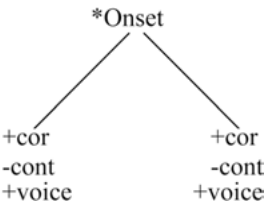
of languages that have this sequence, like Nahuatl (2b).[1] In those Spanish varieties in which /tl/ is not a well-formed cluster, the obstruent is syllabified in the coda and the liquid in the following onset, as seen in (2a).

(2) Syllabification of the cluster -tl-

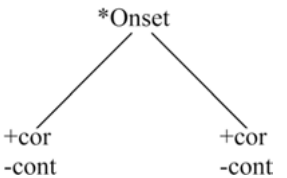
a. *Heterosyllabic*	b. *Onset cluster*	
at.las	a.tlas	'atlas'
at.lético	a.tlético	'athletic'
At.lántico	A.tlántico	'Atlantic'

Harris (1983:33) attributes these facts to co-occurrence restrictions on two adjacent coronals, and on voice in the case of /dl/. Accordingly, he proposes the filter in (3a), which states that a consonant cluster consisting of two non-continuant, coronal consonants that also agree in voice is not permissible. 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 (3b).

(3) a.



b.



Restrictions on /tl/ and /dl/ in onset clusters are not specific to Spanish and 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). The explanation is that the articulatory gestures of the liquid can obscure stop formant transitions if they overlap with the stop (formant transitions, along with stop burst, are crucial cues for stop place). Additional support for this view comes from Blevins and Grawunder (2009) who point to historical changes in Germanic and other languages involving *kl > tl and vice versa that are motivated by the difficulty involved in the perception of the contrast.

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

2 Accounting for Spanish onset clusters

In order to offer an account of Spanish onset clusters and to formulate a generalization that goes beyond description (cf. section 1), the concept of sonority must be introduced. Existing analyses of Spanish onset clusters attribute the main factor driving the well-formedness of the clusters to sonority.

2.1 Onset clusters and sonority

Sonority has no straightforward phonetic definition. It has been traditionally associated with perceptual salience in terms of acoustics and with degree of stricture in articulatory terms. However, recent phonetic studies indicate that intensity (i.e., loudness) is probably the most robust correlate of sonority in measurable phonetic terms (Parker 2008, 2012; Henke, Kaisse and Wright 2012), although it is unlikely to be the only one.[2]

In phonological terms, sonority can be considered "a unique type of relative, n-ary (non-binary) feature-like phonological element that potentially categorizes all speech sounds into a hierarchical scale (Parker 2011: 1160)." Sonority is often defined in terms of its effect on syllable phonotactics. Syllables exhibit a contour according to which the syllable rises in sonority towards the nucleus (the most sonorous point) and decreases towards the coda (Sonority Sequencing Principle, SSP, Clements 1990). In addition, the rise is maximal in the onset and minimal in the coda, according to the Sonority Cycle (Clements 1990). Since sonority is a universal but relative and gradient concept, segments are ranked according to sonority in a universal scale, such as (4).

(4) Obstruents < Nasals < Liquids < Glides < Vowels

The scale is universal with regard to the relative degree of sonority of the classes, so that an obstruent will always be less sonorous than a nasal and a nasal in turn will always be less sonorous that a vowel. Languages differ, however, in the number of sonority classes needed.

2 An argument in favor of the position that intensity may not be the only correlate of sonority lies in the fact that, although [f] and [θ] are similar in terms of center of gravity (distribution of intensity), [f] has higher intensity peaks than [θ]. This would mean that [f] is more sonorous than [θ], a statement that is not supported by phonotactics data. I thank an anonymous reviewer for pointing out the intensity facts.

While most (if not all) of the literature on Spanish onset clusters is sonority-based, it must be acknowledged that the notion of sonority and its role in syllable phonotactics is a somewhat controversial issue in phonological theory today (cf. for instance, the topic of a recent book, *The sonority controversy*, Parker (2012)). Not all researchers agree that syllable phonotactics are entirely ascribable to sonority. Some argue that a perception-based account captures phonotactic generalizations, including those pertinent to onset clusters, more adequately than sonority by offering wider empirical coverage (Wright, 2004; Henke, Kaisse and Wright 2012; among others); thus they propose replacing sonority scales with scales of auditory cue robustness, according to which the cross-linguistic phonotactic patterns observed in onset clusters respond to the maximization of perceptually recoverable strings. Take, for instance, /s/ + stop clusters. Despite violating sonority requirements (because of flat or decreasing sonority, depending on the scale in use), /s/ + stop clusters are a frequent sequence in the world's languages; they are in fact the most attested pattern in some surveys (Morelli 1999, 2003). Proponents of a perception-based account of onset phonotactics contend that a sonority-based account cannot explain this fact; in contrast, a perception-based one highlights the strong internal perceptual cues of the sibilant as the reason for the typological frequency of this cluster. It is likely that sonority alone cannot account for onset phonotactics for all languages, in particular for those that allow highly complex onset combinations. Yet, Spanish, which exhibits a rather unmarked type of onset cluster (O(bstruent)L(iquid), cf. the typology in Parker 2012), is a good example of a language in which onset clusters are mainly, if not entirely, driven by sonority, as demonstrated by the existing literature.

Returning to the sonority scale, for Spanish, Harris (1989a, b) (also Hualde 2005: 72) proposes the one in (4) in which obstruents are less sonorous than nasals and nasals in turn are less sonorous than liquids. (The scale is shown again in (5), listing the Spanish phonemes in each category). Harris formulates the onset generalization as a condition that requires that the onset contain two consonants that are not adjacent in the sonority scale.

(5) Harris's Sonority scale for Spanish (1983)

Obstruents	Nasals	Liquids	Glides	Vowels
p, b, t, d, k, g, f, θ, s, h, x, tʃ, dʒ	m, n, ɲ	l, r, ɾ	j, w	a, e, i, o, u

Thus, it is not possible to have the sequences obstruent + nasal or nasal + liquid; in sum, obstruent + liquid is in principle an acceptable cluster. Since the only non-stop obstruent allowed as the first member of the cluster is /f/, it is necessary to eliminate /θ, s, h, x, ʧ, ʤ/. Harris resorts to point of articulation restrictions to accomplish this, positing a filter that bans two adjacent [+alveolar] consonants.

Although it seems fairly intuitive to group stops, fricatives and affricates in one sonority class and then try to rule out the fricatives, except for /f/, and the affricates, as Harris does, Martínez-Gil (2001) shows that this approach is fraught with difficulties. Among them he lists the use of feature [alveolar], unnecessary for Spanish and not commonly used for other languages, and the inability to rule out some impermissible clusters, such as affricate + liquid, interdental + liquid and /x/ + liquid (Martínez-Gil 2001: 213–215). Martínez-Gil (2001) argues that a more elegant and insightful analysis can be obtained by grouping only the stops and /f/ in the class of the lowest sonority. He proposes the scale in (6) (Martínez-Gil 1996, 1997, 2001; Colina 2009a).

(6) Sonority scale for Spanish (Martínez-Gil 2001: 217)

Obstruents		Sonorants	
p, b, t, d, k, g, f	θ, s, h, x, ʧ, ʤ	m, n, ɲ, ʎ, r	l, ɾ
1	2	3	4

He also argues that sonority classes are driven by manner of articulation, rather than point of articulation. According to this, the relevant onset cluster generalization is that an onset cluster in Spanish consists of two consonants that differ maximally in sonority rank (7): the first member is drawn from the group of the least sonorous consonants permissible in the onset (voiced and voiceless stops) and the second member from the most sonorous ones (liquids), i.e., from groups 1 and 4 respectively in (6).

(7) Complex Onset Condition (Martínez-Gil 2001: 219)
A complex onset in Spanish is limited to two consonants that differ maximally in sonority rank.

Given the scale in (6) and the Complex Onset Condition in (7), it is clear that Spanish does not allow /s/ + stop clusters, as some languages do, because of the sonority reversal that they entail (i.e., they do not satisfy the Complex Onset Condition). Placing Spanish in a broader cross-linguistic context, one may also

wonder why a glide is not permissible as the second consonant in the cluster, as CG is also an unmarked cluster type. Spanish normally parses prevocalic glides in the nucleus, indicating a preference for a complex nucleus over a complex CG onset (Colina 2009a: 21; Hualde 2014: 199–200, Kaisse this volume). This analysis is further supported by the inability of glides to serve as singleton onsets: when a prevocalic glide is not preceded by a consonant that can serve as an onset, it undergoes fortition, surfacing as an obstruent, *hielo* /ielo/ [ǰélo] 'ice', *com-iendo* [ko.mjén.do] 'eating', *cre-iendo* [kre.ǰén.do] 'believing'; sometimes it also exhibits obstruent insertion, *hueso* [weso] [gweso] 'bone' (cf. however, Martínez-Gil this volume, for a proposal in which prevocalic, postconsonantal glides are in the onset).

This set of facts poses a question regarding the behavior of /f/, as it is not clear why it should belong to the group of the least sonorous consonants or why it should be the only fricative possible. Generally, languages with fricatives as C1 accept more fricatives than just /f/. In accordance with the general unmarked nature of its onset clusters, Spanish appears to belong to the group of languages that do not allow fricatives as C1 in a cluster, in opposition to languages that have restrictions on some fricatives but allow others, such as English. Thus the question remains as to why is /f/ allowed in Spanish onset clusters.

2.2 /f/ and onset clusters

As mentioned above, at first, it is not apparent why /f/ is the only Spanish fricative that clusters with the stops as a permissible first member of the onset, since they do not belong to the same natural class. They do not seem to belong to the same general sonority class either.

Martínez-Gil (2001) argues that /f/ is grouped with the voiceless stops and voiced stops because, like them, it does not have [+continuant] in its representation. In other words, 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]) (voiceless stops) or because they have no specification at all (voiced stops and /f/). In his analysis, [+continuant] is the feature that contributes to sonority among consonants. Therefore, segments specified as [+continuant] will be more sonorous than those without this feature. This is in accordance with the view that phonologically, sonority is related to degree of stricture (i.e., [continuant]) (Clements 1990) and intensity (Henke, Kaisse and Wright 2012).

It is uncontroversial that voiceless stops are [-continuant]. In Martínez-Gil's account, /f/ is not specified for continuancy because [+continuant] is redundant

cross-linguistically for labiodentals, as "no language has labiodental stops… except as allophones" (Ladefoged 1992: 158). Voiced stops are said to be underspecified for continuancy, in agreement with previous analyses and for similar reasons (Lozano 1979; Mascaró 1984; Hualde 1989; and others). This paper presents additional evidence for Martínez-Gil's proposal that the stops and /f/ are well-formed as the first member of an onset cluster in Spanish because they are unspecified for continuancy in the phonology; in other words, they are the least sonorous group of consonants and they belong to the same sonority class, because they do not possess the feature [+continuant] (i.e., they lack [continuant] entirely or are [-continuant]). In addition, while the voiced approximants and /f/ are [+continuant] in the phonetic output, they do not contain this feature in the phonology; this makes them less sonorous than other approximants or fricatives that are phonologically [+continuant].

The current proposal also shares Martínez-Gil's (2001) view that sonority is a basic, indivisible unit in phonology (rather than a derived concept). Whatever features /f/, the voiceless stops and voiced obstruents share, they cannot result from a combination of features because the absence of continuant specification (i.e., [-continuant], no specification for [continuant]) is not the same as [-continuant] and cannot be obtained from the combination of binary features. Thus, although sonority classes and sonority scales rely on features and are based on feature-like elements, they do not coincide exactly with feature classes. Sonority is not a combination of features, but a primitive of phonology; that is, it is a construct that does not result from the addition of other constructs and that cannot be divided up into independent units nor reduced to a list of features.

The analysis of voiced stops in Spanish proposed in section 3 offers independent evidence for the proposal that the voiced obstruents and /f/ lack a [+continuant] specification and expands on the account of onset clusters by showing its implications for the rest of the phonology (e.g., the phonemic inventory of Spanish) (in section 3) and for other dialectal varieties of Spanish, such as Chilean Spanish (in section 4). Section 4 also deals with the point of application issue, a very relevant matter for non-derivational models of phonology like OT.

3 Voiced stops and onset clusters

Based on a recent account of the voiced obstruent alternation (Colina 2013), I present additional evidence for the proposal that voiceless stops, voiced obstruents

and /f/ lack a [+continuant] feature and that the absence of this feature makes them better onset segments than those obstruents specified as [+continuant]; in particular, I propose that the underspecification of voiced obstruents [B, D, G] persists through the output of the phonology (i.e., output underspecification, Hale & Kissock 2007, originally from Keating 1988). I show that the analysis of onset clusters in Spanish is crucially dependent on that of the voiced obstruent alternation and this account needs to be considered in any analysis of these clusters in Spanish. In addition to explaining why /f/ clusters with the stops, the analysis of voiced obstruents presented here helps us understand why the Complex Onset Condition appears to be rampantly violated by the approximant allophones of the voiced obstruents, addressing questions regarding the point of application of the complex onset generalization. It is shown that a comprehensive account of onset clusters must also explain the interactions of these segments with other aspects of the phonology of a language, such as phonemic distinctions, featural specifications and relevant phonological phenomena.

3.1 Existing analyses of voiced obstruents

Spanish voiced plosives have traditionally been described as having a continuant and a non-continuant realization. In the general varieties that are the object of this study,[3] the relevant generalization is that [-continuant] allophones appear after homorganic nasals and laterals, and in word-initial pre-pausal position (8), and [+continuant] allophones elsewhere (9)[4]. The process is affected by much stylistic and dialectal variation (cf. Soler & Romero 1999; and Kirchner 2004 for variation influenced by speech rate; for dialectal variation with experimental evidence see Carrasco, Hualde & Simonet 2012).

(8) bomba [bómba] ‘bomb’
donde [dóⁿde] ‘where’
tango [taŋgo] ‘tango’
toldo [tóˡdo] ‘awning’

3 By ‘general’ varieties I refer to those commonly presented in textbook descriptions of Spanish pronunciation. Some varieties of Spanish, which are not the focus of this study, have stops in more contexts than those presented here.

4 These facts are also supported by recent experimental evidence (Hualde, Simonet, Shosted & Nadeu 2010).

(9)

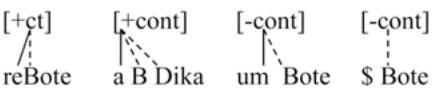
haba	[áβa]	'bean'
nada	[náða]	'nothing'
hago	[áɣo]	'I do'
árbol	[árβol]	'tree'
algo	[álɣo]	'something'
calvo	[kálβo]	'bald'

Existing accounts propose a variety of solutions with regard to the feature that changes, the form of the underlying representation, and the directionality of the change.

Harris (1984) argues that the underlying representation contains [-continuant] because cross-linguistically, this is the unmarked value for the voiced obstruents. Subsequently, in the postlexical level a Continuancy Spreading Rule spreads [+continuant] from a preceding [+continuant] segment to the voiced obstruent. In other words, the rule changes [-continuant] to [+continuant] when preceded by a [+continuant] segment. In Harris' analysis, a condition on autosegmental representations, which requires that when two segments share association lines (e.g., the point of articulation in homorganic segments) both segments must comply with the structural description of the rule, serves to explain the behavior of /ld/, which does not become [+continuant]. /l/ does not meet the conditions of the rule because it is not a voiced obstruent and therefore /d/, the segment with which it shares PA, cannot be the target for [+continuant] spreading. In accordance with this, /lb/ and /lg/ are realized as [+continuant] because they do not share nodes (they are not homorganic). Harris argues that /l/ is [+continuant].

Mascaró (1984) proposes the spreading of the feature [+/-continuant] (i.e., α continuant) to a voiced obstruent that follows it and that is underspecified for continuancy. A separate rule inserts [-continuant] after a pause (Examples in 10 from Hualde 1989).

(10)



In another influential proposal, Hualde (1989) also takes as his point of departure an unspecified voiced obstruent. He proposes a rule that spreads the feature [-continuant] in a homorganic group to the right onto a voiced obstruent. Subsequently, an additional rule inserts [-continuant] in a feature matrix that contains [+voice] and [-sonorant] after a pause; finally, a default feature insertion rule

adds [+continuant] to all voiced obstruents with no specification after the application of the other rules.

Within an Optimality-Theoretic framework, Baković (1997) argues for fortition of underlying approximants. In this approach ordered rules are replaced with hierarchically ranked universal constraints. The driving force behind fortition is a constraint, STRONG ONSET, that requires a [-continuant] or oral closure in strong positions (at the beginning of a breath group, and in a homorganic cluster).

In summary, in addition to the obvious differences in theoretical framework (serial or parallel), existing analyses of voiced obstruent alternation in Spanish differ with regard to directionality, the feature that spreads (for autosegmental accounts), and the form of the underlying representation:

(i) directionality of the process: fortition (Hammond 1976; Baković 1997; Lozano 1979) or lenition (Harris 1969, 1984). Fortition analyses argue that a [+continuant] allophone becomes [-continuant] in strong, prominent positions, such as after a pause or after a homorganic nasal or lateral; in lenition analyses [+continuant] spreads from the preceding segment onto a [-continuant] one, thus resulting in a lenited allophone.

(ii) the feature that spreads: [αcontinuant] (Mascaró 1984); [-continuant] in homorganic clusters (Hualde 1989); [+continuant] (Harris 1984).

(iii) the nature of the underlying representation: [-continuant] (Harris 1969)[5], [+continuant] (Hammond, 1976, Baković 1997); underspecified (Lozano 1979; Mascaró 1984; Hualde 1989; Kirchner 1998[6]). Proponents of the underspecification account, the most numerous and most recent accounts, justify an underspecified input because of the lack of solid evidence for any of the specified forms.

3.2 Voiced stops are underspecified for [continuant]

As mentioned above, I argue that Spanish voiced obstruents are underspecified for continuancy and that this underspecification persists through the output of the phonology (i.e., output underspecification, Hale and Kissock 2007, originally

5 As mentioned by an anonymous reviewer, Piñeros (2003) also proposes [-continuant] in the underlying representation. However, his proposal is for Palenquero (a creole of Spanish and African descent spoken in Colombia), rather than for the standard phonologies that are the focus of the current analysis. Furthermore, the Palenquero data are much more complex (including gemination, prenasalization, etc.), deserving separate treatment.

6 Kirchner (1998) in fact proposes an indeterminate input (rather than truly underspecified), as the choice of underlying representations turns out to be much less crucial to his analysis.

from Keating 1988). Due to the absence of [+continuant] in their phonological representation, voiced stops are acceptable as the first member of the cluster in onset clusters. As a result, the onset condition is operational throughout the phonology and no constraint violations are incurred for the dialects with voiced approximants in the onset.

In what follows, I first present the evidence in favor of the output underspecification of voiced obstruents and then introduce a formal analysis within an Optimality-Theoretic framework. The formal analysis is preceded by some background discussion on underspecification in Optimality Theory (OT).

3.2.1 Evidence for underspecification: voiceless fricatives and variation

The first piece of evidence has to do with the behavior of onset fricatives in homorganic clusters. Unlike voiced obstruents, voiceless fricatives in homorganic clusters do not become [-continuant]. Instead they retain their [+cont] specification, rather than agreeing in continuancy with the preceding nasals, as voiced obstruents do. In other words, there is no alternation in [continuant] for voiceless fricatives in the onset, as seen in (11a).

(11) Voiceless fricatives show no alternation in [continuant]

a. voiceless

un gitano	[uŋ.**x**i.tá.no]	'a gypsy-masc.'
una gitana	[u.na.**x**i.tá.na]	'a gypsy-fem.'
un salón	[un.**s**a.lón]	'a big room'
una sala	[u.na.**s**á.la]	'a room'

b. voiced

un gato	[uŋ.gá.to]	'a cat-masc.'
una gata	[u.na.ɣá.ta]	'a cat-fem.'
un dicho	[un̪.dí.tʃo]	'a saying'
una dicha	[u.na.ðí.tʃa]	'a joy'
un bobo	[um.bó.βo]	'a silly one-masc.'
una boba	[u.na.βó.βa]	'a silly one-fem.

I argue that voiceless fricatives (with the exception of /f/) do not become stops because they are underlyingly specified as [+continuant] and this input specification must be retained. In contrast, voiced obstruents are underspecified, so there is no feature to preserve. A consequence of this is that obstruents in Spanish show a three-way contrast in continuancy: [+continuant] (voiceless

fricatives, except for /f/), [-continuant] (voiceless stops) and underspecified [continuant] (voiced obstruents and /f/).

In an Optimality-Theoretic analysis the correct output is the result of the high ranking of a constraint that requires preservation of the input specification for [continuant] over one that requires assimilation in this feature to the preceding segment, as seen in (12).

(12) Constraints and constraint ranking for N + voiceless fricative

ID-[cont]: the output matches the input with respect to [cont] (McCarthy & Prince 1995)

ID-[voi]: the output matches the input with respect to [voi] (McCarthy & Prince 1995)

NC[cont]: a nasal/lateral agrees in [cont] with the following homorganic obstruent. (cf. feature geometry in Padgett 1994) (Patter 1999, 2001; Martínez-Gil 2004)

ID-[cont] >> NC[cont], ID-[voi]

(13) Post-nasal voiceless fricatives

/manso/ [manso] 'tame'	ID-[cont]	NC[cont]	ID-[voi]
a. ☞ manso		*	
b. manzo		*	*!
c. manto	*!		
d. mando	*!		*

As seen in (13), the voiceless fricative /s/ does not become a stop (13c–13d) because that would entail a change in its continuancy specification and therefore a violation of the top-ranked constraint, ID-[cont]. (13c) and (13d) are therefore ruled out. (13d) is worse than (13c) because it also changes the voice specification of the input, violating ID-[voi]. The two candidates that preserve [+continuant] and do not incur violations of ID-[cont], (13a) and (13b), violate NC[cont], as they are not [-continuant] like the preceding nasal. However, since they are better than (13c) and (13d), NC[cont] must be lower than ID-[cont]. (13a) is the winner because, unlike (13b), it does not violate ID-[voi].

/f/ behaves differently from the rest of the voiceless fricatives. Since, unlike the other fricatives, /f/ is underspecified for continuancy, the analysis incorrectly

predicts a labiodental voiceless stop in the output ([p̪]), due to the high of ranking of NC[cont], as seen in (14).

(14) Post-nasal voiceless fricatives

/enFermo/ [emɟfermo] 'sick'	ID-[cont]	NC[cont]	ID-[voi]
a. emɟfermo		*!	
b. emɟvermo		*!	*
c. ☹ emp̪ermo			

Given that (14c) is not the correct output, a higher ranked constraint must be responsible for its elimination. Labiodental stops are extremely marked, due to the difficulties involved in forming a complete occlusion between the upper front teeth and the lower lip. Therefore, it is reasonable to propose that an undominated constraint against labiodental stops rules out candidate (14c) in favor of (14a).[7] I will return to NC[cont] and the requirement that nasals agree in continuancy with a following obstruent below.

The second important piece of evidence in favor of underspecification rests on phonetic variation. Phonetic studies report 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); furthermore, some studies have also shown that in some dialects, like Madrid Spanish, the distinction between the continuant and the non-continuant allophones is gradient rather than bimodal (Carrasco, Hualde & Simonet 2012). Gradient variation can be easily explained if voiced obstruents are underspecified in the input and also (as explained in the next section) at the output of the phonology (i.e, output underspecification), as this means that they would be realized variably according to the surrounding segments, in the phonetic component. In other words, this is a targetless output that realizes its constriction variably and in a gradient manner depending on the adjacent segments. Due to its underspecification for continuancy, /f/ should also exhibit gradient variation; however, contrary to expectations, Spanish voiceless labiodental obstruents always surface as fricatives. As above, this can also be explained by phonetically motivated articu-

7 The constraint against labiodental stops would dominate the constraint against featural insertion, as the winning [+continuant] [f] must acquire output specification through insertion (a violation of the relevant DEP constraint).

latory constraints, as labiodental approximants are rare, in particular those without voicing.

In sum, phonetic variation and the gradient nature of the phenomenon serve as evidence in favor of a specific type of underspecification, output underspecification. As will be shown with regard to the formal analysis in 3.2.2, output underspecification is an additional piece of evidence in support of input underspecification.

3.2.2 OT analysis of voiced obstruents in Spanish

As mentioned above, this proposal argues that voiced obstruents in Spanish are underspecified for continuancy (i.e., input underspecification) and that underspecification persists into the output of the phonological component. In other words, the analysis proposes both input and output (i.e., phonetic) underspecification. Consequently, before introducing the analysis, a brief discussion of these concepts within OT becomes pertinent.

Underspecified inputs have been objected to by some scholars (e.g., for Galician, Martínez-Gil 2004) on the grounds that underspecification places a restriction on the form of the underlying representation. According to the *Richness of the Base (ROTB)*, a basic principle of OT, no restrictions are possible regarding the form of the input. However, an underspecified form /B, D, G/ places no more restrictions on the input than a fully specified one, e.g., /b, d, g/, as it is just one of many possible inputs. In fact, since ROTB requires that no restrictions be placed on the form of the input, an underspecified input cannot be excluded from consideration. Doing so would be contrary to the ROTB. Additionally, whether the actual input is the underspecified one /B, D, G/, or another one, cannot be determined a priori, it can only be determined through the constraints and constraint ranking that select the form which is most harmonious with the output. In other words, whether the input is fully specified must be decided on the basis of the analysis and the constraints. As will be argued in this section, for Spanish /b, d, g/ the constraints and the constraint ranking provide evidence for an underspecified input.

Along similar lines, Inkelas shows that OT allows for what has been called principled underspecification: underlying forms, including underspecified forms, are determined by the learner through the principle of Lexicon Optimization (LO) and not by any constraints holding directly on underlying forms (Inkelas 1995: 289). She offers the alternation-sensitive definition of LO in (15):

(15) Lexicon Optimization (Inkelas 1995: 289)
Given a set S = {S_1, S_2, S_3} of surface phonetic forms for a morpheme M, suppose that there is a set of inputs I = {I_1, I_2, I_3}, each of whose members has a set of surface representations equivalent to S. There is some $I_i \in I$ such that the mapping between I_i and the members of S is the most harmonic, i.e., incurring the fewest marks in the grammar for the highest ranked constraints. The learner should choose that I_i as the underlying representation for M.

Using LO and thus placing the learner in a central position in her proposal, Inkelas demonstrates that the grammar (i.e., the constraints and the constraint ranking) sometimes selects the underspecified input, sometimes a fully specified one. The underspecified input is selected as the input among various possibilities when the mapping between that underspecified input and the output is the most harmonious in comparison with the mapping for other inputs. Or as Kager puts it (1999: 33), "whenever the learner has no evidence (from surface forms) to postulate a specific diverging lexical form, (s)he will assume that the input is identical to the surface form." In the case of Spanish voiced obstruents, this paper argues that the learner has no conclusive evidence to select one specified input over the other ([+continuant] over [-continuant] or vice versa) and that therefore the input remains underspecified (i.e., undetermined) for continuancy. Also, it is shown that the underspecified input is preferred over fully specified ones because it is the one that incurs the least number of violations of Id-[cont] and therefore it is the most harmonious with respect to the output.

In addition to Inkelas (1995), various other authors have shown the need for input underspecification in OT (Harrison and Kaun 2001; Inkelas 2006; Inkelas, Orgun and Zoll 1997; Itô, Mester and Padgett 1995). Harrison and Kaun (2001) argue that OT allows for principled underspecification and that it "... leaves room for the possibility that partially underspecified lexical entries will on occasion be posited (Harrison and Kaun 2001: 212)." In sum, underspecification does not go against Richness of the Base, as long as underspecified forms are determined by the learner through LO and not by any constraints holding directly on underlying forms (Inkelas 1995: 289).

Colina (2013), in an analysis of Galician geada, contends that Galician obstruent alternation is similar to that of Spanish and that it requires an underspecified input, as the grammar (the set of independently established constraints and constraint ranking) selects the correct output only when it is in correspondence with an underspecified input. Other languages and processes in which an underspecified input is selected include Yoruba ATR harmony, Walpiri vowel harmony and Turkish vowel-glide alternations (Inkelas 1995).

Also within the OT framework, Hale and Kissock (2007) argue for a different type of underspecification that they call perseverant underspecification. This is underspecification that persists from underlying representation through phonetic representation. It results in forms that are never fully specified featurally and that are realized variably according to the surrounding segments, i.e., in the phonetic component. It is also known as phonetic or output underspecification and was originally proposed by Keating (1988), who convincingly argues that the velar fricative in Russian /ixa/ is underspecified for the feature [back] because it shows the continuous, transitional features characteristic of sounds which are dependent in their articulation upon their adjacent sounds. Output underspecification accounts for phenomena that are highly variable and gradient in nature. As mentioned above, I contend that it also explains the great degree of phonetic variation in aperture in continuant allophones, generally dependent on the adjacent sounds (cf. Bradley and Delforge 2006a, Bradley and Delforge 2006b, Bradley 2007, Colina 2009b for output underspecification in various dialects of Spanish; cf., however, Colina 2013, for a phenomenon that requires input underspecification, but does not appear to involve phonetic underspecification).

Before continuing with the analysis, it must noted that the output underspecification analysis of Spanish voiced obstruents proposed relates to a controversial issue in the phonetics/phonology interface, namely how gradual phonetic phenomena should be accounted for by formal phonology. Accounts range from those that incorporate formal mechanisms such as phonetically-grounded constraints, input-output relations (cf. van Oostendorp 2008) and/or underspecification (this paper), to those that argue against formalist views of phonology (Port & Leary 2005). While the matter is still under debate, it is clear that most relevant phenomena evince the presence of a phonological component, often through underlying distinctions (cf. voicing in Catalan and Dutch, van Oostendorp 2005: 1364). In the current proposal, as shown below, a three-way contrast in continuancy [+] [–] and [ ] accounts for the alternations and phonological behavior observed in voiced obstruents (vs. voiceless stops and fricatives), thus demonstrating that, despite the important role played by the phonetics, the process is also phonological.

Moving on to the OT analysis, it is now necessary to add two faithfulness constraints, DEP-[cont] and MAX-[cont], that contemplate the presence or absence (i.e., insertion or deletion) of a [continuant] feature in the output with respect to the input to the constraints and constraint ranking established in (12).

(16) Voiced obstruents: Constraints and constraint ranking (McCarthy & Prince 1995)

ID-[cont]: the output matches the input with respect to [cont]

ID-[voi]: the output matches the input with respect to [voi]

DEP-[cont]: the feature [cont] present in the output must have a correspondent in the input.

MAX-[cont]: the feature [cont] present in the input must have a correspondent in the output.

ID-[cont] >> ID-[voi] >> DEP-[cont] >> MAX-[cont]

Considering the output as the point of departure now, as is customary in OT, it becomes clear that the most harmonious input for an underspecified output must be also the underspecified input, because any other input would either violate a faithfulness constraint, as shown in (17), or it would result in the selection of the wrong output, as seen with fully specified inputs (18–19).

In (17) the optimal candidate, underspecified [aBlo] (17a), does not incur any constraint violations. Candidates specified for continuancy, (17b–d), with default value insertion) violate the constraint against the insertion of this feature (be it + or –); (17d), [aplo], also incurs a violation of ID-[voi] since there is a change in the voicing specification.

(17) The underspecified input is the most harmonious input

/aBlo/ [aBlo]	ID-[cont]	ID-[voi]	DEP-[cont]	MAX-[cont]
a. ☞ aBlo				
b. aβlo			*!	
c. ablo			*!	
d. aplo		*!	*	

In (18) and (19) the outputs that are identical to the input, one with a voiced stop in (18c) and one with a voiced approximant in (19b), are mistakenly selected as the winners because they do not incur any constraint violations. It could be argued that a candidate like (19b) would be the winner if the output was [aβlo]; however, the output cannot be [aβlo] as it does not match the phonetic evidence, which indicates that the output has a variable degree of constriction. It should

be noted that, in addition to [continuant], the feature [sonorant] must also be underspecified. It is assigned in the phonetic component and it follows from the degree of constriction: the least constricted approximant realizations of the voiced obstruents are sonorants, while the more constricted fricative and stop realizations are obstruents.

(18) The specified input ([-cont]) is not the most harmonious for the output

/ablo/ [aBlo]	ID-[cont]	ID-[voi]	DEP-[cont]	MAX-[cont]
a. aBlo				*!
b. aβlo	*!			
c. ☹ ablo				
d. aplo		*!		

(19) The specified input ([+cont]) is not the most harmonious for the output

/aβlo/ [aBlo]	ID-[cont]	ID-[voi]	DEP-[cont]	MAX-[cont]
a. aBlo				*!
b. ☹ aβlo				
c. ablo	*!			
d. aplo	*!	*		

One important implication of the OT analysis in (17–19), as indicated in 3.2.1, is that it offers additional evidence for an underspecified input, by demonstrating that it is the most harmonious input for the underspecified output.

Notice also that the proposed Optimality-Theoretic account with input and output underspecification is superior to derivational accounts in that it can account for phonetic variability in obstruent realizations, a descriptive fact that is not captured by existing serial accounts (Baković 1997; Harris 1969, 1984; Hualde 1989; Lozano 1979; Mascaró 1984). Because they do not incorporate output underspecification, these analyses have to assume that voiced obstruents are either approximants or fricatives, but variably both (for the same individual and variety).

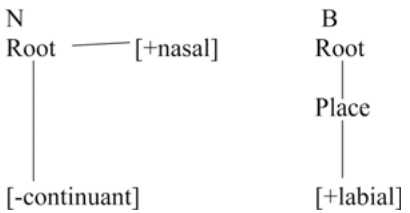
Moving on to the postnasal context, recall that the stop is the most common allophone, and variation is minimal (cf. however recent phonetic studies that

suggest that in some dialects the aperture continuum may also affect the post-nasal position, e.g., Carrasco, Hualde & Simonet 2012). This seems to indicate that the [-cont] is acquired from the adjacent consonant.[8]

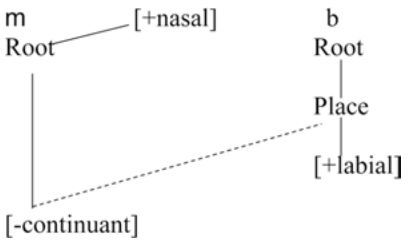
The need for obstruents to agree in continuancy with a preceding, homorganic nasal (captured by the constraint NC[cont], in [12]) can be motivated in a model of feature geometry like the one proposed by Padgett (1994) in which sharing place features means sharing the aperture nodes dominated by them. The connection noted by many researchers between nasal homorganic clusters and voiced stops is a consequence of the domination of aperture nodes by place features in feature geometry models. In (20a) a sequence of a nasal, underspecified for point of articulation, and a voiced bilabial obstruent, without a continuancy specification, becomes a bilabial nasal + bilabial stop through sharing of the place and aperture nodes (20b), a violation of LINK, a constraint that bans the double association of features (cf. [23]). Voiced obstruents, being unspecified for continuancy, share the [-continuant] specification of the nasal (20b).

(20) Feature-geometric representation for nasal + voiced obstruent clusters

a.



b.



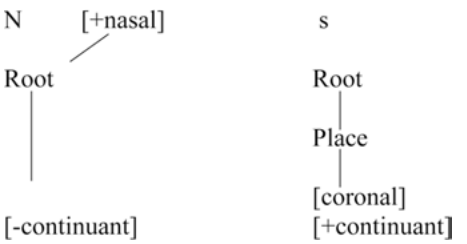
Agreement in continuancy with a preceding nasal only affects voiced obstruents: voiceless fricatives are not affected. This is because the sharing of aperture nodes only takes place when it does not require altering the aperture node of the

8 Another context exhibiting minimal (if any) variability is absolute word-initial position (post-pausal). The pause favors a stop in the phonetic implementation of the underspecified output.

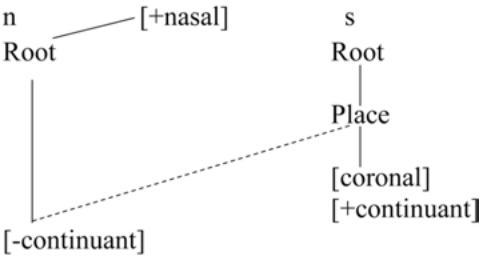
post-nasal segment. Recall that we argue that voiced obstruents are underspecified for continuancy, but voiceless stops and fricatives are specified as [-continuant] and [+continuant], respectively. In Optimality-Theoretic terms, as seen in (12), this means that ID-[cont] dominates NC[cont]. Segments underlyingly specified as [+continuant], such as voiceless fricatives, retain their [+continuant] specification due to the domination of ID-[cont] over NC[cont] (21). As explained above, /f/ does not become a stop, despite its underspecification for [continuant]. This is due to an undominated constraint that bans the highly marked labiodental stops, *p̪ (22).

(21) Feature-geometric representation for nasal + voiceless fricative clusters

a. Input

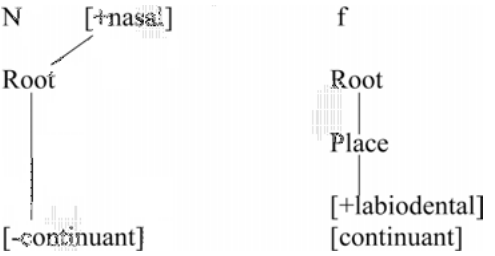


b. Output

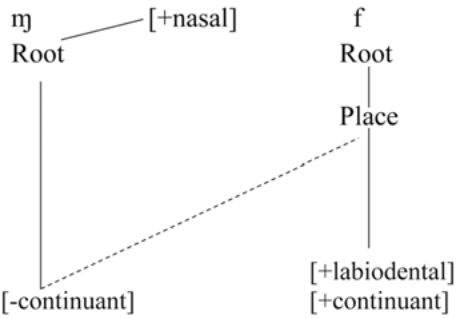


(22) Feature-geometric representation for nasal + /f/ clusters

a. Input



b. Output



(23) NC[cont]: Post-nasal obstruents must agree in continuancy with the preceding coda nasal, i.e. they must be [-continuant].

LINK: No double association of features (Itô, Mester & Padgett 1995; Colina 2009b)

As determined above, LINK must be dominated by NC-[cont], and this in turn by ID-[cont]; however, the ranking between LINK and ID-[voi] is undetermined.

(24) Voiced obstruents in NC clusters

/tieNBlo/ [tjemblo]	ID-[cont]	NC-[cont]	ID-[voi]	LINK
tjemBlo		*!		
tjemβlo		*!		
☞ tjemblo				*
tjemplo			*!	*

I argue that LINK is the responsible constraint in (24) (rather than DEP-[cont]) because insertion (a DEP-[cont] violation) would incur an additional OCP violation by having two contiguous identical association lines. Note that an alternative account with an input identical to the output (i.e., with a stop) in the homorganic context would work, but it would in turn require a stop in non-nasal contexts. As mentioned above, this would not explain the phonetic variability observed in these contexts.

This section presented the evidence and the analysis in favor of the view that voiced obstruents are underspecified for continuancy. This view offers additional evidence for Martínez-Gil's proposal that /f/ and the voiced obstruents belong to the same sonority class in Spanish (the least sonorous one) because they all lack a [+continuant] specification. [+continuant] is the feature that contributes to sonority. Consequently, the relevant generalization that accounts for onset clusters in Spanish is that a complex onset in Spanish is limited to two consonants that differ maximally in sonority rank (Complex Onset Condition, Martínez Gil 2001: 219)

This condition raises a potentially problematic issue – point of application. Since Spanish voiced obstruents are often realized as approximants (i.e., [+continuant]), the Complex Onset Condition appears to be violated at some point. The next section discusses the point of application of the Complex Onset Condition and shows that it constitutes another piece of evidence in support of input and output underspecification of voiced obstruents.

4 The Complex Onset Condition: point of application

4.1 Point of application

An important question arises with regard to the point at which the Complex Onset Condition is operative, especially since voiced obstruents are often surface approximants in Spanish, in apparent violation of such a condition. Martínez-Gil (2001), under a derivational framework, proposes that the condition is operative at the level of the underlying representation, where the voiced obstruents would be stops. This makes the sonority proposal and the Complex Onset Condition dependent on an account of voiced obstruent allophony in which the input is a stop. Although Martínez-Gil does not present the details of such an analysis, it is clear that it would be problematic for an Optimality-Theoretic account, as the Complex Onset Condition applies to the input, not to the output, in direct contradiction with the essence of OT.

OT analyses (Martínez-Gil 1997, Colina 2009a) have claimed that the condition, formulated as the Maximal Sonority Distance (MSD) constraint, is violated under domination by a more highly ranked constraint, requiring the presence of an approximant realization for voiced obstruents in some contexts (i.e., non-homorganic clusters and when not preceded by a pause).

While constraint violation is definitely a possible way of explaining surface approximants, the proposal argued for in this paper – in which voiced obstruents are underspecified in the input and at the output of the phonology –, presents a more economical, elegant and straightforward account. Like all constraints in OT, the Complex Onset Condition (MSD constraint) applies to output forms; in other words, the Complex Onset Condition is a phonological condition that must be satisfied at the output of the phonology. Given that in the current proposal, voiced obstruents still lack the specification [+continuant] at the output of the phonology (which will be assigned later as a matter of phonetic implementation), MSD is satisfied. This explanation is independently needed to account for why /f/ is grouped with the obstruents. In sum, the proposed analysis offers an elegant and straightforward account of the Onset Condition as it does not need to specify or restrict the point at which it applies.

4.2 Chilean dialects

Data from some Chilean dialects poses some potential problems for the account that says that the onset condition applies at the output of the phonology. In these dialects, underlying oral stops are vocalized in a syllable coda, becoming glides (Lenz, Bello & Oroz 1940; Oroz 1966; Martínez-Gil 1997).

(25)	/p, b/	[w]	ap.to	a[w].to	'apt'
	/t, d/	[j]	ét.ni.co	é[j].nico	'ethnic'
	/k, g/	[j] or [w]	ac.to	a[j].to, a[w].to	'act'

Underlying voiced stops also undergo vocalization when followed by a tautosyllabic liquid in word-medial position (26a–c), but not across words (26d). Voiceless stops in onset clusters are not vocalized (26e–g).

(26)	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.[ð]ro.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 it is the need to improve the sonority contour of the complex onset that explains why only voiced (not voiceless) onset obstruents vocalize and are subsequently parsed in the coda. In other

words, voiced obstruents become [+continuant], in order to avoid an approximant as the first member of the cluster. The need for a better onset is what motivates the parsing and vocalization of the approximants in the coda. Since voiceless stops do not have approximant allophone, they do not vocalize in an onset cluster (they do, however, when they are in the coda [25]). As seen in (26d), vocalization does not take place across words in an effort to avoid misalignment of syllables and word boundaries.

The above account, however, presents a possible obstacle for the analysis proposed here. If, as it is argued in this paper, 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. /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] (27):

(27) Sonority scale for some varieties of Chilean Spanish

Obstruents			Sonorants	
p, t, k, [+voiceless, +labiodental]	b, d, g	θ, s, h, x, ʧ, ʤ	m, n, ɲ, ʎ, r	l, ɾ
1	2	3	4	5

With a sonority scale like the one in (27), the Complex Onset Generalization for these Chilean dialects only allows segments in class 1 and 5 (e.g., voiceless stops and /f/, and l, ɾ). As mentioned in section 2, the sonority scale is universal with regard to the relative degree of sonority of the classes, so that an obstruent will always be less sonorous than a nasal and a nasal in turn will always be less sonorous that a vowel. Thus, at first glance, the scale in (27) may appear problematic, because /f/ is above the voiced stops. However, (27) 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. 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, the apparent reversal does not involve a major sonority class (such as obstruents vs. nasals).

In absolute word-initial position and post-nasal environments, voiced stops do occur as the first member of the cluster (Lenz, Bello & Orozco 1940: 108). This can be attributed to the fact that the coda parsing option is not available, as the resulting nasal + stop is an ill-formed coda in Spanish *[tjemb.lo] *[tjemj.lo], and to the high ranking of the relevant constraint.

In an alternative explanation that relies on the violation of MSD under domination of the constraints enforcing spirantization, Martínez-Gil (2013) explains the Chilean data through Stratal OT. Stratal OT is a modular version of OT that distinguishes two strata: the lexical stratum (word phonology) and the postlexical one (phrasal phonology) (Bermúdez-Otero 2006, forthcoming; Kiparsky 2000, 2008, 2010). Each level is a grammar with its own ranking and the output of the lexical stratum is the input to the postlexical level. For the general dialects, Martínez-Gil proposes that in the lexical stratum MSD dominates SPIR (the constraint or group of constraints responsible for spirantization)[9], because spirantization is a postlexical process; this ranking is reversed in the postlexical stratum, where spirantization surfaces regardless of sonority violations in complex onsets. In the Chilean dialects referred to above, the MSD outranks faithfulness of lexical parsing. In other words, the MSD applies only lexically in most dialects, but in Chilean it is also enforced postlexically. This forces the voiced spirant resulting from SPIR into the coda of the previous syllable where it undergoes vocalization.

While this approach works, Stratal OT is a controversial proposal within OT. It has been argued to introduce serialism into OT, in particular because it cannot reconstruct the principles that allowed its serial predecessor (Lexical Phonology) to set limits on the number of levels allowed, and on how levels differ from each other (cf. McCarthy 2002: 172–174). Given the current status of Stratal OT within the theory, an analysis that does not need to resort to stratal solutions is preferable. Furthermore, the stratal account is normally invoked to account for cyclity or opacity effects. The Chilean data are only a case of dialectal variation.

5 Conclusions

This paper presented an Optimality-Theoretic analysis of voiced obstruents and of onset clusters in Spanish. Voiced obstruents are argued to be underspecified for [continuancy] in the input and in the output. The proposed analysis accounts

9 *Spirantization* (SPIR): The value of the feature continuant in voiced obstruents may not disagree with that of the preceding segment (Martínez-Gil 1997: 190).

for why /f/ is the only fricative accepted as the first member of an onset cluster in Spanish, providing support and independent evidence for Martínez-Gil's proposal that what contributes to sonority is the presence of [+continuant]. Consequently, /f/ patterns with the voiced obstruents due to the absence of [+continuant] in its representation; voiced obstruents and /f/ comply with the Complex Onset Generalization, as they constitute the most sonorous class of sounds in Spanish.

Output and input underspecification of voiced obstruents is consistent with recent phonetic evidence on variable and gradient realizations of voiced obstruents and with the absence of continuancy alternation of /f/ in postnasal position. It is also shown that underspecification does not go against the essence of OT and that, on the contrary, underspecified candidates must be considered in accordance with the ROTB. In the analysis presented the underspecified input is selected by the constraints and the constraint ranking as the most harmonious input for the phonetically underspecified output.

In addition, the proposed analysis solves the point of application problem faced by the onset generalization in previous analyses. In line with Optimality-Theoretic tenets, restrictions on onset clusters apply to the output forms of the phonology. Finally, data from some Chilean dialects, in which vocalization is preferred to the common open (i.e., approximant) realizations of voiced obstruent, initially pose a challenge to the analysis but are also accounted for. It is shown that a comprehensive account of onset clusters must explain the interactions of these segments with other aspects of the phonology of a language, such as phonemic distinctions, featural specifications and relevant phonological phenomena.

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