SURFACE IDENTITY AND TERNARY SCALES IN SPANISH VOICING ASSIMILATION

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0. Introduction

In several Latin American dialects, Spanish obstruent consonants participate in a process of partial voicing assimilation when they appear in syllable final position.

(1)	/raskar/	→	[r̄as.kar]	‘to scratch’
	/rasgar/	→	[r̄as^{z}.ɤar][1]	‘to rip’
	/admirar/	→	[að.mi.rar]	'to admire'
	/adxuntar/	→	[að$^{\theta}$.xun̥.tar]	'to adjoin'

In this paper, I develop a novel analysis of this process building on several recent proposals within Optimality Theory. Voicing assimilation results from the interaction of input-output faithfulness constraints and surface identity constraints, which come into direct conflict because the former demand that output segments be identical to their input correspondents, whereas the latter require output segments to be identical to neighboring segments (Gnanadesikan 1997, Grijzenhout and Kraemer 1999). I argue that partial assimilation is optimal because it represents a state of harmony between being completely faithful to the input and achieving total identity to adjacent output segments. More specifically, assimilation is partial due to the fact that the faithfulness constraints that regulate input-to-output mappings (e.g. STAY) outrank the surface identity constraints that force assimilation (e.g. ASSIM). This ranking prevents the loss of voicing specifications from input segments. However, although input-voicing specifications must be preserved, assimilation must take place because ASSIM dominates some of the faithfulness constraints that regulate output-to-input mappings (e.g. RESIST). As a result, the optimal output correspondent of an obstruent segment that is parsed as a syllable coda is one that retains the original input voicing while it also picks up the voicing specification of an adjacent onset segment. Following Beckman (1996, 1999), I incorporate the notion of positional faithfulness to capture the resistance of onset segments to alter their feature specifications, which provides an explanation for the fact that voicing assimilation is regressive. It is also assumed that voicing in sonorants, voiced obstruents and voiceless obstruents represents three different values on a ternary voicing scale, where voiced obstruents are the marked value (Gnanadesikan, 1997). Under this assumption, final devoicing is simply the response to a ban against the appearance of the marked voicing value at the right edge of the prosodic word.

The remaining of this paper is organized as follows. Section 1 presents the data in the context of the inventory of Spanish obstruents. Section 2 reviews several important theoretical assumptions. In Section 3, I develop an analysis of partial voicing assimilation based on bi-directional input-output faithfulness constraints and surface identity constraints. Section 4 accounts for the inventory of Spanish obstruents in terms of the interaction between markedness and faithfulness constraints. It is concluded that Spanish has no underlying voiced fricatives. The fully voiced and partially voiced fricatives that surface in this language are compelled by surface identity constraints that require adjacent output segments to resemble one another in voicing and stricture. Section 5 summarizes the main findings of this study.

1. Spanish obstruents and voicing assimilation

The obstruent series of the Spanish sound inventory is composed of affricates, stops and fricatives. Within these sub-classes, voicing contrasts distinguish between labial /b/ ~ /p/, dental /d/ ~ /t/ and velar /g/ ~ /k/ stops. Fricatives, however, do not contrast in voicing. As a result, the voiceless labio-dental /f/, alveolar /s/ and velar /x/ fricative phonemes do not have voiced counterparts (e.g. /v/, /z/, /ɣ/), although it has traditionally been assumed that there is a voiced palatal fricative phoneme /y/.[2] Furthermore, it has been assumed that affricates do not contrast in voicing and that the only affricate Spanish phoneme is a voiceless alveo-palatal segment (e.g. /č/). Table 1 illustrates this traditional organization of Spanish obstruent phonemes.

(2) *Traditional organization of Spanish obstruent phonemes*

Obstruent classes	Labial		Labio-dental		Dental		Alveolar		Palatal		Velar	
	+v	-v	+v	-v	+v	-v	+v	-v	+v	-v	+v	-v
Affricates										č		
Stops	b	p			d	t					g	k
Fricatives				f				s	y			x

Stricture and voicing are properties that may change in the process of rendering these phonemes into physical form. Through spirantization, the voiced stops /b, d, g/ change their stricture to become fricatives [β, ð, ɣ].[3]

(3)	bó.no	‘bonus’	mi.βó.no	‘my bonus’
	du.na	‘dune’	la.ðú.na	‘the dune’
	go.ma	‘gum’	tu.ɣó.ma	‘your gum’

Additionally, a process of partial voicing assimilation changes the voiceless fricatives /f, s, x/ into [f^{v}, s^{z}, x^{ɣ}] when they appear in coda position, preceding a voiced segment.

(4)	/afganistan/	→	[af^{v}.ɣa.nis.tán]	'Afghanistan'
	/desde/	→	[dés^{z}.ðe]	'from'
	/relox barato/	→	[re.lóx^{ɣ}.βa.rá.to]	'cheap watch'

Both stop series also participate in this process of partial voicing assimilation. This results in /b, d, g/ surfacing as [β^{ɸ}, ð^{θ}, ɣ^{x}] before a voiceless consonant (3), whereas [p, t, k] are rendered as [p^{b}, t^{d}, k^{g}] when preceding a voiced consonant (4).

(5)	/absurdo/	→	[aβ^{ɸ}.súr.ðo]	'absurd'
	/adxunto/	→	[að^{θ}.xún̪.to]	'adjunct'
	/sigsag/	→	[siɣ^{x}.sáɣ^{x}]	'zigzag'
(6)	/klip grande/	→	[klíp^{b}.grán̪.de]	'big clip'
	/atmosfera/	→	[at^{d}.mós.fe.ra]	'atmorphere'
	/tik nerbioso/	→	[tík^{g}.ner.βjó.so]	'nervous tick'

Voiced stops are also partially devoiced word-finally, where no adjacent segment could be the source of voicelessness. This devoicing, therefore, is not the result of assimilation but a consequence of final devoicing.

(7)	/klub/	→	[klúβ^{ɸ}]	'club'
	/sed/	→	[séð^{θ}]	'thirst'
	/sigsag/	→	[siɣ^{x}.sáɣ^{x}]	'zigzag'

Finally, there is a voiced palatal obstruent that surfaces as a fricative in the same contexts where /b, d, g/ spirantize, and as an affricate in the same contexts where /b, d, g/ remain non-continuant.

(8)	/Yabero/	→	[y̌a.βé.ro]	'key ring'
	/elYabero/	→	[el̆.y̌a.βé.ro]	'the key ring'
	/unYabero/	→	[uň.y̌a.βé.ro]	'a key ring'
	/suYabero/	→	[su.ya.βé.ro]	'his key ring'

This segment has been traditionally analyzed as a voiced palatal fricative phoneme that undergoes fortition to become a voiced alveo-palatal affricate. In Section 4 below, I argue that the alveo-palatal affricate is the actual phoneme and that the pala tal fricative is derived from it through spirantization. The implementation of all these transformations results in the following allophonic inventory for Spanish obstruents.

(9) *Spanish obstruent allophones*

Obstruent classes	Labial			Labio-den			Dental			Alveolar			Palatal			Velar		
	+	-	±	+	-	±	+	-	±	+	-	±	+	-	±	+	-	±
Affricates													y̌	č				
Stops	b	p	p^{b}				d	t	t^{d}							g	k	k^{g}
Fricatives	β		β^{ɸ}		f	f^{v}	ð		ð^{θ}		s	s^{z}	y			ɤ	x	ɣ^{x}

Table 9 shows that in these Spanish dialects there are eight voiced d bstruents, seven voiceless obstruents, and eight voice-contour obstruent allophones. In Section 3 below, I develop an analysis that explains the emergence of voice-contour obstruents in Spanish. This is done through the use of ternary scales, bi-directio nal identity constraints, and surface identity constraints, which provide inside into the process of voicing assimilation.

2. Theoretical assumptions

Since the analysis developed here makes use of several novel proposals, it is convenient to set the background by reviewing these theoretical assumptions.

2.1 Ternary scales

Following Rivas (1977), Gnanadesikan (1997) proposes to replace certain binary features (e.g. [voice], [sonorant], [high], [low], [continuant], [consonantal]) with ternary scales that do away with the problem of predicting a fourth value, which does not exist (e.g. [-high, -low], [+sonorant, -voice], [-continuant, -consonantal]). Another problem with binary features that does not arise with ternary scales is the need to underspecify segments that are transparent to a process or that fail to trigger a process despite the fact that they bear the feature in question. A further advantage of ternary scales is that they allow a unified treatment of assimilation and chain-shifting processes, since the latter can now be analyzed as one-step assimilatory movements on a scale. For an extensive discussion on ternary scales, the reader is referred to Gnanadesikan (1997). It is specifically the Inherent Voicing scale and the Consonantal Stricture scale that interest us here.

(10) *The Inherent Voicing scale*

voiceless obstruent	voiced obstruent	sonorant
IV1	**IV2**	**IV3**

(11) *The Consonantal Stricture scale*

stop	fricative/liquid	vocoid/laryngeal
CS1	**CS2**	**CS3**

Ternary scales allow the relation of three different segmental classes in a scalar fashion. In (10), for instance, the class of sonorant segments is more closely related to the class of voiced obstruents than to the class of voiceless obstruents because sonorants are adjacent to voiced obstruents whereas they stand further away from voiceless obstruents. The IV-scale moves from voicelessness (IV1), at one end, to inherent voicing (IV3), at the opposite end, with and intermediate state of non-inherent voicing (IV2). It is precisely IV2 that is the marked value because it causes the otherwise maximally dispersed voicing contrast to be reduced. These observations also hold for the Consonantal Stricture scale, which moves from maximal stricture (CS1) to minimal stricture (CS3) through an intermediate degree of stricture (CS2). The IV and CS scales allow us to give a unified treatment to processes that involve adjacent values (e.g. X1-X2, X2-X3) and processes that involve non-adjacent values (e.g. X1-X3). For instance, the process by which a voiceless obstruent assimilates in voicing to a sonorant segment is clearly a case of attraction of IV1 towards IV3 that results in an IV2 segment. Similarly, the process that assimilates a stop consonant to a vowel (e.g. spirantization), is a case of attraction of CS1 towards CS3 that results in a CS2 segment. From this standpoint, attraction is clearly an instance of assimilation and should be accounted for through the same mechanism. Ternary scales emerge as the device that allows this unification.

2.2. Featural Faithfulness

In McCarthy and Prince (1995), faithfulness is split into segmental faithfulness (e.g. the MAX(seg) and DEP(seg) constraint families) and featural faithfulness (e.g. the IDENT(F) constraint family). Pater (1995) further divides featural faithfulness into IDENT(I→O), which penalizes the loss of a feature, and IDENT(O→I), which sanctions the addition of a feature. Gnanadesikan (1997) follows Pater (1995) when replacing IDENT(I→O) by STAY and IDENT(O→I) by RESIST. I adopt Gnanadesikan's terminology here. The input-to-output and output-to-input feature faithfulness constraints are defined after Gnanadesikan (1997) in (12) and (13).

(12) STAY X: If α is an input segment and β is an output correspondent of α, then if α possesses a scale value X, β possesses X.

(13) RESIST Y: If α is an input segment and β is an output correspondent of α, then if α does not possess a scale value Y, β does not possess Y.

It is usually the case that a STAY violation entails a RESIST violation given that the change from one scale value to another one implies the loss a value and the acquisition of a new value. However, this does not always have to be the case, as I will argue that in partial voicing assimilation, a violation of RESIST is incurred by the assimilating segment but no violation of STAY is incurred since the assimilating segment maintains the value of its input correspondent.

Assuming that higher sonority translates into higher prominence (Prince and Smolensky 1993), and that higher prominence is equated with higher faithfulness (Beckman 1996), Gnanadesikan (1997) also proposes that the inherent prominence relations on ternary scales are translated into a universal ranking of faithfulness constraints. According to this, the highest value on a scale is sponsored by a faithfulness constraint that ranks higher than the faithfulness constraints that sponsor lower scale values. On the IV-scale, for example, the higher prominence of sonorants (IV3) is supported by a FAITH-IV3 constraint, which universally ranks higher than the FAITH-IV2 constraint, and this one in turn, outranks the FAITH-IV1 constraint. Segmental prominence then translates into the following universal ranking.

(14) FAITH-X3 >> FAITH-X2 >> FAITH-X1

Furthermore, since featural faithfulness is bi-directional, faithfulness to each scale value is split into the STAY and RESIST constraint families.

(15) FAITH-X3 >>> FAITH-X2 >> FAITH-X1

STAY-X3 RESIST-X3 STAY-X2 RESIST-X2 STAY-X1 RESIST-X1

I will argue below that Gnanadesikan's assumption that this ranking is fixed in UG needs to be modified given that in partial voicing assimilation, a low-value STAY-IV constraint may dominate a higher-value RESIST-IV constraint. In other words, the feature faithfulness constraints may not only be organized in a way that favors higher values over lower values, but also in a way in which retaining a value is more important than acquiring a value: STAY >> RESIST.

2.3. Assimilation as Surface Identity

In the work of Lombardi (1995, 1996) and Beckman (1996, 1999), voicing assimilation is compelled by the constraint AGREE, which requires obstruent clusters to agree in voicing. Grijzenhout and Kraemer (1999) point out that AGREE is neither a markedness constraint nor a correspondence constraint. In lack of motivation for a new constraint scheme, these authors propose to recast assimilation as a type of correspondence that holds of neighboring output segments.[4] From this viewpoint, assimilation is an identity requirement that applies to neighboring segments in the output form. Gnanadesikan (1997) also recasts AGREE as surface identity constraints. Here I will use Gnanadesikan's terminology (e.g. ASSIM). Surface identity is divided into two constraint families, IDENTICAL and ADJACENT, which are responsible for assimilation and attraction processes.

(16) ASSIM(ILATION) constraints:

IDENTICAL: Adjacent output segments must have identical values.

ADJACENT: Adjacent output segments must have values that are adjacent on the scale.

Based on the fact that full assimilation is cross-linguistically more favored than attraction, Gnanadesikan proposes that the ranking IDENTICAL >> ADJACENT is universal. Under the assumption that neighboring output segments stand in a correspondence relationship, there is no need to posit geometric representations where segments that agree in a feature must be linked through an association line. Instead of spreading, the reason for the agreement in feature values among a set of neighboring output segments is the identity requirement enforced by the surface correspondence relationship they participate in. Within this approach, assimilatory processes do not take place when the faithfulness constraints STAY and RESIST dominate ASSIM. However, when ASSIM dominates some of the STAY and RESIST constraints, either assimilation or attraction patterns may arise.

1.4. Positional Faithfulness

Beckman (1996, 1999) proposes to capture the privileged status of certain linguistic positions through positional faithfulness constraints, which rank above context-free faithfulness constraints: FAITH-(position) >> FAITH. This approach is based on the assumption that prominent positions require greater faithfulness. Within the syllable domain, for example, onsets are perceptually more prominent by virtue of their release, which serves to signal a wider range of distinctive contrasts. This prominence of syllable onsets results in greater faithfulness to onset segments: FAITH-(onset) >> FAITH. When a surface identity constraint like ASSIM is high-ranking, it requires that an output segment change its value of a feature in order to resemble a neighboring segment. Positional Faithfulness predicts that if one of the segments is parsed as a syllable coda, whereas the other one is parsed as a syllable onset, it will be the coda segment that changes to resemble the onset segment and not vice versa. As a result of Positional Faithfulness, assimilation must be regressive, provided that no other conflicting constraint outranks FAITH-(onset).

3. Voicing assimilation

The analysis I develop here contributes to a new line of research that views assimilation as a conflict between input-output faithfulness and surface identity (Gnanadesikan 1997, Grijzenhout and Kraemer 1999). The conflict is resolved by negotiating a point of balance between these two correspondence relationships. Such a state of harmony is one in which neither total input-output faithfulness nor complete surface identity are possible. Rather, a minimal degree of faithfulness is sacrificed in order to allow an optimal degree of surface identity.

3.1 Partial voicing assimilation

The fact that voicing assimilation affects obstruent consonants appearing at the right, but not at the left syllable margin, suggests that faithfulness to the onset position is more highly valued.

(17)	/absurdo/	→	[aβ$^{\phi}$.súr.ðo]	‘absurd’
	/futbol/	→	[fút^{d}.bol]	‘soccer’

The ranking FAITH-Onset >> FAITH assures a privileged status to onset segments (Beckman 1996, 1999). Following Gnanadesikan (1997) and Grijzenhout and Kraemer (1999), I also assume that there is a family of correspondence constraints that demands identity among adjacent surface segments. It is precisely these surface identity constraints that induce assimilation processes. In the case at hand, the relevant surface identity constraint requires identity in terms of IV-values. For convenience, the IV-scale is repeated in (19).

(18) ASSIM(IV) *Surface IV-identity*
Adjacent output segments must have identical IV-values.

(19) *The Inherent Voicing Scale*

voiceless obstruent	voiced obstruent	sonorant
IV1	**IV2**	**IV3**

Although it is desirable that adjacent output segments have identical IV-values, IV-identity may not be obtained by altering onset segments because the positional faithfulness constraint FAITH(IV)-Onset outranks the surface identity constraint ASSIM(IV). However, surface IV-identity may be achieved by altering coda segments because ASSIM(IV) dominates the context-free faithfulness constraint FAITH(IV).

(20) FAITH(IV)-Onset >> ASSIM(IV) >> FAITH(IV)

/absurdo/	FAITH(IV)-Onset	ASSIM(IV)	FAITH(IV)
a. aβ.sur.ðo		*!	
b. ☞ aβ^{ɸ}.sur.ðo			*
c. aβ.^{z}sur. ðo	*!		

In tableau (20), candidate (20a) is ruled out by ASSIM(IV) because the segment [s], which bears an IV1 value, is standing next to the segment [β], which bears an IV2 value.[5] Candidates (20c) and (20d) exhibit partial voicing assimilation. The difference is that whereas in (20b) assimilation is regressive; (20c) is a case of progressive assimilation. As a result of partial voicing assimilation, the segments [$β^{Φ}$] and [^{z}s], bear both and IV2 and an IV1 value.[6] Therefore, neither of these candidates violates ASSIM(IV) because in both cases the two adjacent consonants are identical in one IV-value. Note that [$β^{Φ}$] and [s] share an IV1-value, whereas [β] and [^{z}s] have an IV2-value in common. FAITH(IV)-Onset rules against (20c) because the segment [^{z}s], which is parsed as a syllable onset, is not completely faithful to its input correspondent. The optimal candidate is one that meets the surface identity requirement at the expense of altering a coda segment rather than an onset segment (20b). This is, of course, a type of unfaithfulness, but one that is tolerable given the lower-prominence = lower faithfulness equation that applies to syllable codas.

Furthermore, given that any correspondence relationship is bi-directional, a precise evaluation of featural faithfulness requires the splitting of FAITH into constraints that regulate input-to-output mappings (e.g. do not lose a value) and constraints that govern output-to-input mappings (e.g. do not gain a value). This motivates the explosion of FAITH(IV) into STAY(IV) and RESIST(IV).

(21) STAY(IV): If α is an input segment and β is an output correspondent of α, then if α possesses an IV-scale value X, β possesses X.

(22) RESIST(IV): If α is an input segment and β is an output correspondent of α, then if α does not possess an IV-scale value Y, β does not possess Y.

To keep the tableaux within reasonable size, I will not include the constraints STAY(IV)-Onset and RESIST(IV)-Onset. This omission has no consequences since it was already shown in tableau (20) above that FAITH(IV)-Onset is top ranking. Except for (25), in the tableaux that follow, only candidates that abide by STAY(IV)-Onset and RESIST(IV)-Onset will be considered.

The fact that Spanish voicing assimilation is partial results from the ranking, STAY(IV) >> ASSIM(IV) >> RESIST(IV). Crucially, partial assimilation is better than total assimilation because STAY(IV) outranks ASSIM(IV). Tableau (23) illustrates the result of this constraint ranking. Candidate (23a) is put out of competition by ASSIM(IV) because [β] and [s] have different IV-values (e.g. IV2 ≠ IV1). Candidates (23b) and (23c) both achieve surface identity through regressive assimilation (e.g. IV1 = IV1). However, (23c) is penalized by STAY(IV) because the segment [ɸ] fails to preserve the IV-value of its input correspondent. The optimal output form is one that meets the surface identity requirement by allowing a coda obstruent to take on the IV-value of an adjacent onset segment, but without losing the IV-value of its input correspondent (23b). In other words, surface identity may cause unfaithfulness but only in output-to-input mappings. This causes assimilation to be partial rather than total.

(23) STAY(IV) >> ASSIM(IV) >> RESIST(IV)

/absurdo/	STAY(IV)	ASSIM(IV)	RESIST (IV)
a. aβ.súr.ðo		*!	
b. ☞ aβ^{ɸ}.súr.ðo			*
c. aɸ.súr.ðo	*!		*

Markedness, however, has something to say about the winning candidate (23b). Contour segments are obviously more marked than simple segments because they require more structure. The fact that a contour segment is preferred over a non-assimilating simple segment indicates that ASSIM(IV) also outranks the markedness constraint *CONTOUR, which is defined in (24).

(24) *CONTOUR: Let *x* and *y* be two different values on a ternary scale, if *x* is associated with a segment X, then *y* may not be associated with X.

Tableau (25) includes the vote of *CONTOUR in the evaluation. It should be noted that contour segments in Spanish only arise under pressure by surface identity. Furthermore, since assimilation may only affect segments in the coda, contour segments may only be found in coda position (25b). Tableau (25) incorporates top-ranking FAITH(IV)-Onset to illustrate this point. A broken line between two constraints indicates non-crucial ranking.

(25) FAITH(IV)-Onset >> STAY(IV) >> ASSIM(IV) >> *CONTOUR, RESIST(IV)

/absurdo/	FAITH(IV)-Onset	STAY(IV)	ASSIM(IV)	*CONTOUR	RESIST (IV)
a. aβ.súr.ðo			*!		
b. ☞ aβ^{ɸ}.súr.ðo				*	*
c. aβ.^{z}sur.ðo	*!			*	*
d. aɸ.súr.ðo		*!			*

Candidate (25b) is the most harmonic output because it represents the only way to achieve surface identity without altering onset segments (25c) and without losing input IV-values (25d). The cost of this trade is the creation of a contour segment, which is half way between being completely faithful to the input and being completely identical to neighboring segments (25b).

Notwithstanding, the ranking illustrated in (25) is still imprecise. Although it is clear that STAY(IV) dominates ASSIM(IV), it appears that not all RESIST(IV) constraints are dominated by ASSIM(IV). This is revealed by the data in (26), which show that sonorants (IV3) do not cause either voiced obstruents (IV2) or voiceless obstruents (IV1) to become inherently voiced (e.g. sonorants). In other words, an IV3 value may not be added under any circumstances.

(26)	/admirar/	→	[að.mi.rár]	'to admire'
	/etniko/	→	[ét^{d}.ni.ko]	'ethnic'

In order to account for this limitation in the power of voicing assimilation, it is necessary to allow the faithfulness constraints that sponsor specific IV-values to come into the evaluation. STAY and RESIST are faithfulness constraints that regulate featural faithfulness but they are composed of more specific constraints. In particular, STAY(IV) and RESIST(IV) break down into STAY(IV3), STAY(IV2), STAY(IV1) and RESIST(IV3), RESIST(IV2), RESIST(IV1), respectively. The fact that coda obstruents may take on an IV2 or and IV1 value in order to assimilate to a following onset segment indicates that ASSIM(IV) outranks the constraints that militate against the addition of IV2 and IV1 values; that is, RESIST(IV2) and RESIST(IV1). On the other hand, the fact that an IV3 value may never be added translates into the ranking RESIST(IV3) >> ASSIM(IV). For reasons of space, I will use STAY(IV)all to compress STAY(IV3), STAY(IV2) and STAY(IV1). There is no crucial ranking between STAY(IV)all and RESIST(IV3) since these faithfulness constraints do not conflict.

(27) STAY(IV)all, RESIST(IV3) >> ASSIM(IV) >> RESIST(IV2), RESIST(IV1)

	/admirar/	STAY(IV) all	RESIST (IV3)	ASSIM(IV)	RESIST (IV2)	RESIST (IV1)
a. ☞	að.mi.rár			*		
b.	al.mi.rár	*!	*			

Tableau (27) illustrates the case of an input that contains a voiced obstruent (IV2) followed by a sonorant (IV3). Note that both STAY(IV)all and RESIST(IV3) sanction the change of /d/ to [l]. Since these constraints outrank ASSIM(IV), the candidate that undergoes assimilation may not win (27b). Candidate (27a) opts to favor faithfulness to the input (e.g. IV2 = IV2) over surface identity (e.g. IV2 ≠ IV3). Despite violating ASSIM(IV), this candidate is selected as optimal because it does not compromise any IV3 values nor does it allow the lost of any input values, whether they are low or high values on the scale. This particular finding about Spanish partial voicing assimilation argues against Gnanadesikan's assumption that faithfulness constraints that sponsor high scalar values are universally ranked above faithfulness constraints that sponsor lower scalar values (e.g. STAY(IV3), RESIST(IV3) >> STAY(IV2), RESIST(IV2) >> STAY(IV1), RESIST(IV1)). In Spanish, STAY(IV1) must rank above RESIST(IV2). This is because since an input IV-value may never be lost, STAY(IV1) must dominate ASSIM(IV). However, since an IV2-value may be gained, ASSIM(IV) must dominate RESIST(IV2). Therefore, by transitivity STAY(IV1) dominates RESIST(IV2). These observations require modifying the statement that faithfulness to higher values always dominates faithfulness to lower values. Rather, faithfulness constraints may be organized in such a way that FAITH(X) >> FAITH(X-1). But the alternative that FAITH(STAY) dominates FAITH(RESIST) must be allowed as well because it is required by the data.

Another aspect of Spanish partial voicing assimilation that awaits an explanation has to do with cases in which the surface identity constraint ASSIM(IV) is only capable of attraction. For instance, when a voiceless obstruent (IV1) is followed by a sonorant (IV3), assimilation only yields attraction towards the sonorant since the voiceless obstruent takes on an IV2, not an IV3-value.[7] In order to account for attraction patterns, Gnanadesikan (1997) proposes that ASSIM is not a single constraint but actually two different constraints that demand two different degrees of surface identity.

(28) IDENTICAL(IV): Adjacent output segments must have identical IV-values.

ADJACENT(IV): Adjacent output segments must have IV-values that are adjacent on the IV-scale.

Since attraction is cross-linguistically less favored than assimilation, Gnanadesikan assumes that ADJACENT is universally ranked below IDENTICAL. Tableau (29) illustrates the selection of the optimal output form when the input contains a voiceless obstruent followed by a sonorant. I assume with Gnanadesikan (1997) that a sequence of output segments that satisfies IDENTICAL also satisfies ADJACENT. Only candidates that abide by the constraint RESIST(IV3), which was already shown to be undominated, are considered.

(29) STAY(IV)all >> IDENTICAL(IV) >> ADJACENT(IV) >> RESIST(IV2), RESIST(IV1)

/etniko/	STAY(IV)all	IDENTICAL(IV)	ADJACENT(IV)	RESIST (IV2)	RESIST (IV1)
a. ét.ni.ko		*	*!		
c. ☞ ét^d.ni.ko		*		*	
b. éð.ni.ko[8]	*!	*			

Candidate (29a) runs afoul of both surface identity constraints because the segment [t], which has an IV1 value, is adjacent to the segment [n], which has an IV3 value. Since IV1 and IV3 are not adjacent on the IV-scale, much less identical, this candidate is penalized by IDENTICAL(IV) and ADJACENT(IV). Candidates (29b) and (29c) undergo assimilation in order to meet the surface identity requirement. Nonetheless, neither of them satisfies IDENTICAL(IV) because neither [t^d], which has an IV1 and an IV2 value, nor [ð], which has an IV2 value only, match the IV3 value of the adjacent sonorant. But assimilation is not futile because it has the merit of approximating the IV1-value of the voiceless stop to the IV3-value of the sonorant so that at least ADJACENT(IV) is satisfied. It is candidate (29b) that is preferred because it has the advantage of preserving the input IV-value of the coda obstruent sparing a violation of the undominated faithfulness constraint STAY(IV)all.

The constraint ranking I have established above accounts for all the patterns of Spanish partial voicing assimilation. Summing up, voicing assimilation takes place because of a surface identity requirement that holds of adjacent output segments (e.g. ASSIM(IV)). This process may alter coda segments but not onset segments because coda segments do not have the benefit of context-sensitive faithfulness (e.g. FAITH(IV)-Onset >> ASSIM(IV) >> FAITH(IV)). Furthermore, surface identity is limited by the fact that coda obstruents may never lose their input IV-values (e.g. STAY(IV)all >> ASSIM(IV)). Under this condition, for surface identity to ensue, coda obstruents need become contour segments (e.g. ASSIM(IV) >> *CONTOUR), which represents a state of harmony between remaining completely faithful to the input and becoming completely identical to neighboring segments (e.g. STAY(IV)all >> ASSIM(IV) >> RESIST(IV)). Tableaux (30) –

(33) illustrate how these universal principles in the order that has been established above determine the IV-value of Spanish coda obstruents. Once again, candidates that violate the undominated constraints FAITH(IV)-Onset and RESIST(V3) are not considered.

In the case of an input form that contains a voiceless obstruent (IV1) followed by a voiced obstruent (IV2), partial voicing assimilation allows the two segments to be identical in an IV2-value (30c).

(30) STAY(IV)all >> IDENTICAL(IV) >> ADJACENT(IV) >> RESIST(IV2), RESIST(IV1)

/rasgar/	STAY(IV)all	IDENTICAL(IV)	ADJACENT(IV)	RESIST (IV2)	RESIST (IV1)
a. r̄as.gar		*!			
b. r̄az.gar	*!			*	
c. ☞ r̄as^z.gar				*	

When the input contains a voiceless obstruent (IV1) followed by a sonorant (IV3), partial voicing assimilation results in an approximation of the obstruent towards the sonorant (31c). In other words, the two segments do not end up with identical IV-values but they manage to become adjacent on the IV-scale.

(31) STAY(IV)all >> IDENTICAL(IV) >> ADJACENT(IV) >> RESIST(IV2), RESIST(IV1)

/asno/	STAY(IV)all	IDENTICAL(IV)	ADJACENT(IV)	RESIST (IV2)	RESIST (IV1)
a. ás.no		*!	*!		
b. áz.no	*!	*		*	
c. ☞ ás^z.no		*		*	

When a voiced obstruent (IV2) is followed by a voiceless obstruent (IV1), partial voicing assimilation allows the two segments to be identical in an IV1-value (32c).

(32) STAY(IV)all >> IDENTICAL(IV) >> ADJACENT(IV) >> RESIST(IV2), RESIST(IV1)

/adkirir/	STAY(IV)all	IDENTICAL(IV)	ADJACENT(IV)	RESIST (IV2)	RESIST (IV1)
a. að.ki.rír		*!			
b. at.ki.rír	*!				*
c. ☞ $a\eth^{\theta}$.ki.rír					*

Finally, when a voiced obstruent is followed by a sonorant, partial voicing assimilation does not represent an improvement because the IV-values of the two segments are already adjacent. To make them identical, a change that would affect an IV3 value would be necessary. Such change is not favored because IV3-values may never be lost or gained.[9]

(33) STAY(IV)all >> IDENTICAL(IV) >> ADJACENT(IV) >> RESIST(IV2), RESIST(IV1)

/ignasio/	STAY(IV)all	IDENTICAL(IV)	ADJACENT(IV)	RESIST (IV2)	RESIST (IV1)
a. iŋ.ná.sjo	*!				
b. ☞ iɤ.ná.sjo		*			

3.2. Final devoicing

The fact that voiced stops partially devoice in word final position indicates that alongside voicing assimilation, there is also a process of final devoicing. Representative data are repeated in (34).

(34)	/klub/	→	[klúβ^{ϕ}]	'club'
	/sed/	→	[sé$\eth^{\theta}$]	'thirst'
	/sigsag/	→	[siγ^{x}.sáγ^{x}]	'zigzag'

To account for this process, I adopt the context-sensitive markedness constraint PWd-FINAL DEVOICING, proposed within a binary-feature system by Grijzenhout and Kraemer (1999). I redefine this constraint as a well-formedness condition that bars the marked IV-value from the right edge of the PWd (e.g. $*IV2]_{\omega}$). As mentioned in Section 2.1, on a ternary scale, the middle value is the marked value because its existence causes the reduction of the maximal dispersion that would result from having equipollent values.

(35) $*IV2]_{\omega}$: *PWd-Final Devoicing*
The marked IV-value may not appear at the right edge of the PWd.

An analysis of final devoicing articulated around the constraint $*IV2]_{\omega}$ predicts that sonorants, although voiced, will not be the target of final devoicing since it is only the marked IV-value that is rejected by the right edge of the PWd. To the best of my knowledge, there are no exceptions to this generalization.

$*IV2]_{\omega}$ obviously outranks RESIST(IV1) in Spanish. This means that adding an IV1-value is better than allowing an IV2-value to close the PWd. Devoicing, however, is restricted by the constraint STAY(IV)all, which has been proven to be undominated. As a result of this, devoicing may only be partial, since even the marked value of the scale may not be lost (36b).

(36) STAY(IV)all >> $*IV2]_{\omega}$ >> RESIST(IV1)

/sed/	STAY(IV)all	$*IV2]_{\omega}$	RESIST (IV1)
a. seð		*!	
b. ☞ seð$^{\theta}$			*
c. seθ	*!		

4. Markedness in the obstruent inventory

Within Optimality Theory (Prince and Smolensky 1993), the sound inventory of any given language is derived from the interaction of universal markedness and faithfulness constraints according to a language particular ranking. Each ranking represents the organization of the universal constrains within a particular grammar. From this standpoint, the reason why languages differ in their sound inventories is because the universal markedness and faithfulness constraints may be ranked differently from one language to another.

As described in Section 1 above, Spanish uses the sets of obstruent sounds [p, t, k] and [b, d, g], which manifest a voicing contrast. This suggests that the markedness constraint that militates against voicing is dominated in Spanish. Within the Ternary Scale model, there is no need to postulate two different markedness constraints, *[+voice] and *[-voice], as it is the case within an approach that assumes that the feature [voice] is binary. An advantage of the Ternary Scale model is that it captures the fact that voicing is marked only when it appears in obstruent sounds. It also takes into account that voicelessness is an inherent property of obstruents just like voicing is inherent to sonorants. Therefore, the markedness constraint *IV2, which militates only against the marked value on the Inherent Voicing scale, is a precise formalization of the facts. Although an approach that assumes that the feature [voice] is privative also needs to rely on only one markedness constraint, *[voice], such constraint would also penalize the natural voicing of sonorants, when indeed, sonorants are only marked when they are voiceless.

Considering that the output forms of a language are selected by a particular ranking of universal constraints, it is not sound to constrain input forms in any way. This is required by the Richness of the Base hypothesis, which states that "The grammatical inventories of a language are the outputs which emerge from the grammar when it is fed the universal set of all possible inputs." (Prince and Smolensky 1993:3). Applying the Richness of the Base hypothesis to the case of voicing contrasts in Spanish, one must deal with the fact that surface [b, d, g] may derive from underlying /p, t, k/ since it cannot be stipulated that /b, d, g/ are the only possible inputs for [b, d, g]. That is to say that whether surface [b, d, g] come from underlying /b, d, g/ or /p, t, k/ is something to be determined through constraint interaction.

Obviously, the markedness constraint *IV2 is at the heart of this matter. Since voiced obstruents do surface in Spanish, *IV2 must be dominated by the faithfulness constraint that requires the faithfulness of input IV-values; that is, FAITH(IV).

(37) FAITH(IV): An output segment and its input correspondent must have identical IV-values.

Under the ranking FAITH(IV) >> *IV2, the IV2 value of an input segment must be preserved by its output correspondent. This is illustrated in tableau (38) by the contrast between candidates (38a) and (38b). This tableau also shows that if the input segment does not have an IV2-value, no violation of markedness is necessary in order to comply with top-ranking FAITH(IV). This is a reflection of the fact that, when it comes to stops, voicelessness is not a marked property (38b'), just like voicing does not make sonorants marked (38b'').

(38) FAITH(IV) >> *IV2

/b, d, g/	FAITH(IV)	*IV2
a. ☞ b, d, g		***
b. p, t, k	***!	
/p, t, k/		
a'. b, d, g	***!	
b'. ☞ p, t, k		
/m, n, ŋ/		
a''. b, d, g	***!	
b''. ☞ m, n, ŋ		

Within this grammar, /b, d, g/ are the optimal inputs for [b, d, g]. This is determined by the principle of Lexicon Optimization (Prince and Smolensky 1993), which states that of a set of possible input forms, the real input is the one that represents the most harmonic mapping from input to output.

(39) Selection of the optimal input

Input	Output	FAITH(IV)	*IV2
a. ☞ /b, d, g/	a. ☞ b, d, g		***
b. /p, t, k/	b. ☞ b, d, g	***!	

The reversal of this ranking constitutes another grammar in which voiced stops may never surface (40b). In this grammar, the optimal inputs for surface [p, t, k] are underlying /p, t, k/. This is because since the undominated markedness constraint *IV2 never allows voiced stops to surface, the speakers of this language will not posit them as underlying representations.

(40) *IV2 >> FAITH(IV)

/b, d, g/	*IV2	FAITH(IV)
a. b, d, g	***!	
b. ☞ p, t, k		***
/p, t, k/		
a'. b, d, g	***!	***
b'. ☞ p, t, k		

A language that illustrates this type of grammar is Hawaiian, where obstruents may only be voiceless (Maddieson 1984, Beckman 1999).

(41) Selection of the optimal input

Input	Output	FAITH(IV)	*IV2
a. /b, d, g/	a. ☞ p, t, k	***!	
b. ☞ /p, t, k/	b. ☞ p, t, k		

In sum, grammars with the ranking *IV2 >> FAITH(IV) do not have voiced obstruents, whereas grammars with the ranking FAITH(IV) >> *IV2 allow them. Obviously, Spanish belongs to the second class. However, the ranking FAITH(IV) >> *IV2 does not adequately account for the entire inventory of obstruents in this language. The problem with this ranking is that it predicts the existence of more obstruent sounds than Spanish actually has. In particular, since Spanish has the set of voiceless fricatives [f, s, x], one would also expect this language to have the set of voiced fricatives [v, z, ɣ]. This follows from the fact that the voiced fricatives /v, z, ɣ/ are possible inputs that would be faithfully mapped onto the output correspondents [v, z, ɣ] given the ranking FAITH(IV) >> *IV2.

(42) FAITH(IV) >> *IV2

/v, z, ɣ/	FAITH(IV)	*IV2
a. f, s, x	***!	
b. ☞ v, z, ɣ		***
/f, s, x/		
a. ☞ f, s, x		
b. v, z, ɣ	***!	***

The contrast illustrated by (42) is the wrong result for Spanish because this language does not contrast voiced and voiceless fricatives. The actual facts are that voicing contrasts are allowed to surface on stops but not on fricatives. To account for this asymmetry between Spanish stops and fricatives, I propose the markedness constraint *[IV2, CS2], which is a ban against the conjunction of the marked values on the Inherent Voicing scale (IV2) and the Consonantal Stricture scale (CS2). For convenience the Consonantal Stricture scale in repeated in (43).

(43) *The Consonantal Stricture scale*

stop	fricative/liquid	vocoid/laryngeal
CS1	**CS2**	**CS3**

(44) *[IV2, CS2]: The scalar values IV2 and CS2 may not appear within a single segment.

After examining (43), it becomes clear that *[IV2, CS2] has nothing to say about the structure of stops or vocoids because they do not have a CS2-value in their composition. Furthermore, although liquids bear a CS2-value, they are also immune to

*[IV2, CS2] because they contain an IV3-value. In other words, the markedness constraint *[IV2, CS2] is only concerned with the structural make-up of voiced fricatives because it is on this particular class of segments that the marked values of the properties of voicing and consonantal stricture converge. The ranking *[IV2, CS2] >> FAITH(IV) >> *V2 successfully accounts for the Spanish obstruent inventory.

(45) *[IV2, CS2] >> FAITH(IV) >> *IV2

/v, z, ɣ/	*[IV2, CS2]	FAITH(IV)	*IV2
a. ☞ f, s, x		***	
b. v, z, ɣ	***!		***
/f, s, x/			
a. ☞ f, s, x			
b. v, z, ɣ	***!	***	***

Whether the input fricatives are voiced or voiceless, their optimal correspondents must be voiceless because *[IV2, CS2] is top ranking (45a). It is precisely this ban against segments that contain the marked voicing and stricture values that keeps Spanish from having voiced fricatives. Consequently, the optimal inputs for surface [f, s, x] are /f, s, x/ because they constitute the most transparent mapping, as illustrated in (46).

(46) Selection of the optimal input

Input	Output	FAITH(IV)	*IV2
a. ☞ /f, s, x/	a. ☞ f, s, x		
b. /v, z, ɣ/	b. ☞ f, s, x	***!	

An issue that remains is that the voiced fricatives [β, ð, ɣ] do surface in Spanish. They appear in complementary distribution with their stop counterparts [b, d, g]. The existence of surface [β, ð, ɣ], however, does not invalid the analysis developed above. Obviously, *[IV2, CS2] is violated by these voiced fricatives, but this does not mean that *[IV2, CS2] is bottom ranking or that the constraint ranking in (45) does not hold. Rather, *[IV2, CS2] is always respected except when overridden by the surface identity constraint ASSIM(CS), which requires that adjacent output segments agree in stricture. This is a proposal put forward by Gnanadesikan (1997), who analyzes spirantization as a case of assimilation on the Consonantal Stricture scale. Under pressure by higher-ranking ASSIM(CS), Spanish output forms may contain the voiced fricatives [β, ð, ɣ], but only when this contributes to enhance the identity between adjacent output segments (e.g. [ár.ðe] < /arde/ 'it burns' vs. [an̪.de] < /ande/ 'walk').

(47) ASSIM (IV) >> *[IV2, CS2] >> FAITH(IV) >> *IV2

/arde/	ASSIM(CS)	*[IV2, CS2]	FAITH(IV)	*IV2
a. ár.de	*!			*
b. ☞ ár.ðe		*	*	*
/ande/				
a'. ☞ an̪.de				*
b'. an̪.ðe	*!	*	*	*

Candidate (47a), which contains a voiced fricative, is the optimal output for the input /arde/ because by changing /d/ to [ð], this segment manages to match the CS2-value of the adjacent segment [r]. By contrast, candidate (47a'), which contains a voiced stop, is the optimal output for the input /ande/ because the segment [d] already agrees with the segment [n] in the stricture value CS1 (nasals are obviously stops from a strictural point of view). In this case, spirantization would only give rise to unnecessary violations of other constraints (47b'). Although Gnanadesikan's proposal leaves several issues unresolved (e.g. why voiceless stops do not spirantize and why spirantization is only triggered by an adjacent segment on the left), I agree that surface identity is the driving force for this process.

The final issue that needs to be addressed concerning the inventory of Spanish obstruents is an alternation that involves the segments [y], a voiced palatal fricative, and [y̌], a voiced alveo-palatal affricate. The traditional assumption that /y/ is the underlying segment from which [y̌] is derived is at odds with our finding that the markedness constraint *[IV2, CS2] outranks FAITH(IV) in Spanish. This constraint ranking prevents the emergence of [y] regardless of the input.

(48) *[IV2, CS2] >> FAITH(IV) >> *IV2

/y/	*[IV2, CS2]	FAITH(IV)	*IV2
a. y	*!		*
b. ☞ y̌		*	*
/y̌/			
a. y	*!	*	*
b. ☞ y̌			*

Tableau (48) shows that [y̌] always scores better than [y] (48b). This is because [y̌] does not contain a CS2 value, which keeps it from running afoul of *[IV2, CS2]. I argue that the fact that the segment [y] does appear in Spanish output forms requires no further complication of our grammar. It was concluded above that although voiced fricatives are highly disfavored in Spanish, they may emerge under pressure by the surface identity constraint ASSIM(CS). This is also the case of [y]. The markedness of this segment is justified when it contributes to enhance surface identity. From this viewpoint, it comes as no surprise that [y] and [y̌] exhibit the same complementary distribution as [b, d, g] and [β, ð, ɤ]. Voiced stops appear after another segment with a CS1-value, whereas voiced fricatives appear after a segment with either a CS2 or a CS3-value. This is illustrated in tableau (49).

(49) ASSIM(CS) >> ADJACENT(CS) >> *[IV2, CS2] >> FAITH(IV) >> *IV2

/...ny̌.../	ASSIM(CS)	*[IV2, CS2]	FAITH(IV)	*IV2
a. ☞ ...ňy̌...				*
b. ...ňy...	*!	*	*	*
/...sy̌.../				
a'. ...s^{z}y̌...	*!			*
b'. ☞ ...s^{z}y...		*	*	*

Candidate (49a) is an optimal output sequence because the nasal and the voiced affricate are identical in stricture. This candidate also abides by *[IV2, CS2] because the IV2–value of the second segment appears in combination with a CS1-value. The only constraint this candidate violates is *IV2 because the affricate is voiced. By contrast, the sequence in (49b) violates all of the constraints because the voiced fricative is marked and detrimental to both surface identity and input-output faithfulness. In a parallel evaluation, the sequence in (49b') is selected as optimal despite violations of all lower constraints. The failed candidate (49a') shows that the voiced affricate may not keep its CS1-value when adjacent to a fricative since ASSIM(CS) is at the top of the hierarchy and penalizes this mismatch in CS-values.

An interesting case involves voiced coronal obstruents in the context of a lateral consonant. It has been noticed that whereas the non-coronal voiced obstruents /b/ and /g/ spirantize after /l/, the voiced coronal obstruent /d/ does not. As Gnanadesikan (1997) points out, this asymmetry follows from the fact that /l/ assimilates in point of articulation to /d/ but not to /b/ and /g/. However, it is not only /d/ that fails to spirantize. The same is true of the other voiced coronal obstruent of the language, /ǰ/. This is also rooted in the fact /l/ assimilates in point of articulation to /ǰ/. Following Padgett (1995), Gnanadesikan assumes that by being place-linked, the sequence [l̪.d] also shares the same stricture. That is to say that whereas in the sequences [l.β] and [l.ɤ], the lateral has its own place of articulation and consequently, its normal CS2-value; in the sequence [l̪.d] the lateral shares the CS1-value of the stop by virtue of having the same point of articulation. As a consequence of this, /d/ does not have to spirantize after /l/ because the sequence [l̪.d] is already identical in stricture. This is also true for the sequence /lǰ/, which is realized as [ľ.ǰ]. When the lateral becomes alveo-palatal, it also acquires the CS1-value of the affricate. Tableau (50) below illustrates this situation with two examples, one where the two segments are place-linked and one where they are not. Candidate (50a) is ruled out by ASSIM(CS) because the sequence [l.b] disagrees is strictural values. Note that since they are independently articulated, [l] has its normal

CS2-value, and likewise, [b] has its regular CS1-value. Candidate (50b) receives approval from ASSIM(CS) because the CS2-value of [β] matches the normal strictural value of [l]. In a parallel evaluation, candidate (50a') shows that when the voiced obstruent is coronal, spirantization is unnecessary. This is because [l] is able to assimilate in place to another coronal thereby acquiring its strictural value. The sequence [ľ.y̌] is optimal because it shares a CS1-value in compliance with ASSIM(CS) and it also avoids unnecessary violations of *[IV2, CS2] and FAITH(IV). Note that although candidate (50b') also satisfies ASSIM(CS) given that [ľ] and [y̌] share a CS2-value, it does so at the cost of violating all of the lower-ranking constraints.

(50) ASSIM(CS) >> ADJACENT(CS) >> *[IV2, CS2] >> FAITH(IV) >> *IV2

/...lb.../	ASSIM(CS)	*[IV2, CS2]	FAITH(IV)	*IV2
a. ...lb...	*!			*
b. ☞ ...lβ...		*	*	*
/...ly̌.../				
a'. ☞ ...ľy̌...				*
b'. ...ľy...		*!	*	*

The intention of the above discussion was not to account for spirantization but simply to show that this process is the driving force in the emergence of fully voiced fricatives in Spanish. Several generalizations are gained by incorporating this approach. First of all, there are no underlying voiced fricatives in Spanish. Both fully voiced and partially voiced fricatives arise as a means to achieve surface identity, which is required of adjacent output segments in terms of IV and CS values. Furthermore, spirantization does not only affect voiced stops but all voiced obstruents, which also includes an underlying voiced alveo-palatal affricate. From this optic, it is not merely coincidental that the segments [y̌] and [y] follow exactly the same distributional pattern as the rest of voiced obstruents of the language.

4. Summary

In this paper I have applied several recent theoretical proposals to Spanish data. I have argued that voicing assimilation is partial in Spanish because it is the best way to satisfy the conflicting requirements that two different types of correspondence relationships impose on output segments. While output segments must remain faithful to their input, they are also required to resemble neighboring segments. Partial voicing assimilation is a harmonic solution to these conflicting demands, where neither of these imperatives is completely subordinated to the other. Rather, they are both partially met. To capture these facts, it is essential to conceive featural correspondence as a bi-directional relationship so that faithfulness/identity can be assessed in terms of both loss and gain of feature values. With these theoretical assumptions, Optimality Theory can satisfactorily account for and explain processes of partial assimilation, which other frameworks simply refuse to deal with claiming that they are the result of low-level phonetic rules, when indeed partial voicing assimilation is in almost every respect exactly like total voicing assimilation, as this study has unveiled. The use of ternary scales also contributes to our understanding of assimilation processes and sound inventories. On a ternary scale, attraction is a type of assimilation in which adjacent scalar values are enough to satisfy surface identity. Furthermore, the fact that only one value on the scale is marked accurately reflects the role of voicing in all classes of segments. Within this model, voiceless obstruents are not marked for being voiceless, just like sonorants are not marked for being voiced. The only markedness constraint in the grammar that is concerned with voicing is *IV2, which penalizes only those cases where voicing is actually a marked property. Dispensing of markedness constraints that penalize not only the marked but also the unmarked is certainly a desirable result. Several important generalizations about Spanish are also gained by using markedness constraints that militate against marked scalar values only. *[IV2, CS2] reflects the cross-linguistic observation that voiced fricatives are more marked than voiceless ones. Although this is a high-ranking constraint in Spanish, it conflicts with surface identity constraints that force its violation. It was concluded that Spanish has no underlying voiced fricatives. However, partially voiced and fully voiced fricatives arise as optimal output segments when they contribute to enhance surface identity. This is precisely what the processes of partial voicing assimilation and spirantization do.

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Notes

1 These examples also show the effects of spirantization, which changes voiced stops into fricatives.

2 Since the data I analyze here comes from Latin American dialects, I ignore the voiceless interdental fricative phoneme /θ/ that occurs in Peninsular dialects.

3 The context for spirantization varies across dialects. In most dialects, voiced stops spirantize when preceded by any [+continuant] segment except for the homorganic sequence [ld]. But certain Latin American dialects (Colombia, El Salvador, Honduras, Nicaragua, etc.) are more restrictive and only allow spirantization post-vocalically.

4 Since AGREE has been formulated to deal specifically with obstruent clusters, another reason why this constraint needs be modified is to encompass cases where the two segments that participate in the assimilation process are not obstruents. Such is the case of Spanish, where sonorants may cause a voiceless obstruent to assimilate in voicing (e.g. [is^{z}.la] < /isla/ 'island').

5 To keep the evaluation simple, the reader is asked to ignore the effects of spirantization, which are orthogonal to the focus of this paper. Also note that violations of ASSIM(IV) are being counted only for obstruent-obstruent sequences. As the analysis develops, it will become clear that other sequences that run afoul of ASSIM(IV) (e.g. [aβ] or [ðo] in [aβ.súr.ðo]) are actually optimal given that neither of the two segments may be changed without running afoul of undominated principles such as FAITH(IV)-Onset or FAITH(IV3). To avoid complicating the tableaux, I choose not to include those violations in the count.

6 It is pointed out below that the presence of two IV-values within a single segment is sanctioned by the markedness constraint *CONTOUR, which both [β$^{\phi}$] and [^{z}s] violate.

7 This pattern contrasts with the pattern of a language like Korean, where coda obstruents become sonorants when preceding another sonorant (e.g. [sam.nal] < /sapnal/ 'blade of a shovel').

8 Note that although the sequence [..i.ko] is in violation of both ADJACENT(IV) and IDENTICAL(IV), [k] may not undergo voicing assimilation because it is parsed as an onset, where it is protected by undominated FAITH(IV)-Onset.

9 Another important contender is [ig.ná.sjo], which scores just as well as [iɣ.ná.sjo]. The former, however, is rejected by independent constraints that ban a voiced stop after a vocoid. This is also a type of surface identity that requires that adjacent output segments be similar in stricture (see Gnanadesikan 1997:185-189).