A critical view of licensing by cue: codas and obstruents in Eastern Andalusian Spanish[*]

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1 Introduction

  The confluence of two interconnected yet independent research

programs underlies this paper. One regards the issue of language

particular phonetics, while the other concerns the emergence of

Optimality Theory as the dominant paradigm in contemporary

phonology. Regarding the first, research over the past twenty years has

clearly shown that at least part of phonetic implementation must be

viewed as falling within the purview of the linguistic grammar (see, for

example, Pierrehumbert 1980, Pierrehumbert and Beckman 1988, Keating

1988, Cohn 1990, Huffman 1989). An interesting consequence of this is that language particular phonetics raises difficult questions regarding the objects and nature of phonological inquiry. These questions pertain, for example, to whether certain phenomena are phonological or phonetic, to where and/or how the line should be drawn between phonetics and phonology (e.g. Keating 1990, Huffman 1993, Pierrehumbert 1991, Cohn 1993, 1999, Zsiga 1997, Kingston and Diehl 1994, Myers 1999, Gerfen 1999), and to whether any line should be drawn at all (Ohala 1990).

Secondly, Optimality Theory (Prince and Smolensky, to appear, hereafter OT) does not constitute a theory of possible linguistic constraints per se. Rather it provides an architecture for evaluating input/output pairings in terms of a set of (partially) rank-ordered constraints. Insofar as it is a theory of how constraints interact, nothing in the architecture of the theory itself dictates the nature of the constraints invoked. In fact, given that a fundamental axiom of OT is that all constraints are violable, OT actually affords the opportunity to construct grammars from universal phonetic principles. This has traditionally been somewhat problematic for phonological theory, in that it has been

difficult to reconcile the putative universality of phonetically based

principles with language particular counterexamples to the

generalizations that give rise to those very same principles.[1] In OT, by

contrast, we expect to find constraint violations. That is, violations do not

falsify the universality of phonetically motivated principles, but rather,

violations account for why such principles constitute tendencies rather

than absolutes.[2]

  The combination of an architecture which does not inherently restrict the

nature of what can be a constraint with the ability to express phonetic

universals in a violable fashion has given rise to a proliferation of

constraints in the literature. Thus, constraints have been proposed which

take as their arguments an ever-growing range of elements. Many refer to

familiar categorical features. Constraints governing feature cooccurrence,

such as ATR/HI (Archangeli and Pulleyblank 1994), are an example.

Other constraints refer to the alignment of morphological and/or

phonological structures (McCarthy and Prince 1993) or to privileged

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errors are my own.
[1] See, for example, Archangeli and Pulleyblank (1994) for extended
discussion of phonetically motivated grounding conditions which
function, in essence, as soft universals.

positions within morphemes (Beckman 1997a). Of particular relevance here, numerous constraints have been employed which reference syllable structure. For example, Onset and *Complex (see Prince and Smolensky, to appear) militate for syllables with onsets while constraining possible syllable margins, respectively. Beckman (1997b) makes use of Faithfulness in Onset position. Itô, Mester, and Padgett (1995) and Itô and Mester (1994) employ Coda Conditions (CodaCond) to account for featural licensing or non-licensing, as does Lombardi (1999, this volume), who also employs a positional licensing constraint that presupposes syllable structure.[3]

At the same time, numerous constraints have been proposed which refer to phenomena outside of the traditional purview of work in generative phonology. Such constraints reference gradient phonetic properties such as duration or f0 (Kirchner 1997), general functional principles regarding minimal effort or maximal clarity, such as Lazy, (Kirchner 1997, this volume), Maintain and Mindist (Flemming 1995), perceptual Space

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[2] I am grateful to Paul Smolensky and Jaye Padgett for feedback on this issue. See Padgett (to appear) for additional discussion.
[3] See also Padgett (1995), who proposes a constraint requiring Faithfulness to Release that presupposes syllabification in that consonants can be predicted to be released in part based on their position in the syllable.

constraints (Ní Chosáin and Padgett, this volume), or phonetic contexts directly (Steriade 1997). In short, if research in phonetics and phonology has called attention to the role that phonetics must play in the grammar and, as a consequence, to the difficulty of distinguishing between the phonetic and the phonological, OT has made it easy, formally, to eradicate the line between the two.

Within this context, the broad issue under consideration here is the licensing of segmental contrast, with a specific focus on the role of phonetic cues in determining contrast distribution. In particular, I examine recent claims that contrast licensing is best viewed as being directly driven by the presence or absence of phonetic cues (cf. Steriade 1997), rather than by constraints which call upon familiar phonological entities such as syllable onsets and/or codas. Anticipating my conclusions, I will argue that while cue-based accounts are attractive and often highly insightful, they fail to eliminate the need for more traditional constraints in the phonological grammar.

As a point of departure, in §2 I discuss Steriade's (1997) notion of LICENSING BY CUE as representative of direct phonetic licensing. In so doing, I review two cases which would appear to motivate the superiority

of cue licensing both in terms of empirical coverage and explanatory

depth. In §3, I turn to the problem of obstruent licensing (or, alternatively,

obstruent neutralization) in coda position in Eastern Andalusian Spanish.

Here, I argue that the best account of obstruent licensing in Eastern

Andalusian resides in a more traditional, syllable-based analysis. Finally,

I present my conclusions in §4, advocating a view in which both phonetic

cues and traditional structures have an active role to play in phonology.

2 Direct phonetic licensing

 Steriade's (1997) recent discussion of licensing by cue provides a clear

example of a directly phonetic approach to accounting for phonotactic

constraints on contrast licensing. A simple example is her discussion of

the distribution of apical stops in Gujarati (with data from Dave 1977), a

language which contrasts the plain alveolar [t] with its retroflex

counterpart [ʈ]. Steriade notes that, phonetically, what most clearly

differentiates these stops is the presence of VC, but not CV, formant

transitions. In Steriade's terms, the VC context supplies the richest

acoustic cues for *implementing* the distinction, and Steriade argues that this

phonetic generalization has two direct consequences for phonological

markedness. One is that if a language loses the contrast between [t] and [t̪], it will do so first in word-initial or post-consonantal position, i.e. a position lacking VC transitions. The other is that if a language possesses this contrast, it will have it post-vocalically. Importantly, neither of the relevant contexts, post-vocalic and non-post-vocalic, translates into a single syllable position. For example, although word-initial consonants will be onsets, post-consonantal consonants can either be onsets or codas, depending on the preceding segmental material and the syllabification pattern of the language. Steriade concludes that it is thus not syllable position per se that licenses contrast and drives markedness in this case. Rather, it is the presence of a phonetic environment that is cue-rich, i.e. a phonetic environment that renders the contrast easier to implement.

A second, illustrative case discussed by Steriade involves the licensing (or neutralization) of laryngeal features in Klamath. Building on Blevins (1993), Steriade notes that Klamath has contrastive aspiration and ejection on obstruents, but that these contrasts are positionally conditioned. Specifically, laryngeal contrasts are neutralized in two contexts: 1) before another obstruent, and 2) word-finally. At first glance, this appears to make Klamath a prototypical case of laryngeal neutralization in coda

position (cf. Lombardi 1991, 1995), given that pre-obstruent and word-final positions are generally subsumable under the category of syllable coda. However, for Klamath this approach quickly runs into trouble.

The problem resides in the fact that aspirates and ejectives are licensed in Klamath before plain sonorant consonants and that all VCCV sequences in Klamath must be syllabified VC.CV. Thus, even if a CC cluster is comprised of an obstruent followed by a plain sonorant, as in /pʰet'-wa/ 'floats in water', the surface syllabification is [pʰet'.wa], a form in which ejection is licensed in coda position.[4] Clearly, then, one cannot trivially argue that syllable position is responsible for the licensing/neutralization of contrastive ejection and aspiration in obstruents in Klamath. Instead, Steriade claims that the situation is better understood in terms of the phonetic context in which the laryngeal features are licensed; i.e. laryngealization is licensed in an environment sufficiently rich in phonetic cues.

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[4] The Klamath data are actually more complicated than what is discussed here in that laryngeal contrasts are neutralized before not only obstruents but also aspirated and glottalized sonorants. See Steriade (1997) and the references therein for more details. The larger point regarding the role or non-role of syllable structure in the licensing of laryngeal contrasts in obstruents is not undermined by the additional data, however.

What are the relevant cues? For obstruent aspiration and ejection, Steriade argues that they are burst properties and VOT, both of which require a "right-hand modal sonorant context" (94) to be felicitously implemented. Under this view, the modal voicing of a plain sonorant consonant provides the necessary context, regardless of whether that sonorant is an onset or a coda. In broad strokes, then, Steriade's arguments really amount to two fundamental claims. First, we should look to what have traditionally been viewed by phonologists as low level phonetic (i.e. non-phonological) contextual properties such as CV transitions, presence or absence of burst, f0 excursions, duration and so forth, for explanations regarding where phonological contrasts are licensed/neutralized. Secondly, the formal encoding of these patterns in the grammar should be accomplished by direct reference to these phonetic properties rather than through more traditional phonological constraints. That is, *ejection in cue impoverished contexts*–contexts which are decomposed into harmonic scales and which project a range of constraints–rather than *ejection in coda.* That this is not an oversimplification of Steriade's position is evidenced by the following strong claim: "More generally, it remains to be seen whether the

syllable as a constituent is at all a relevant factor in controlling phonotactic possibilities." (99)

In the remainder of this paper I discuss data which challenge this view by militating for a case of syllable-based rather than direct phonetic licensing of contrast. In particular, I examine the licensing of obstruents in coda position in Eastern Andalusian Spanish (EAS).

3 Obstruent licensing in Eastern Andalusian

In this section I examine the phenomenon of obstruent licensing in Eastern Andalusian. §3.1 provides the necessary background, with a brief discussion of coda phonotactics in Standard Peninsular Spanish (SPS). I then turn in §3.2 to a description of the relevant EAS facts and to the arguments for why syllable position, and not simply phonetic context, is crucial to understanding the EAS patterns. In §3.3, I briefly sketch how a syllable-based account would proceed in OT.

3.1 Standard Peninsular Spanish and obstruent codas

As is well known, /s/ is by far the most common coda obstruent in Spanish. This is exemplified in forms such as [kas.ko] 'helmet' and [ga.fas]

'eyeglasses'.[5] Other obstruents also surface as codas, although these almost always appear word-internally.[6] Relevant here is that word-internal coda obstruents are contrastive for both place and voice features in SPS. The range of data is given in (1) and (2). In (1a), voiced obstruent codas surface before voiceless onsets. Note that these consonants need not share place or manner features (e.g. [ad.xun.to]). In (1b) we have cases in which voiceless obstruent codas are followed by voiceless onsets, which, again, need not share their place and manner features with the preceding coda (e.g. [ak.θe.so] 'access').

1) Voiced and voiceless coda obstruents before voiceless onsets

   a) [ab.sur.do] '**absurd**'; [sub.sis.tir] '**subsist**'; [ob.tu.so] '**obtuse**';

      [ob.θe.no] '**obscene**', [sub.ko.mi.sjon] '**subcommission**';

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[5] See Harris (1983) for the most complete overview of syllable structure in Spanish in general.

[6] In peninsular dialects with phonetic [θ], there are numerous words containing [θ] word-finally, as in [lapiθ]. In all American dialects and some peninsular dialects, of course, [θ] has merged with [s]. Some words also have a [d] word-finally (e.g. /bajadolid/ 'Valladolid', /madrid/ 'Madrid'), and other obstruents surface in codas of word-final syllables in borrowed forms such as [klub] 'club' or [biθeps] 'biceps', though these are highly marginal.

[ab.sen.tis.mo] '**absenteeism**'; [ad.sor.ber] '**absorb**', [ad.ki.rir]

'**acquire**'; [ad.xun.to] '**adjunct**', [ob.te.ner] '**obtain**'

b) [kap.tar] '**capture**'; [ap.to] '**apt**', [kap.su.la] '**capsule**', [klep.to.ma.no]

'**kleptomaniac**'; [et.θe.te.ra] '**etcetera**', [pak.to] '**pact**', [ak.θe.so]

'**access**'; [ek.si.lio] '**exile**'; [ak.tor] '**actor**', [de.fek.to] '**defect**';

[in.fek.tar] '**infect**'; [fak.tor] '**factor**'

By contrast, (2a) and (2b), respectively, provide examples in which

voiced and voiceless codas precede a following onset that is phonetically

voiced. Again, there is no obligatory sharing of place and manner features

between the coda and the following onset (e.g. [mag.da.le.na] '**cupcake**' and

[tek.ni.ko] '**technical**').

2) Voiced and voiceless obstruents before phonetically voiced onsets

a) [ab.di.kar] '**abdicate**'; [sub.di.to] '**subject**'; [ab.ne.gar] '**renounce**';

[ad.mi.rar] '**admire**'; [e.nig.ma] '**enigma**', [ag.nos.ti.ko] '**agnostic**',

[sig.no] '**sign**', [pug.nar] '**bid**', [dig.no] '**dignified**'; [mag.da.le.na]

'**cupcake**', [ig.no.ran.te] '**ignorant**', [dog.ma.ti.ko] '**dogmatic**'

b) [ip.no.sis] '**hypnosis**', [et.na] '**Etna**', [a.rak.ni.do] '**arachnid**', [fut.bol]

'**soccer**', [et.ni.ko] '**ethnic**', [ak.ne] '**acne**', [ak.me]; '**acme**' [ap.nea]

'apnea', [tek.ni.co] 'technical', [rit.mo] 'rhythm', [a.rit.me.ti.ka]

'arithmetic'

Note that while this does not pretend to exhaust the generalizations

regarding syllable contact in Spanish, such forms do indicate that we

cannot globally attribute the voicing, place, or manner of coda obstruents

to those of a following onset. In SPS these features can be licensed on their

own. These observations lead us to the case of Eastern Andalusian.

3.2 Obstruent codas and EAS

One of the most well-known features of EAS is the phenomenon of S-

ASPIRATION, which is most commonly discussed as involving the

"deletion" of word-final /s/ and the concomitant aspiration and

sometimes lengthening of the preceding vowel (see, for example, Zamora

Vicente 1969, Rodríguez Castellano & Palacio 1948, Alarcos Llorach 1958,

Goldsmith 1981, Zamora Munné & Guitart 1982, Guitart 1985, Hualde

1987). This is illustrated in forms such as /ganas/ which are realized in

EAS as [ga.na^h] 'desire'. Less discussion, however, has focused on the fact

that s-aspiration is not limited to word-final tokens of /s/ (see, for

example, Romero 1995, Gerfen and Piñar 1999).[7] These word-internal cases of s-aspiration result in the lengthening (i.e. gemination) of the following consonant. This can be seen in the words in (3), which contrast EAS realizations with their SPS counterparts.

(3)   SPS   EAS   gloss

      [bos̱.ke]   [boʰk.ke]   forest

      [es̱.la.βo]   [eʰl.la.βo]   Slavic

For the purposes of illustration, we can see that gemination is clearly visible in the representative spectrograms in Figures 1 and 2 for a native EAS speaker (S1). Figure 1 shows the singleton /l/ of [alero] 'eaves of a roof', while Figure 2 provides an example of the geminate in [eʰl.la.βo].

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[7] The lack of focus on word-internal s-aspiration is due to the potential morphological consequences of word-final s-aspiration, given that both familiarity and plurality are expressed by word-final /s/ in Spanish.
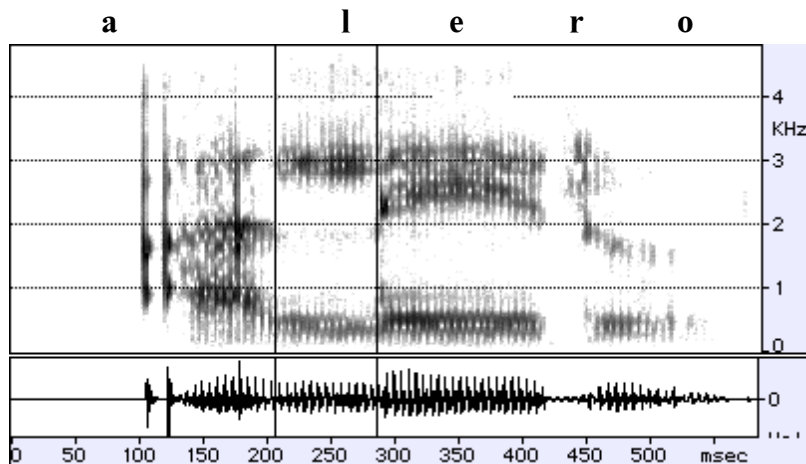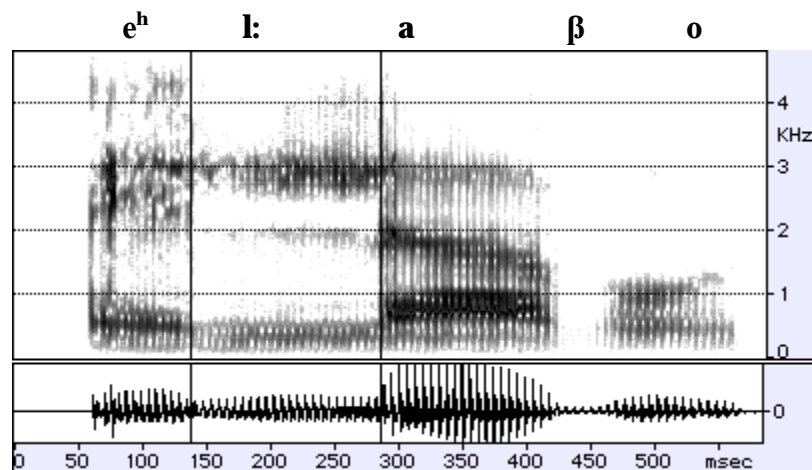
Figure 1: /alero/ 'eaves of a roof'

Figure 2: /es.la.βo/ 'Slavic'

Descriptively, the simplest characterization of both word-internal and word-final s-aspiration is that they occur in coda position. This becomes clear when we consider the general behavior of [sC] clusters across all dialects of Spanish. As is well-known, [sC] clusters (where C is any

obstruent, liquid or nasal) are banned in onsets in Spanish. That [sC]

clusters must be heterosyllabic can be demonstrated by garden variety

distributional arguments. Thus, while forms such as [es.ta.do] 'state'

abound, Spanish lacks any forms such as *[sta.do]. Additionally, borrowed

forms beginning with [sC] clusters are phonologized via the epenthesis of

a word-initial [e], as in [es.ki] 'ski', and, similarly, the so-called foreign

accent syndrome, e.g. the production of [es.kul] for the English [skul]

'school', also provides evidence for the impossibility of tautosyllabic [sC]

clusters in Spanish.

   Arguably, in and of itself this constitutes evidence that syllable structure

plays a role in general Spanish phonotactics. That is, it is important to

recognize that Spanish does not ban [sC] sequences. Rather, [sC]

sequences are only prohibited in a particular syllable position, i.e. in the

onset. If we abandon the notion of the syllable in accounting for the

behavior of /s/ in /sC/ clusters, one might attempt to claim that /s/ is

licensed only when adjacent to a preceding or following vowel. However,

such an approach quickly runs into problems from forms such as

[abs.trak.to] 'abstract', in which /s/ is both preceded and followed by a

consonant. In addition, it is unclear why such a condition should be

imposed at all, given that VC and CV transitions most strongly cue place. That is, it is unclear why VC or CV contexts should be a requisite for cueing /s/ in particular, a sibilant whose most salient cues are internal to the segment (more on this below). Crucially, then, the generalization that [sC] clusters are banned in onset raises serious challenges to anyone seeking to abandon the syllable in favor of constraints which govern segmental licensing via direct reference to phonetic cues.

   Returning to the issue of s-aspiration in EAS, we see that all of the word-internal cases of s-aspiration thus correspond to forms in which /s/ would surface as a coda in SPS. The length distinction illustrated in the spectrograms above is highly robust[8]. To confirm this, I ran a small experiment, in which I recorded two native, female EAS speakers (S1 and S2), both from the city of Granada, Spain. The speakers recorded a set of eight words ([es.la.βo] 'Slavic' appeared twice on the list), each of which was written on a single note card in Spanish orthography. The list is provided in (4).

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[8] See also Gerfen and Piñar (1999) for evidence of the robust nature of the gemination process. In that study, ten native EAS speakers exhibit the same pattern of gemination for /t/ in [kaʰt.ta] (from underlying /kas.ta/ 'caste') that the two speakers here exhibit for /l/.

(4) Experimental list

orthography	gloss	phonemic representation
eslavo	'Slavic'	/eslabo/
Atlanta	'Atlanta'	/atlanta/
atleta	'athlete'	/atleta/
aclara	's/he/it clears up'	/aklara/
aclama	's/he acclaims'	/aklama/
alaba	's/he praised'	/alaba/
alero	'eaves of a roof'	/alero/

Speakers were instructed to produce each word in the frame sentence *la palabra es* _____, *tío* 'the word is _____, pal'. The note cards were randomized by shuffling after each pass through the list, and each was read multiple times by each speaker (speaker S1 = 21 repetitions per word; speaker S2 = 12 repetitions per word). The readings were done in a quiet room and recorded on a Marantz PMD 222 professional cassette recorder with a Shure SM10A-CM close-talking, unidirectional microphone. Speakers were informed that they were participating in a study of how people from Granada speak and that they should speak in a

natural and relaxed fashion, as if they were at home with family. These
instructions were aimed at mitigating the chances that the standard
orthography would induce a formal reading register, i.e. that speakers
would fail to produce forms with their normal s-aspiration. Additionally,
the frame itself is highly informal in tone in order to induce speakers to
speak naturally. During the task, neither speaker had any difficulty
producing typical EAS forms.

  The data were digitized at 22 kHz. with 16 bit sampling and analyzed in
SoundScope on a Power Macintosh computer. For each word, the
duration of /l/ was measured by hand. The onset of /l/ was determined
by locating the amplitude drop in the waveform and the offset of F2 of the
preceding vowel. The offset of /l/ was determined by locating the rise in
amplitude of the waveform and the onset of F2 in the following vowel.
After measuring the data, I first compared the duration of the geminate [l:]
in the s-aspirated context (/es.la.bo/ 'Slavic') with that of the singleton [l]
in the words /a.le.ro/ 'eaves' and /a.la.ba/ 's/he praises'. That is, I
compared the duration of [l] in the underlying /vslv/ context with that of
the /vlv/ context. The robustness of the distinction is shown in (5), where
the mean duration of geminated [l] in the s-aspirated forms is more than

twice that of the singleton [l] for both speakers. Figure 3 provides a bar

graph of the mean [l] durations and standard deviations by context for

each speaker.

(5) Mean /l/ durations

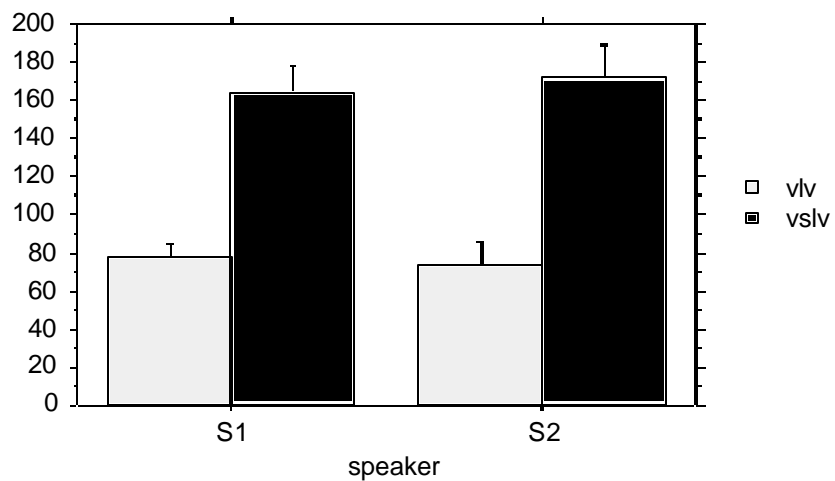| speaker	[l] duration in /vlv/ in msec.	st. dev.	[l] duration in /vslv/ in msec.	st. dev.
S1	76.936	(8.012)	162.843	(14.989)
S2	72.302	(13.260)	171.5	(17.706)

Figure 3: /l/ durations in msec. by speaker and context

Not surprisingly, a two factor ANOVA with context (/vlv/ vs. /vslv/) as the first factor, and speaker as the second, shows that the difference in [l] duration is highly significant by context (p = .0001).

Comparing Eastern Andalusian to Standard Peninsular Spanish, we thus see that in SPS all [sC] clusters must be heterosyllabic, while EAS bans /s/ from appearing in coda position. In word-final position in EAS, /s/is deleted, but word-internally, the coda position is maintained via gemination of the following onset. This is summarized in (6).

(6) Comparison of SPS and EAS

Context	SPS	EAS
$_\sigma$[sC	no	no
s]$_\sigma$ #	yes	no
s] $_\sigma$[C	yes	no, but syllable is closed via gemination

How might this scenario be accounted for under a phonetic cues approach? If we abandon syllable structure as the driving force behind the distributional facts, it is reasonable to assume that we would be led to claim that EAS requires [sV] contexts for the licensing of [s]. That is, [s] is only licensed in contexts in which there is a transition to a following

vowel. Our contextual constraints would thus be ordered such that [s] is banned in contexts lacking this transition.

One objection to this approach, however, is that unlike laryngeal features in stops, the most salient cues for fricatives lie largely within the fricatives themselves. In the case of sibilants such as /s/, high frequency noise is generated as a result of channel turbulence at the point of constriction, as well as by the noise resulting from airflow hitting the teeth in front of the constriction (see, for example, Shadle 1997, Johnson 1997, Stevens 1998). In Steriade's terms, sibilants can be said to have strong *internal* cues, rather than relying heavily on contextual cues, as stops must. A priori, we should thus expect contexts such as [CV] transitions to play a far less significant role in licensing fricatives than in the licensing of laryngeal features in stops.

Further objections to a phonetic cues approach emerge, however, when we consider the behavior of other obstruents in Eastern Andalusian. As noted above, less attention has been paid to the fact that all obstruent codas are, in fact, "aspirated" in that all word-internal codas that would

surface as obstruents in SPS will trigger the gemination of the following

onset in EAS. Examples are given in (7).[9]

(7) Aspiration of all obstruent codas in EAS[10]

SPS	EAS	Gloss
[ap.to]	[a^{h}t.to]	'apt'
[piθ.ka]	[pi^{h}k.ka]	'pinch, small amount'
[ak.θjon]	[a^{h}θ.θjon] ([a^{h}s.sjon])	'action'
[ob.tu.so]	[o^{h}t.tu.so]	'obtuse'

Of particular interest here is the behavior of stop+liquid clusters. As the

data in (8) show, these are not globally banned as onsets in EAS (or any

other dialect of Spanish).

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[9] Note that EAS does not ban codas altogether. Nasals and liquids do
surface in coda position just as they do in SPS. Examples include forms
such as [par.ke] 'park', [pal.ko] 'balcony', and [men.ta] 'mint'.
[10] As pointed out in note (4) above, many Andalusians speak the so-called
seseo dialect, in which all SPS interdental fricatives are realized as [s].
Thus, [a^{h}θ.θjon] 'action' in the table is realized as [a^{h}s.sjon] in the seseo
dialect.

(8) Initial stop+liquid clusters

a) [klaro]   'clear'   c) [plano]   'flat'

b) [grado]   'grade'   d) [trapo]   'rag'

Word-internally in EAS, the clusters in (8) do not trigger the gemination of the following liquid, as seen in (9). Put in simple terms, the obstruents appear to be patterning as part of the onset.

(9) Word-internal obstruent+liquid clusters

a) [a.klara]   's/he/it clears up'   c) [a.plika]   's/he/it applies'

b) [a.grada]   's/he/it pleases'   d) [a.trapa]   's/he/it traps'

However, such forms might equally look like an argument in favor of the cue licensing approach. Specifically, the distinctive voicing and place features for obstruent stops can be viewed as banned when the following C is an obstruent. Thus, underlying /apto/ 'apt' is realized in EAS as [aʰtto] because the underlying obstruent+obstruent contexts are cue impoverished relative to the expression of voicing and place on C1. By contrast, the modal voicing of the following liquid in forms such as [aplika] 'she/he applies' presumably provides a sufficiently rich context for the expression of the cues for voicing and place at the release of the stop.

Though I have no disagreement with the reasoning behind such a story, serious problems arise regarding its adequacy in accounting for the data directly. First, the problem of /sl/ clusters remains unresolved. That is, why should medial [kl] and [pl] be licit clusters, while /sl/ triggers s-aspiration? Secondly, we miss a broader generalization that becomes evident upon consideration of the behavior of /tl/ clusters in EAS. Interestingly, these behave phonetically like /sl/ clusters, rather than like their /pl/ and /kl/ counterparts. That is, input /tl/ clusters pattern as though the underlying /t/ must be syllabified as a coda, thus conditioning the gemination of the following /l/.

Note that the syllabification of /tl/ clusters is ambiguous across Spanish dialects (see Harris 1983). In Mexico, they can be onsets, as evidenced by the word-initial /tl/ clusters incorporated into Mexican Spanish from contact with indigenous American languages.

(10) /tl/ onsets in Mexican Spanish

    a) [tla.pa.ne.co] 'Tlapaneco (language)'

    b) [wau.tla] 'Huautla (name of a town)'

Though initial /tl/ clusters are vanishingly rare at best in peninsular

Spanish dialects, we do find common forms such as /atlas/ 'atlas',

/atlantico/ 'Atlantic', /atleta/ 'athlete', or /atlanta/ 'Atlanta' all of which

contain medial /tl/ clusters. Of particular importance here is that their

phonetic implementation makes it clear that EAS treats the /t/ of

underlying word-internal /vtlv/ sequences as it does all other obstruent

codas. Consider, for example, the spectrograms in Figures 4 and 5, which

contrast /aklara/ 's/he makes clear' with /atleta/ 'athlete' for S1,
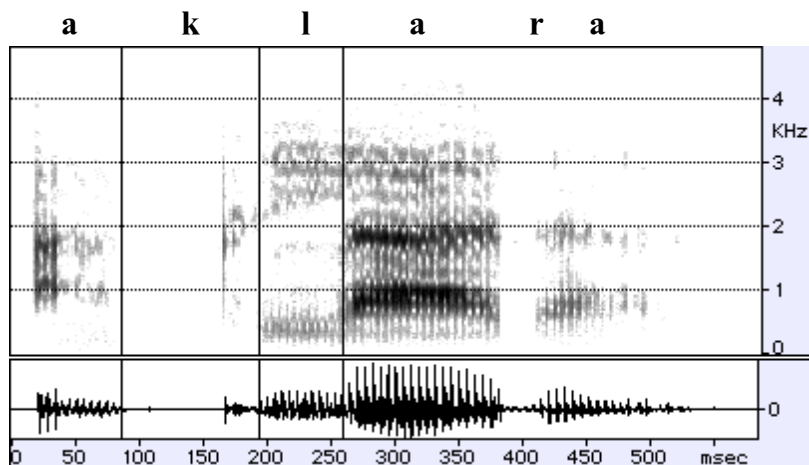
respectively.
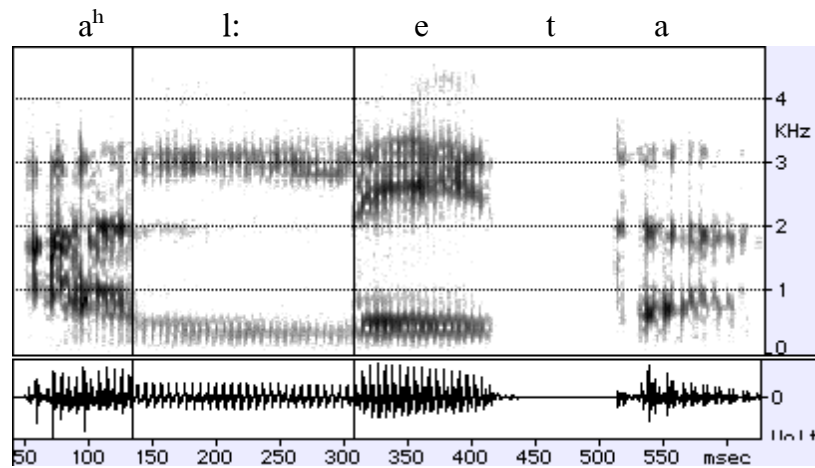
Figure 4: /aklara/ 'she/he/it clears up'

Figure 5: /atleta/ 'athlete'

In /aklara/, there is full stop closure for [k] followed by the liquid [l]. By contrast, /atleta/ lacks any stop closure for the first /t/. Rather, /atleta/ is phonetically realized as [aʰlleta], with [l] gemination of the type that we saw above in [eʰllaβo] from underlying /eslabo/ 'Slavic'. Phonetically, then, /t/ in /tl/ clusters is *behaving* in the same way that all other obstruent codas behave in EAS. This can be seen when we compare average [l] durations in underlying /vtlv/ contexts with /vklv/ contexts in Figure 6. Again, a two factor ANOVA of /l/ duration by context (/vklv/ vs. /vtlv/) and speaker reveals context to be highly significant (p = .0001).
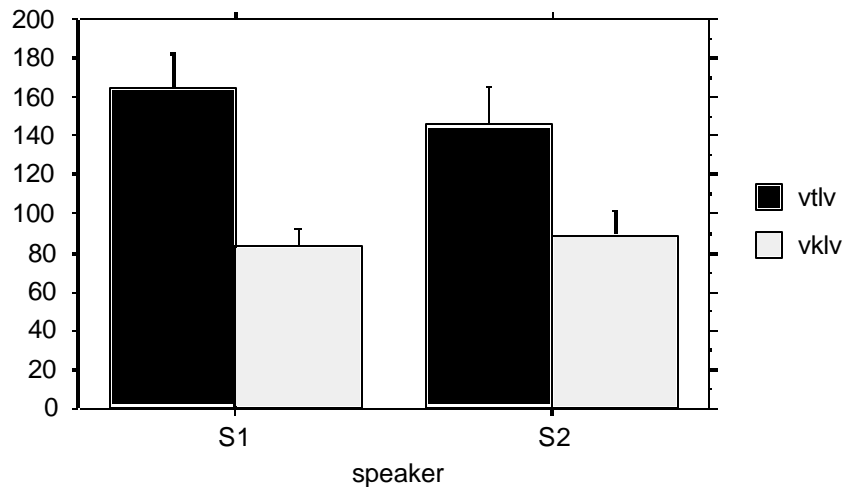
Figure 6: [l] in /vtlv/ vs. /vklv/

The bar graph in Figure 7 shows the full range of data involving all four

contexts measured in the words in the experimental list above: /vlv/,

/vtlv/, /vslv/, and /vklv/, respectively. Note the clear two-way split for

both speakers consisting of [l]-gemination in coda contexts (/vslv/ and

/vtlv/) versus the singleton [l] in the onset cluster context /vklv/ and the

/vlv/ context. To test this, I recoded the data, creating two categories,

coda (pooling the /vtlv/ and /vslv/ conditions) and onset (pooling

/vklv/ and /vlv/ conditions). Again, a two factor ANOVA of [l] duration

by context and subject confirms that [l] is significantly longer in the coda
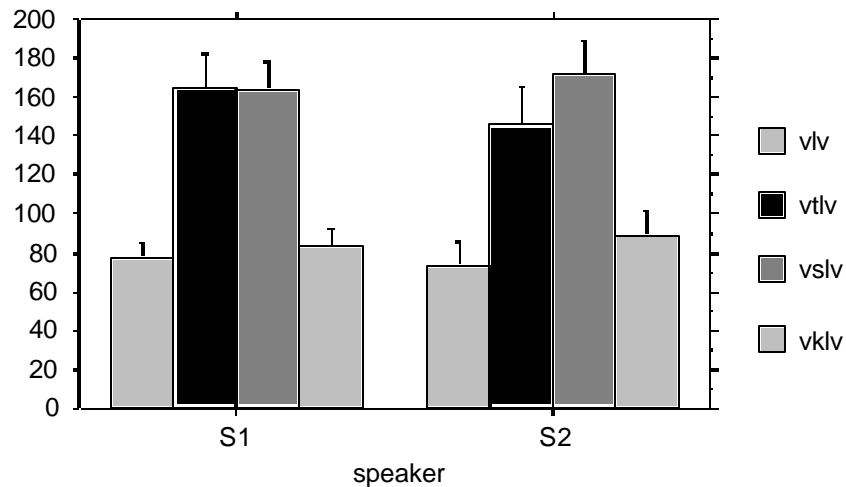
context (p = .0001).

Figure 7: /l/ duration in all contexts by speaker

In sum, phonetic evidence confirms that [kl] patterns as an onset in EAS,

while the /t/ of /tl/ clusters patterns identically to underlying /s/ in

/sC/ clusters, by triggering so-called s-aspiration. Its *behavior* is entirely

consistent with what we know to be the behavior of all obstruent codas in

EAS. And this leads us to the larger conclusion that it is syllable position

and not simply phonetic context which dictates the licensing of distinctive

features in EAS obstruents. In this sense, EAS constitutes an interesting

counterpoint to Steriade's Klamath discussion in that EAS can be viewed

as an anti-Klamath. It isn't the phonetic sequencing which conditions

contrast licensing independent of syllable structure. Rather, it is syllable

structure itself that drives licensing[11].

3.3 Sketching an OT approach

In OT terms, then, the most straightforward characterization of the

differences in the distributional properties of obstruent contrasts in EAS

versus SPS lie in constraints which invoke syllable structure directly.

Though an exhaustive characterization of EAS syllabification is beyond

the scope of this paper, the general picture emerges fairly clearly. I first

assume that EAS and SPS share the ranking of constraints governing licit

onset combinations. The dialects' respective hierarchies will thus generate

the same set of possible onsets, and, importantly, will dictate which

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[11] One might argue that a phonetic cues approach to "s-aspiration" in /tl/ contexts resides in the increased difficulty of releasing /t/ into a lateral, as opposed to releasing velar or bilabial stops into a following lateral, as in forms such as [a.kl.ra] in which there is no aspiration. Under such an approach, the aspiration of obstruents in Eastern Andalusian would obtain in the more phonetically driven "unreleased" contexts, rather than in syllable-final position. The idea merits further investigation, though one would have to quantify more carefully the notion of "difficulty". Note, for example, that /t/ does not aspirate before the alveolar tap, as in [a.tra.pa] 's/he traps'. Under the analysis here, this is due to the fact that /tr/ is a licit onset cluster, while /tl/ is not. A larger problem is that this account still fails to account for behavior of /s/, which aspirates before all following consonants. The treatment here unifies the explanation under the rubric of the syllable.

segments must be mapped into coda position for any given input string.

Of interest here is that the difference between the dialects resides in the

treatment of how input obstruents that cannot be mapped into output

onsets are realized (or not) as codas. The task of generating the differences

between the two dialects thus falls to the relative ranking of coda and

faithfulness constraints.

  This is the typical scenario in OT under which constraint ranking

derives typological variation. For its part, SPS must be characterized by a

high ranking of faithfulness over coda constraints, thus allowing for the

independent licensing of obstruents in coda. In EAS, coda constraints on

obstruents will outrank input faithfulness. Of course, coda constraints

will not outrank all input-output faithfulness, given that EAS is not driven

towards the more unmarked situation in which codas are banned

altogether. Thus, EAS does not simply delete word-internal obstruents in

coda position, but rather, geminates the following onset to maintain a

closed syllable. (Additionally, sonorant consonants must be allowed to

surface as codas, as seen in forms such as [par.ke] 'park' or [al.kal.de]

'mayor'.)

As an illustration of how such an analysis would proceed, let us consider a form such as /kasta/ 'caste', which surfaces as [kat.ta]. [12] First, assuming a correspondence-based view of faithfulness (McCarthy and Prince 1995), we might argue that MaxC militates for the preservation of input consonants, while Coda Condition (CodaCond) bans obstruents from coda position. (Note that for simplicity I employ CodaCond here as shorthand for the family of right margin constraints in Prince and Smolensky (to appear) and return to this issue below.) Simply ordering CodaCond >> MaxC alone would produce the effect of deletion, predicting a surface [ka.ta]. Since s-aspiration in EAS preserves syllable weight, a highly ranked Max constraint for moras, MaxMora (see, for example Broselow, Chen, and Huffman (1997)) would appear to be well motivated, as seen in (11).[13]

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[12] I abstract away from the issue of aspiration here.

[13] Note that, given richness of the base, there is no reason to assume that moraic information must be excluded from input.

(11) MaxMora

Input: /kas.ta/	CodaCond	MaxMora	MaxC
a) kas.ta	*!		
b) ka.ta		*!	*
c) ☞ kat.ta			*

Three points are of note regarding candidate (c). First, while it preserves
the moraic structure of the input, one might ask why vowel lengthening
does not occur, giving us an optimal output of [kaa.ta]. Formally, this can
be accomplished by penalizing surface long vowels more heavily than
banning geminate consonants: *V: >> *C:. Both of these constraints must
be ordered below MaxMora.[14] Secondly, I have assessed a MaxC violation
to the winning candidate in (c) under the assumption that gemination
involves the association of a single segment to the coda mora of the first
syllable and the onset of the second (see Hayes 1989), as in (12).

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[14] Word-finally, where there is no following onset available for
gemination, at least some degree of vowel lengthening does occur.

(12) Geminate representation

```
        σ              σ
       /|\             |
      / μ  μ           μ
     /   \  /\         |
    k    a  t          a
```
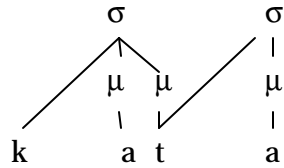
The optimal output in (11) thus violates MaxC for the input /s/. Finally, I have not assessed a CodaCond violation to (c), despite the fact that gemination supplies a coda consonant. In this sense, my use of CodaCond is clearly an oversimplification. A comprehensive analysis would require a more finely grained CodaCondition (CodaCond) approach (cf. Itô 1989; Itô, Mester, and Padgett 1995; Itô and Mester, 1994) in which obstruents cannot be independently licensed in coda position. Specifically, the strategy would entail the argument that the shared association of the geminate segment spares it from violating CodaCond. By contrast, an obstruent would violate CodaCond were it to be uniquely associated to the final mora of the first syllable.

Note that the formal possibilities here vary depending on assumptions regarding the representation of geminates and the interpretation of association lines. More importantly, however, the particular articulation of coda constraints is orthogonal to the larger issue under discussion.

That is, the range of EAS facts receive the simplest, most unified account in terms of direct reference to syllable structure in the constraint hierarchy rather than in terms of a *F(sans phonetic cues) approach to the data.

4 Conclusions

In this paper, I have argued against viewing the licensing of contrast strictly in terms of licensing by phonetic cue. In so doing, I have provided evidence from Eastern Andalusian which strongly points towards the necessity of taking syllable structure into account in order to understand where obstruent contrasts can be licensed in this dialect. Though attempting to prove a negative is an inherently dangerous proposition, my analysis argues that phonology cannot reduce to directly referencing cues such formant transitions, f0 perturbations, duration and so forth. That is, we cannot (and thus should not) dispense with higher-order categorical categories such as onset and coda, nor with the constraints which refer to them in our OT grammar. In EAS, a highly ranked CodaCond (Itô, Mester, and Padgett , 1995, Itô and Mester , 1994, Lombardi, 1999, this volume) drives the surface licensing of contrastive

obstruent features; that is, it neutralizes obstruents that are contrastive in coda position in the standard peninsular variety of the language.

I do not, however, wish to claim that the project of direct phonetic licensing is off the mark or that subphonemic phonetic cues have no place in phonological analyses. There are, in fact, good reasons to believe that such approaches provide productive and insightful results. A particularly important aspect of the cue licensing approach is that it attempts to derive phonological patterns from an in-depth consideration of the physiological and physical properties of both speech production and perception (cf. Ohala 1990, Lindblom 1990). The potential benefits are enormous if we consider the circularity in much phonological work. For example, Ohala (1990) discusses the pitfalls of invoking constraints such as *[F] in coda, based on the observation that [F] fails to appear in coda position in language after language. Undeniably, there is a fundamental circularity in using observed patterns of segmental ordering in syllables to derive a sonority hierarchy and subsequently using that same hierarchy to *explain* the possible orderings of segments within syllables. This is not to say that such a hierarchy fails to make predictions about the likelihood of finding

particular syllable types in natural languages, but it offers little in the way of understanding why such patterns arise.[15]

Nevertheless, the EAS data show that it is not clear that the viability of such constraints obviates the need for traditional syllable-based analyses. To the extent that these approaches often afford identical empirical coverage, the situation invites reduction, as seen by Steriade's (1997) questioning of the relevance of syllable structure at all in conditioning segmental phonotactics. At the very least, a phonetic cues approach should shift the burden of proof to traditional approaches like the one I have sketched for EAS. That is, we must ask why one should resort first to explanations that are less directly grounded in articulation and/or acoustics, rather than assuming a priori the adequacy of an account based on higher level constraints.

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[15] Jaye Padgett (p.c.) has questioned whether the sonority hierarchy does, in fact, make predictions, given that the predictions are based on observations of the kind of things being predicted. I would argue, in fact, that there are two distinct issues here. The first regards prediction and the second regards explanatory depth. Clearly, a sonority hierarchy derived from observing segmental ordering with syllables across many languages makes predictions about syllable phonotactics in languages beyond the set of languages observed in deriving the hierarchy. What is missing is an explanation for *why* the hierarchy should be structured thus, i.e. for why sound A is more or less sonorous than sound B. Such an explanation cannot be derived from the facts of segmental sequencing.

At this point, we are only at the initial stages of an exploration of these issues. And, for now, I would advocate a hybrid, and admittedly less restrictive, approach. That is, if it is necessary to recognize that phonetics drives much of phonotactics, we must also countenance the continuing relevance of more abstract phonological structures to our understanding of generalized patterns in the grammar. In simple terms, once such structures are a part of the grammar, there is no reason to think that they, themselves, will not make their influence felt within the grammar.

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