

Combining SPE and OT in Descriptive Language-Oriented Courses

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1 Introduction

This paper discusses a range of pedagogical strategies that can be used to introduce phonological theory in Catalan Philology BA degrees, which have an empirical and descriptive orientation. We illustrate how fundamental concepts can be introduced and how an SPE-type rule-based approach (*The Sound Pattern of English*, Chomsky & Halle 1968, SPE for short) and Optimality Theory (Prince & Smolensky 2004, OT for short) can be incorporated in these descriptive courses, and we also assess the advantages and drawbacks of SPE vs. OT-framed treatments. Section 2 introduces fundamental phonological concepts like contrast, minimal pairs and regularities, and also SPE rules and OT markedness constraints, through the description and analysis of the distribution of a single feature (voicing). In section 3 we show how the notion of constraint ranking is useful to understand the workings of epenthesis and the determination of the epenthesis site in Catalan. Section 4 shows how the different patterns of vowel reduction found in dialects of Catalan are useful for introducing students to some of the basics of OT, such as constraint reranking. Finally, in section 5 we briefly compare the advantages and disadvantages of SPE and OT approaches in reconciling the two goals of the courses: the description of the whole phonology of the language, including some dialectal variation, and its theoretical analysis. Not all the strategies presented need be used in the same course, if students are taking more than one undergraduate course in phonology; if they are taking only one phonology course, a subset of the strategies we mention here can be adopted.

2 Familiarizing students with basic concepts: voicing in obstruents

In Catalan, obstruents contrast in voicing in onset position; in word-final position, they are subject to final devoicing, whereas in coda position before any consonant they undergo voicing assimilation (Bonet & Lloret 1998). Resorting to these phenomena to introduce fundamental concepts or to consolidate them at a later stage is very helpful, because only one feature is at play and students can more easily concentrate on the theory.

The notion of contrast can be shown either with or without minimal pairs; for both types of example, students must see that there is voicing neutralization at the end of a word, as illustrated in (1a,b). They can be asked to provide other examples with different obstruents.

- (1) a. Contrast with minimal pairs vs. final devoicing
[búzus] ‘busses’ [bús] ‘bus’
[búsus] ‘divers’ [bús] ‘diver’
- b. Contrast without minimal pairs vs. final devoicing
[pérðən] ‘they lose’ [pért] ‘s/he loses’
[súrtən] ‘they leave’ [súrt] ‘s/he leaves’

First, students must see that the regularity found in this distribution is the fact that at the end of a word all obstruents must be voiceless. It is easy to formulate this requirement as an SPE rule or as an OT constraint. Students understand this almost immediately and, since most are native speakers of Catalan, they can also be shown that they unconsciously apply this rule or constraint when pronouncing English words like *dog*, which

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most speakers pronounce like the word *dock*. What is more difficult for them is to find the underlying representation (UR) in each case. It seems counterintuitive to them that it is the longer words in (1) that contain the underlying obstruent unchanged rather than the shorter words, which very often coincide with the root. If devoicing is covered after vowel reduction (discussed in section 4), it is even more difficult for students to understand how to find the UR; with vowel reduction, in order to find the UR they have to look at the shorter word, which contains the relevant stressed vowel. Moreover, in the case of sibilants, finding the UR is even harder because Catalan has a postlexical process of voicing of sibilants at the end of a word before a vowel-initial word (as in [buz ál] ‘tall diver’ / ‘tall bus’, but [pèrt əmíks] ‘s/he loses friends’) (see Bonet & Lloret 1998). Students are often aware of this sandhi phenomenon because it is taught in high school, and they tend to conclude that the rule or constraint that applies between words also applies within words. A useful exercise, then, is to ask them to find the predictions made if one assumes the voiceless variant to be the UR together with a voicing rule or constraint that applies at the word level; they are expected to see that then all the contrast would be lost, and the two plural forms in (1a) should sound [búzus] regardless of their meaning.

Voicing assimilation can also be formulated as a rule or as a constraint. It has to be shown that it applies across the board, regardless of whether trigger and target belong to the same word or to different words.

- (2) a. Voicing assimilation across words
 [sàbgrəmátikə] ‘s/he knows grammar’
 [sap kózəs] ‘s/he knows things’
 b. [əgzámən] ‘exam’
 [táksi] ‘taxi’

The combination of final devoicing and voicing assimilation can lead to a discussion of certain theoretical aspects. One of them is what the UR should be for non-alternating cases, as in (2b). Here, depending on the level of the course, one can assume (a) that the UR coincides with the surface representation (a Lexicon Optimization view), (b) that one has to consider URs with either value for voicing (a Richness-of-the Base view), or (c) that the UR does not have a feature for voicing (an underspecification view). In basic courses it is better just to adopt (a) and leave this question aside in order to concentrate on other aspects. An issue that must be raised is the distinction between levels of rule or constraint application, lexical and postlexical. A third issue concerns the formulation of final devoicing: given that word-final obstruents are in coda position and voicing assimilation affects the coda position, final devoicing can be reformulated as a rule or as a constraint affecting coda positions generally, as shown in (3). The definition given in (3b) is not necessary if students have not been introduced to tableaux; they just need to know that voiced codas are not allowed.

- (3) a. Final devoicing as an SPE rule (see Bonet & Lloret 1998):
 obstruent → [–voice] / ____]_σ
 b. Final devoicing as an OT constraint (see Wheeler 2005):
 *VOICED-CODA: Assign a violation mark for every obstruent in coda position.

With an SPE orientation, the lack of devoicing in the first example of (2b), for instance, can be attributed to (postlexical) voicing assimilation overriding the effects of (lexical) devoicing. When focusing on constraints, one can introduce constraint ranking, even informally, by stating that it is more important to have two consonants agreeing in voice than to have only voiceless codas. That is, one can introduce the two markedness constraints involved (*VOICED-CODA and AGREE(voice)) and the idea of competition and constraint ranking without having to appeal to faithfulness constraints or candidate sets. Only if the OT architecture has already been introduced in a certain amount of detail can one give a more elaborate account, which might rely on a stratal version of OT. It has to be kept in mind that many SPE rules can be reformulated as markedness constraints, but faithfulness constraints only make sense within models like OT.

3 Introducing basic OT intuitions through syllable structure

One of the easiest ways to persuade Catalan students that phonology exists is to give them examples like *stop* (and *Spielberg*, *Sting*...) and make them realize that they are introducing an initial epenthetic schwa, [əstóp], a vowel that is not present in the spelling or in the pronunciation by native speakers. This phenomenon together with its relation to syllable structure represents a very easy way to introduce OT candidate sets and constraint ranking, which can be done gradually, together with both markedness and faithfulness constraints. Students can learn basic syllable structure and sonority requirements for Catalan through their own examination of data from the language, identifying the types of consonant clusters they can find at the beginning of a word or at the end of a word. Afterwards one can start working with configurations that require an epenthetic vowel, which we illustrate here with the example [əstóp].

As a first step students can compare the surface form [əs.tóp] with the ungrammatical but faithful candidate *[stóp] considering only two constraints: SONSEQ and DEP-V, where SONSEQ can stand for the set of constraints that regulate the types of onset and coda clusters allowed in Catalan. They have to reach the conclusion that the ranking must be SONSEQ >> DEP-V. As a second step, the candidate *[sə.tóp] can be incorporated. Students have to realize first that this candidate also solves the syllabification problem with epenthesis but placing the epenthetic schwa in a different site, which represents a disruption of the contiguity relation between the segments /s/ and /t/, a violation of O-CONTIGUITY. They must also see that this candidate performs better with respect to the syllabic constraints ONSET and *CODA. Given these observations, they must conclude that these two constraints have to be outranked by O-CONTIGUITY. As a third step one can incorporate a candidate with deletion of the offending initial sibilant, *[tóp], a candidate that violates none of the constraints considered so far. This should lead students to propose that another faithfulness constraint, MAX-C, must be ranked higher than DEP-V, ONSET, and *CODA. This step-by-step exemplification will show them that constraints are violable, given that the surface form [əs.tóp] violates a higher number of constraints than the other candidates considered, and that what matters is the ranking between different constraints. This gradual introduction of candidates and constraints is summarized in (4).

(4) Gradual introduction of candidates and constraints for an input /stóp/

Step 1	Candidates: [əs.tóp], *[stóp] Constraints: SONSEQ, DEP-V
Step 2	Candidates: [əs.tóp], *[stóp], *[sə.tóp] Constraints: SONSEQ, DEP-V, ONSET, *CODA, O-CONTIGUITY
Step 3	Candidates: [əs.tóp], *[stóp], *[sə.tóp], *[tóp] Constraints: SONSEQ, DEP-V, ONSET, *CODA, O-CONTIGUITY, MAX-C

It is important to argue in class that the constraints in (4) are not necessary only for examples like [əs.tóp] but that they play a role elsewhere in the language. Students must see, for example, that the constraint DEP-C, unlike DEP-V, is generally never violated in Catalan, and that this is the reason why a violation of ONSET is never avoided through consonant epenthesis; a word like *ahir* ‘yesterday’ is realized as [ə.í], not *[tə.í] or *[ʔə.í]). Students can also be shown that ONSET is satisfied in Catalan as long as no consonant has to be “invented”. Leaving aside the obvious examples of word-internal syllabification (with, for instance, [búsus] ‘divers’ in (1b) being syllabified as [bú.sus] instead of *[bús.us]), at this point it is interesting to bring up the phenomenon of resyllabification across words. In Catalan, while [ə.í] has two onsetless syllables, the first syllable of the word acquires an onset when it is preceded by a consonant-final word, like *tot* ‘all’: *tot ahir* ‘all yesterday’ [tò.tə.í]. Thus, they can see that ONSET is satisfied whenever it does not go hand in hand with a violation of DEP-C.

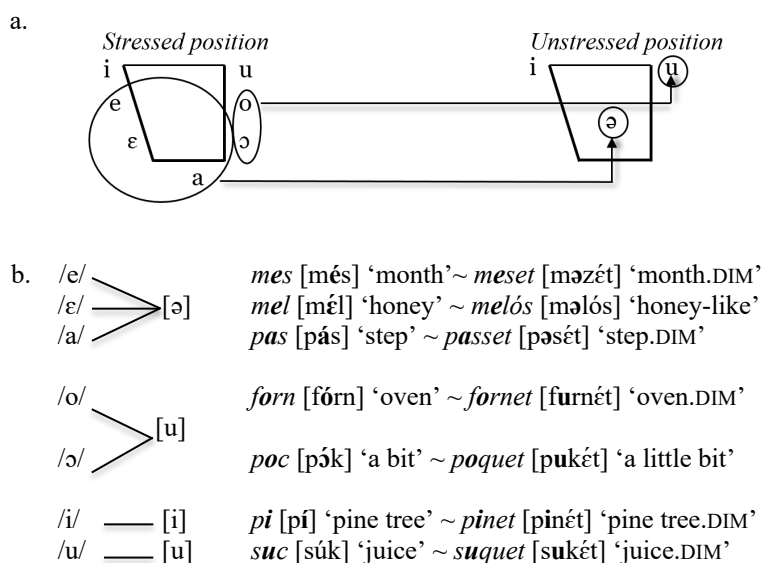
4 Introducing OT constraint (re)ranking through dialectal variation

Our students are expected to learn the stressed and unstressed vowel systems in Catalan dialects, as well as their different types of vowel reduction, both of which are subject to a significant amount of variation. In this section, we show that the typology of vowel reduction systems in Catalan provides a good empirical grounding to introduce and illustrate prominence-driven (Prince & Smolensky 2004; Crosswhite 2001, 2004)

and contrast-driven vowel reduction (Crosswhite 2001, 2004), as well as to exemplify some fundamentals of OT, such as variation via constraint re-ranking, the formalization of universal patterns through universal constraint hierarchies, the conflict between markedness and faithfulness, and the notion of constraint ranking argument (Prince & Smolensky 1993 / 2004). In what follows, we describe the main types of vowel reduction in Catalan dialects and show why they are particularly useful for introducing students to the basics of OT.

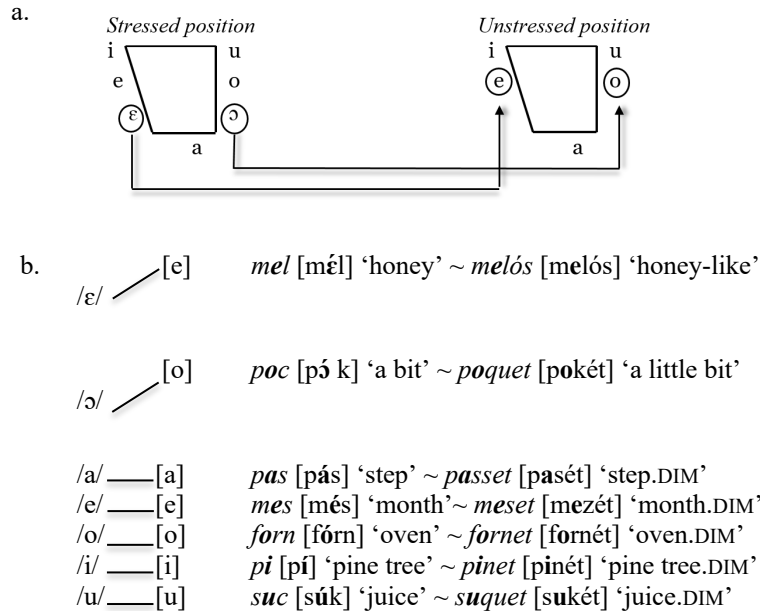
A set of varieties spoken in the Eastern area of the Catalan territory, to which we will refer as Varieties A, show a system of seven vowels in stressed position and a system of three vowels in unstressed position. This unstressed vowel system is the result of a lexical process of vowel reduction according to which the front vowels /e/ and /ɛ/ and the low vowel /a/ are realized as [ə] in unstressed position, and the back vowels /o/ and /ɔ/ are realized as [u], also in unstressed position; the high vowels /i/ and /u/ do not undergo any change under the lack of stress. This type of vowel reduction, which is one of the most drastic found in Catalan dialects, is represented schematically in (5a) and illustrated by the alternations in (5b), which reflect the quality changes that certain vowels undergo under stress displacement.

(5) Vowel reduction in Varieties A (Eastern Catalan) (see Mascaró 2002 / 2008)



Another set of varieties spoken in the Western area, referred to as Varieties B, also show a stressed vowel system of seven elements, but an unstressed vowel system of five elements. This unstressed vowel system is the result of a lexical process of vowel reduction according to which the low-mid front vowel /ɛ/ is realized as [e] in unstressed position, and the low-mid back vowel /ɔ/ is realized as [o], also in unstressed position; in these varieties, the high vowels /i/ and /u/, the high-mid vowels /e/ and /o/ and the low vowel /a/ do not undergo any change under the lack of stress. This type of vowel reduction, less drastic than the one in Varieties A, is represented in (6a) and illustrated by the vowel alternations in (6b).

(6) Vowel reduction in Varieties B (Western Catalan) (see Mascaró 2002 / 2008)

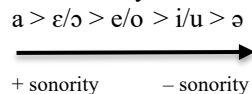


These patterns provide an ideal grounding for introducing prominence-driven vowel reduction to our students, and to start familiarizing them with some basic properties of OT. Within OT, the reduction of a vowel system in unstressed position is generally interpreted, along the lines of Prince & Smolensky (2004) and Crosswhite (2001, 2004), as an effect of the universal harmony scale for vowels in unstressed position (7a). This harmony scale and the subsequent constraint hierarchy (7b) express the universal preference for segments of low sonority in unstressed position or, in other words, the universal dispreference for segments of high sonority in stressed position (see the assumed sonority scale for vowels in 8). Therefore, the higher the relative sonority of a vowel, the more disfavored this vowel is in unstressed position. There is, thus, a direct relation between the prominence of the vowel and the prominence of the position in which it occurs; this is why the reduction of a vowel system induced by this constraint hierarchy is known as prominence-driven vowel reduction. An important consequence of this universal constraint ranking is that if a vowel of high sonority is allowed in unstressed position, all the vowels with a lower sonority should also be allowed in this position. By the same reasoning, if a vowel of a certain sonority is forbidden in unstressed position, all the vowels with more sonority will also be forbidden.

(7) Universal harmonic scale and universal constraint hierarchy for vowels in unstressed position

- a. Universal harmonic scale for vowels in unstressed position
 UNSTRESSED/ə > UNSTRESSED/i,u > UNSTRESSED/e,o > UNSTRESSED/ε,ɔ > UNSTRESSED/a
- b. Universal constraint hierarchy for vowels in unstressed position
 *UNSTRESSED_a >> *UNSTRESSED_{ε/ɔ} >> *UNSTRESSED_{e/o} >> *UNSTRESSED_{i/u} >> *UNSTRESSED_ə

(8) Assumed sonority scale for vowels



The behavior of Varieties A clearly conforms to the universal constraint ranking on vowels in unstressed position (see Wheeler 2005, Pons-Moll 2013a,b), so it is especially useful for illustrating prominence-driven vowel reduction in the phonology class. Students can see how only the vowels with a low sonority ([i, u, ə,])

are found in unstressed position because they are targeted by the lowest-ranked markedness constraints: *UNSTRESSED_i/u and *UNSTRESSED_ə (5). They can also see how, in contrast, vowels with a higher relative sonority (such as [a], [ɛ], [ɔ], and even [e] and [o]) cannot be found in the unstressed position because the constraints that penalize them in this position are all high-ranked and, most importantly, undominated (9).

(9)

*UNSTRESSED_a >> *UNSTRESSED_{ɛ/ɔ} >> *UNSTRESSED_{ə/o} >> *UNSTRESSED_i/u >> *UNSTRESSED_ə
Undominated in Varieties A

The behavior of Varieties B conforms to the universal constraint ranking on vowels in unstressed position as well, but at a lower range, because we find vowels less preferable in unstressed position, such as the high-mid vowels [e] and [o], and a highly unexpected one, the low vowel [a] (see Wheeler 2005; Lloret & Jiménez 2008). Students can see that in these varieties only the constraint *UNSTRESSED_{ɛ/ɔ} is undominated, and this is why [ɛ] and [ɔ] are the only vowels that cannot be found in unstressed position (10).

(10)

*UNSTRESSED_a >> *UNSTRESSED_{ɛ/ɔ} >> *UNSTRESSED_{ə/o} >> *UNSTRESSED_i/u >> *UNSTRESSED_ə
Undominated in Varieties B

As illustrated in (11), these patterns are useful for teaching how the interposition of faithfulness constraints can restrict the activity of markedness, a phenomenon that is especially clear in Varieties B, and how the different position of the same set of faithfulness constraints with respect to the same constraint hierarchy leads to different unstressed vowel systems. Students also learn how certain vowels, because of their inherent prominent nature, are more likely to be protected by faithfulness constraints. This is the case of the low vowel [a], which in Varieties B is protected by a specific faithfulness constraint, ranked above *UNSTRESSED_a.

(11)

*UNSTRESSED _a >> *UNSTRESSED _{ɛ/ɔ} >>	*UNSTRESSED _{ə/o} >>	*UNSTRESSED _i /u >> *UNSTRESSED _ə
Specific Faith in varieties B	Faith in varieties B	Faith in varieties A

Once these ideas are introduced, it is easy for our students to understand how these rankings can be translated into tableaux, and they now understand how constraint re-ranking can account for dialectal variation and the notion of ranking argument. The constraint ranking (and the tableaux) for Varieties A (12) show that markedness in general takes priority over faithfulness, and this leads to a more drastic vowel reduction with just three elements. The constraint ranking (and the tableaux) for Varieties B (13) show that the higher position of faithfulness constraints with respect to the shared hierarchy on vowels in unstressed position impedes a drastic vowel reduction, and that this leads to an unstressed system with more elements.

(12) Constraint ranking for Varieties A

*UNSTR_a >> *UNSTR_{ɛ/ɔ} >> *UNSTR_{ə/o} >> **IDENT-V** >> *UNSTR_i/u >> *UNSTR_ə

(13) Constraint ranking for Varieties B

IDENT-SpecV >> *UNSTR_a >> *UNSTR_{ɛ/ɔ} >> **IDENT-V** >> *UNSTR_{ə/o} >> *UNSTR_i/u >> *UNSTR_ə

Let us illustrate now how the OT formalization of these constraint differences can be gradually introduced to students. The most effective strategy is to start with the feature that Varieties A and Varieties B share: the lack of reduction of the high vowels /i/ and /u/. The common ranking IDENT-V >> *UNSTR_i/u explains that these vowels are preserved in unstressed position in both types of varieties, as the following tableau shows. With a simple tableau like this one, with only a few constraints at play, it is easy for students to understand the notion of ranking argument.

(14) Varieties A and Varieties B. IDENT-V >> *UNSTri/u: No reduction of the high vowels /i/ and /u/

/suk+oz/	IDENT-V	*UNSTri/u	*UNSTR↔
☞ a. [sukós]		*	*
b. [səkós]	*!		

Another feature that Varieties A and Varieties B have in common is the fact that they do not allow the low-mid vowels [ɛ] and [ɔ] in unstressed position, because of the undominated condition of the constraint *UNSTRE/ɔ, which in both varieties outranks IDENT-V: the student can see the fully faithful candidates (candidates b in the tableaux in 15). However, the outcome in the two types of varieties is completely different, due to the ranking of the constraint *UNSTRE/o with respect to IDENT-V. In Varieties A, partial vowel reduction of /ɛ/ and /ɔ/ to [e] and [o], which leads to fewer faithfulness violations than vowel reduction to [ə] and [u] (compare the number of violations of the constraint IDENT-V in candidates a and c in the tableaux in 15), is not possible, due to the activity of the constraint *UNSTRE/o, which outranks IDENT-V. In contrast, in Varieties B, partial vowel reduction is possible thanks to the opposite ranking, i.e., IDENT-V >> *UNSTRE/o. This can be seen in the following tableaux, where we illustrate the situation with the back vowels.

(15) Reduction of the low-mid vowels (/ɛ/ and /ɔ/) in Varieties A and Varieties B

a. Varieties A. *UNSTRE/ɔ >> *UNSTRE/o >> IDENT-V: reduction of the low-mid vowel /ɔ/ to [u]

/pɔk+et/	*UNSTRA	*UNSTRE/ɔ	*UNSTRE/o	IDENT-V	*UNSTri/u	*UNSTRə
☞ a. [pukét]				**	*	
b. [pɔkét]		*!				
c. [pɔkét]			*!	*		

b. Varieties B. *UNSTRE/ɔ >> IDENT-V >> *UNSTRE/o: reduction of the low-mid vowel /ɔ/ to [o]

/pɔk+et/	*UNSTRA	*UNSTRE/ɔ	IDENT-V	*UNSTRE/o	*UNSTri/u	*UNSTRə
☞ a. [pɔkét]			*	*	*	
b. [pɔkét]		*!				
c. [pukét]			**!			

As illustrated in the two tableaux below, students can then learn how the same differences in the ranking of the constraints *UNSTRE/o and IDENT-V explain why the high-mid vowels /e/ and /o/ undergo vowel reduction in Varieties A but are preserved in Varieties B.

(16) Reduction vs. preservation of the high-mid vowels (/e/ and /o/) in Varieties A and Varieties B

a. Varieties A. *UNSTRE/o >> IDENT-V: reduction of the low-mid vowel /o/ to [u]

/forn+et/	*UNSTRA	*UNSTRE/ɔ	*UNSTRE/o	IDENT-V	*UNSTri/u
☞ a. [furnét]				*	*
b. [fɔrnét]			*!		

b. Varieties B. IDENT-V >> *UNSTRE/o: preservation of the high-mid vowel /o/

/forn+et/	*UNSTRA	*UNSTRE/ɔ	IDENT-V	*UNSTRE/o	*UNSTri/u
☞ a. [fɔrnét]				*	
b. [furnét]			*!		*

As we stated above, an important consequence of the universal constraint ranking in (7b) is that if a vowel of a certain sonority is forbidden in unstressed position, all the vowels with more sonority will also be forbidden. However, this is not what we find in Varieties B; here the low-mid vowels [ɛ] and [ɔ] are not allowed in unstressed position, but the low vowel [a], which has more sonority, is allowed. These patterns are useful for explaining why certain vowels are more likely to be protected by specific faithfulness

constraints, i.e., because of their inherent prominent nature. The only way to explain this apparent contradiction with respect to the universal constraint hierarchy is to assume that a specific faithfulness constraint protecting low vowels outranks the high ranked markedness constraint *UNSTRA. The tableau in (17b) shows that a change to a less sonorous vowel than [a] is not possible, because of the activity of this specific faithfulness constraint, which, of course, is dominated by *UNSTRA in Varieties A (17a). At this point, we also teach our students that the schwa is not a possible outcome of vowel reduction in Varieties B because it does not belong to its sound inventory, a circumstance which, in terms of OT, is expressed through the context-free markedness constraint *SCHWA.

(17) Reduction vs. preservation of the low vowel /a/ in Varieties A and Varieties B

a. Varieties A. *UNSTRA >> IDENT-SpecV: reduction of the low vowel /a/

/pas+et/	*UNSTRA	*UNSTRE/ɔ	*UNSTRE/o	IDENT-SpecV	IDENT-V	*UNSTRə
☞ a. [pəsét]				*	*	*
b. [pasét]	*!					
c. [pəsét]		*!		*	*	
d. [pesét]			*!	*	*	

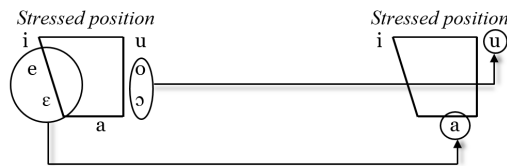
b. Varieties B. IDENT-SpecV >> *UNSTRA: preservation of the low vowel /a/

/pas+et/	IDENT-SpecV	*UNSTRA	*UNSTRE/ɔ	IDENT-V	*UNSTRE/o	*UNSTRə
☞ a. [pəsét]		*				
b. [pasét]	*!		*	*		
c. [pəsét]	*!				*	
d. [pəsét]	*!					*

We also teach our students that the occurrence of [a] in unstressed position cannot always be explained by resorting to (specific) faithfulness. This is the case of Algerese Catalan (Varieties C), in which not only the low vowel /a/ is realized as [a] in unstressed position, as in Varieties B, but also the front mid vowels /e/ and /ɛ/, as a result of a process of vowel reduction (see 18a and 18b).

(18) Vowel reduction in Varieties C (Algerese Catalan) (see Mascaró 2002 / 2008)

a.



- b.
- | | | |
|-----|-----|---|
| /e/ | [a] | <i>mes</i> [més] ‘month’ ~ <i>meset</i> [mazét] ‘month.DIM’ |
| /ɛ/ | | <i>mel</i> [mél] ‘honey’ ~ <i>melós</i> [malós] ‘honey-like’ |
| /o/ | [u] | <i>forn</i> [fórn] ‘oven’ ~ <i>fornet</i> [furnét] ‘oven.DIM’ |
| /ɔ/ | | <i>poc</i> [pók] ‘a bit’ ~ <i>poquet</i> [pukét] ‘a little bit’ |
| /a/ | [a] | <i>pas</i> [pás] ‘step’ ~ <i>passet</i> [pasét] ‘step.DIM’ |
| /i/ | [i] | <i>pi</i> [pí] ‘pine tree’ ~ <i>pinet</i> [pinét] ‘pine tree.DIM’ |
| /u/ | [u] | <i>suc</i> [súk] ‘juice’ ~ <i>suquet</i> [sukét] ‘juice.DIM’ |

In contrast to Varieties A and B, the unstressed vowel system of Algerese Catalan, with the three vowels [i], [u] and [a], cannot be driven by prominence; the most prominent vowel, [a], is the result of the process

of vowel reduction of /e/ and /ɛ/, two vowels that would be preferable in unstressed position because they are less sonorous. The drive behind this type of vowel reduction is the need to obtain a vocalic space that is maximally dispersed, i.e., maximally contrastive, in unstressed position, with just corner or peripheral vowels (see Lloret & Jiménez 2008). So it can be used in the phonology class to illustrate contrast-enhancing vowel reduction (Crosswhite 2001, 2004). According to Crosswhite (2004: p. 195), “[c]orner vowels /i, u, a/ are special in that they are maximally acoustically distinct: in theory, a vowel system consisting of these three vowels would be the easiest in terms of perception because the possibility for confusing an intended vowel quality for an incorrect but adjacent vowel quality is minimized.”. The constraint hierarchy active in this type of varieties is one in which a constraint on non-peripheral vowels in unstressed position (*UNSTRESSED/NON-PERIPHERAL), which rules out any mid vowel ([ɛ], [ɔ], [e], [o], [ə]) in this position, outranks the faithfulness IDENT-V and the markedness constraint *UNSTRA. By transitivity, this constraint also outranks the rest of markedness constraints belonging to hierarchy on vowels in unstressed position according to their sonority.

(19) Constraint ranking for Varieties C (Algherese Catalan)

*UNSTRESSED/NON-PERIPHERAL >> IDENT-V, *UNSTRA >> *UNSTRE/ɔ >> *UNSTRE/o >> *UNSTRI/u >> *UNSTRə

(20)

a. Varieties C: *UNSTR/NON-PERIPHERAL >> IDENT-V, *UNSTRA: reduction of the high-mid vowel /e/ to [a]

/mez+et/	*UNSTR/NON-PERIPHERAL	IDENT-V	*UNSTRA	*UNSTRE/ɔ	*UNSTRE/o	*UNSTRə
☞ a. [mazét]		*	*			
b. [mezét]	*!				*	
c. [məzét]	*!					*

b. Varieties C: *UNSTR/NON-PERIPHERAL >> IDENT-V, *UNSTRA: reduction of the low-mid vowel /ɛ/ to [a]

/mɛl+oz/	*UNSTR/NON-PERIPHERAL	IDENT-V	*UNSTRA	*UNSTRE/ɔ	*UNSTRE/o	*UNSTRə
☞ a. [malós]		*	*			
b. [mɛlós]	*!			*		
c. [məlós]	*!					*

5 SPE and OT-based approaches in class: advantages and drawbacks

Our teaching experience tells us that descriptive language-oriented courses aimed at covering the whole system of a language provide a good grounding for checking the limits of theoretical models in describing and explaining the grammatical behavior of languages. Our own experience using SPE and OT as a theoretical framework to describe phonological aspects of Catalan has proved beneficial in some respects but not in others. An SPE-based formalization constitutes a clear-cut descriptive device. Among many other features, the devoicing rule introduced in § 2 and reproduced in (20) is definitely easy for students to grasp, as they can see which type of element undergoes the change, the type of change it undergoes, and the exact context in which it occurs. However, generalizations and dialectal variation cannot be accounted for easily. The rule in (20), indeed, tells us very little (if anything at all), about the behavior of other languages with respect to obstruents in coda position, since no typological consequences can be derived from rules, or about the drive of the process it describes; as it stands, the rule in (20) does not explain why devoicing has to apply, why this change applies and not the opposite one and so on. In contrast, in the previous section, we illustrated how the simple reranking of the same set of constraints can straightforwardly account for the different types of vowel reduction in Catalan dialects. Within SPE, to account for the same phenomena, one has to resort to rules such as the ones in (21), which cause students several difficulties (for instance, its arbitrary formulation to account for dialectal variation, its eventual vacuous application (see $e \rightarrow e$ and $o \rightarrow o$ in 21b), and its opaqueness with respect to the features involved, etc.).

- (20) Final devoicing as an SPE rule:
obstruent $\rightarrow [-\text{voice}] / __]_{\sigma}$

- (21) Vowel reduction in Varieties A and Varieties B within SPE

- a. Varieties A ($a, \varepsilon, e \rightarrow \text{ə}; \text{ɔ}, o \rightarrow u$)

$$\begin{bmatrix} -\text{high} \\ <+\text{lab}> \end{bmatrix} \rightarrow \begin{bmatrix} +\text{back} \\ +\text{ATR} \\ <+\text{high}> \end{bmatrix} / \begin{array}{c} \text{---} \\ -\text{Stress} \end{array}$$

- b. Varieties $B(\varepsilon, e \rightarrow e; \circ, o \rightarrow o)$

$$\begin{pmatrix} \text{high} \\ \text{low} \end{pmatrix} \rightarrow +\text{ATR} \quad / \quad \overline{\text{Stress}}$$

Likewise, OT is a good descriptive device; it is easy for students to understand markedness constraints such as *VOICED-CODA, introduced in § 2 and reproduced in (22), it handles dialectal variation in a very straightforward way, as seen in § 4, and the set of candidates generated for a given underlying structure allows the teacher to expand on the behavior of other languages, varieties, and the typological consequences of all the possible combinations of the same set of constraints.

- (22) Final devoicing as an OT constraint:

*VOICED-CODA: Assign a violation mark for every obstruent in coda position.

However, the description of a process often compromises the description of other processes, due, for instance, to the participation of the same constraint in more than one process. This is especially frequent with regard to faithfulness constraints, because they interact with a significant number of markedness constraints. Take as an example the constraints DEP-IO and MAX-IO, which may be in conflict with markedness constraints relative to syllable structure (*CODA, ONSET), to syllable complexity (*COMPLEX-ONSET, *COMPLEX-CODA), to the organization of segments within the syllable and across the syllable depending on their sonority (SONORITY SEQUENCING PRINCIPLE, MINIMUM SONORITY DISTANCE, SYLLABLE CONTACT), or even with markedness constraints relative to voicing alternations such as *VOICED-CODA or AGREE(voice). Therefore, a very precise description in terms of OT of the overall phonological system of a language cannot be given in class. Other difficulties that both teachers and students have to face when working on OT in class are the lack of a conclusive ranking for a given language or variety, and the lack of a database containing all the possible constraints.

6 Conclusions

Theoretical models are conceived as a means for describing and giving an explanation for the grammatical behavior of languages. In language-oriented courses, the fact that the whole grammar of a given language is taken into consideration represents a challenge for any theoretical model, and also for the instructor and students, because the analysis cannot be restricted to a limited set of data (a common practice in introductory courses to linguistics or phonology); rather, all data that characterize a grammatical system must be taken into account. However, as we have tried to show in this article, this enterprise is possible if SPE and OT are combined in class, since the pedagogical disadvantages of one model can be counterbalanced by the advantages of the other, and vice versa.

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