

Surface sound and underlying structure : The phonetics-phonology interface in Romance languages

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Manual of Grammatical Interfaces in Romance

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Edited by
Susann Fischer and Christoph Gabriel

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José Ignacio Hualde and Ioana Chitoran

1 Surface sound and underlying structure: The phonetics-phonology interface

Abstract: In this chapter we offer an overview of phenomena at the phonetics-phonology interface in the Romance languages. Processes affecting consonants and vowels are studied separately. Parallels with historical sound changes in the same or in another language are mentioned when relevant.

Keywords: allophony, lenition, fortition, assimilation, neutralization, vowel reduction, vowel harmony, coda consonants, palatalization

1 Scope of this chapter

This chapter on the phonetics-phonology interface focuses on phenomena that can be considered facts of pronunciation, including both postlexical or phrase-level phonological rules and conventionalized, language-specific, phonetic processes. We are thus excluding from our overview morphophonological (or lexical) phonological alternations, which will be dealt with in a different chapter.

An example may be useful in order to clarify the set of phenomena that we are excluding from the scope of our discussion. In the Romance languages the evolution of mid vowels in stressed syllables (under different conditions) has created numerous morphophonological alternations, e.g. Sp. *puedo/podemos* ‘I/we can’, Fr. *bois/buvons* ‘I/we drink’, It. *buono/bontà* ‘good/goodness’, Rom. *seară/seri* ‘evening/s’, etc. The treatment of this type of alternation is different in different theoretical frameworks. In Generative Phonology, morphemes are given a single invariant form in the underlying representations of all words containing them. Accounting for these alternations is thus an important part of phonological analysis within this framework. Morphophonological rules account for the mapping between allomorphs of the same morpheme in different words. In a volume like the present one, however, these facts clearly belong to the phonology-morphology interface, rather than to the phonology-phonetics interface, and thus they will not be examined further in this chapter.

Instead, in this chapter we will study both regular obligatory allophony, such as the spirantization of /b d g/ in Spanish, e.g. /la bodega/ [laβo'deβa] ‘the tavern, shop’ (but not in Brazilian Portuguese [abo'dega]), and language-specific but optional, variable processes, such as the aspiration of /s/ in Spanish varieties and the spirantization of /p t k/ in Florentine Italian.

The contemporary Romance languages differ substantially in their phonology and phonetics, although common processes are also found. Interestingly we often see that certain phenomena are recurrent. We wish to draw special attention to the fact that what is an active process at the phonetics-phonology interface in one language may mirror a completed sound change in another language. For instance, the variable aspiration and deletion of coda /s/ in many Spanish dialects ran its full course centuries ago in French, e.g. Sp. *escuela* [eh'kwela] ~ [e'kwela] 'school', cf. Fr. *école*.

This view of the evolution of sound systems, with specific application to Romance, was first presented by Pierre Delattre in a 1946 paper explicitly entitled "Stages of Old French phonetic changes observed in Modern Spanish". Delattre discusses 31 well-known sound changes of Old French for which an equivalent synchronic stage characterized by phonetic variation can be found in Modern Spanish. We will give just one example here. Glide strengthening in initial position takes place in French, with subsequent reduction to a fricative (cf. also section 2.4 below): Germanic [wadja] 'wage' > Gallo-Roman [gwajja] > Fr. [gɑʒ]. A similar synchronic variation is encountered in Spanish, where *huesos* 'bones' is frequently pronounced [gwesos]. We refer the reader to Delattre (1946) for other examples of parallel sound changes in Old French and Modern Spanish.

In the remainder of this chapter we classify phonetic/phonological phenomena by the nature of the segments that are affected and by their environment. For each main type of phenomenon we will consider the extent to which synchronically active processes at the phonetics-phonology interface find parallels in completed sound changes in the same or other Romance languages. Phenomena affecting consonants are considered before those that apply to vowels.

2 Consonants

Consonants are often weakened in the intervocalic context and are subject to various neutralizations (in place, manner and/or voicing) in the coda. When in contact with front glides and vowels, palatalization is frequent. At the phonetic level, strengthening of consonants in phrase-initial position has been observed in several languages, and this phenomenon may be phonologized as word-initial fortition, although such conventionalized processes are relatively rare.

2.1 Intervocalic lenition

The weakening of intervocalic consonants is a common phonological phenomenon that is abundantly attested in the synchronic and diachronic phonology of the Romance languages.

The historical voicing (and further lenition) of intervocalic obstruents is one of the main features that serve to separate the Western Romance languages (Portuguese, Spanish, Catalan, French, etc.) from Eastern Romance (Italian, Romanian), cf. (1):

(1) Latin intervocalic /p t k/: Eastern vs. Western Romance

Lat.	It.	Sp.	Fr.	
SAPĒRE	sapere	saber	savoir	'to know'
VĪTA(M)	vita	vida	vie	'life'
AMĪCA(M)	amica	amiga	amie	'female friend'

The voicing of intervocalic obstruents, which must have started as an across-the-board postlexical rule of allophony (Weinrich 1958), eventually produced phonological recategorization word-internally in the Western Romance area.

Voiced stops were subsequently weakened to different extents in different languages, along a common path of development, e.g. [t] > [d] > [ð] > 0. In French, word-internal intervocalic /d/ and /g/ were eventually lost ([vita] > [vīda] > [viðə] > [viə], [a'mika] > [a'miga] > [a'miçə] > [a'miə]) and the labial (from Latin p, b and v) remains as /v/, so that there is no active rule of allophony in modern French. In Spanish and Catalan, on the other hand, the spirantization of /b d g/ both inside words and across word boundaries is an essentially obligatory allophonic phenomenon and an important aspect of the phonology of these languages, e.g. Sp. *dama* ['dama] 'lady', but *la dama* [la'dama] 'the lady'.

Unlike the phonological recategorization of voiceless obstruents in Western Romance, which affected exclusively postvocalic consonants, the allophonic spirantization of /b d g/ applies after vowels, glides and most consonants in Catalan and most Spanish varieties, e.g. Sp. *árbol* ['arβol] 'tree'. There are, nevertheless, Spanish dialects (spoken in parts of Central America and Colombia) where systematic spirantization is limited to the intervocalic context, e.g. *cada* ['kaða] 'each' but *cardo* ['kardo] 'thistle' (cf. Carrasco/Hualde/Simonet 2012).

In Brazilian Portuguese intervocalic voiced stops do not undergo systematic weakening. This is thus a major phonological difference between this language and Spanish:

(2)	Sp.	BPor.	
sabe	['saβe]	['sabi]	's/he knows'
lado	['laðo]	['ladu]	'side'
amiga	[a'miʝa]	[a'miga]	'female friend'

In European Portuguese the spirantization of /b d g/ is found as a variable phenomenon in northern and central areas (cf. Mateus/d'Andrade 2000, 11, footnote 2).

In the varieties of central and southern Italy, as well as Corsica and Sardinia, where Latin intervocalic /p t k/ did not undergo phonological recategorization,

we find that, nevertheless, these consonants are often voiced and sometimes spirantized synchronically, both word-internally and across word boundaries, e.g. *ho capito* [oga'bido] 'I have understood'. In a recent study, Hualde/Nadeu (2011), over 50% of all tokens of intervocalic /p t k/ were found to be realized as fully voiced in a corpus of Rome Italian. Sardinian has a more systematic alternation, e.g. [ˈtɛra] 'land', [saˈðɛra] 'the land' (cf. e.g. Jones 1997). Less widespread voicing (and spirantization) of intervocalic /p t k/ is also found in some varieties of Spanish. Velar /k/ appears to be especially prone to reduction, e.g. Peninsular Sp. *lo que te digo* [loyedeˈðiyɔ] 'that which I tell you' (cf. Hualde/Simonet/Nadeu 2011; Torreira/Ernestus 2011). In the case of Spanish, this is a 'second round of voicing' (Oftedal 1985) from a historical point of view, although continuity with the first round (without recategorization across word boundaries) cannot be excluded. Interestingly, European Portuguese appears to be undergoing the opposite process: partial devoicing of obstruents (Pape/Jesus 2011).

Florentine Italian is well known for showing a different type of lenition of intervocalic /p t k/, where these segments are variably realized as voiceless fricatives, e.g. *la tavola* [laˈθavola] 'the table' (Canepari 1979, 214; Giannelli/Savoia 1978; 1979/1980; Cravens 1984; Marotta 2001; 2008; Soriano 2001; Villafañá Dalcher 2006; 2008).

The Western Romance intervocalic voicing sound change also affected singleton /s/ and other fricatives, e.g. PASSU(M) > Por. *passo* ['pasu] 'step' vs. CASA(M) > Por. *casa* ['kaze] 'house'. As a synchronic variable across-the-board process, voicing of intervocalic fricatives is also found in those languages where stops voice in this context (cf. Torreira/Ernestus 2012 and Hualde/Prieto 2014 for Spanish as well as Nocchi/Schmid 2007 for Southern Italian).

In the history of the Romance languages we find other processes of intervocalic weakening. In particular the Latin geminates, which are preserved in Italo-Romance, were systematically simplified in both Western Romance and Balkan Romance (e.g. CUPPA(M) > Sp. *copa*, Rom. *cupă* vs. It. *coppa*; PECCATU(M) > Sp. *pecado*, Rom. *păcat* vs. It. *peccato*), but these sound changes did not give rise to any robust synchronic alternations (excluding a few limited morphophonemic processes).¹

When sequences of identical consonants arise across morphemes or words, sometimes they are reduced to the duration of a single consonant and sometimes they are preserved as geminates. In Spanish, consonants with full contact between the articulators, such as /l/ and /n/, preserve a single vs. geminate contrast more effectively than approximants and fricatives (e.g. *come nueces* 's/he eats walnuts' vs. *comen nueces* 'they eat walnuts'; *inútil* 'hopeless' vs. *innoble*; but /des-alar/ 'to

¹ In Spanish and Catalan, geminate /n l r/ had a special evolution. In particular /ll/ and /nn/ became palatals. A related fact is the synchronic alternation that we find in cases like Sp. *él* 'he', *ella* 'she'.

remove the wings' ~ /des-salar/ 'to remove the salt'; *sabe solo* 's/he knows only' ~ *sabes solo* 'you know only'; cf. Hualde 2005, 97–98). In French, schwa deletion may produce geminates, as in *là-d(e)dans* (cf. Walker 2001, 130).

In some Romance languages intervocalic sonorants have also undergone weakening. Thus, in Portuguese intervocalic /n/ and /l/ delete, e.g. LŪNA(M) > *lua* 'moon', COLŌRE(M) > *cor* 'colour', and in Romanian intervocalic /l/ becomes /t/, e.g. SŌLE(M) > *soare* 'sun'. This deletion of intervocalic consonant has produced some morphophonological alternations, e.g. Port. *sol* 'sun' vs. *sois* 'suns' < SŌLES, but again, nowadays we do not seem to find any systematic processes of intervocalic sonorant weakening at the phonology-phonetics interface.

2.2 Lenition/neutralization in the coda

A number of phenomena may affect coda consonants, generally resulting in a reduced inventory compared to that found in the onset position. Common processes include place assimilation, cluster simplification, voice assimilation and complete assimilation.

2.2.1 Assimilation and weakening of coda obstruents

Whereas, as already mentioned, the Latin geminates underwent simplification in both Western Romance and Balkan Romance, Italian has not only preserved the etymological geminate consonants but also developed new geminates. One important source of new geminates that must have already been present in Late Latin (Loporcaro 2011, 93) is the total assimilation of coda obstruents, e.g. AD CASA(M) > [a'kasa] 'to the house', which is the origin of the phenomenon known as *raddoppiamento (fono)sintattico* (RS) or syntactic doubling in central and southern Italian. The synchronic status of RS is particularly interesting. Nowadays it is simply the case that an arbitrary set of function words trigger the gemination of word-initial consonants, since there is no longer any evidence for the word-final consonant that gave rise to the phenomenon; for example, in these Italian varieties, there is gemination of the word-initial consonant in *a casa*, but not in *la casa*. RS also takes place after oxytonic words, as in *città* [p:]*iccola* 'small town'. Interestingly, word-initial consonants in the context of RS are protected from intervocalic weakening processes. Thus in Rome Italian, the word-initial stop may be voiced in *la casa* 'the house', but not in *a casa* 'to the house' or *tre case* 'three houses', where it geminates instead (cf. Loporcaro 1997, 1–2). Thus a seemingly low-level, probabilistic, phonetic phenomenon (intervocalic voicing) is blocked by a lexical feature (i.e. the fact that the preceding word belongs to the class of RS-triggering items). In Catalan, there is obligatory devoicing of word-final consonants, which produces many morphophonological alternations, e.g. *amic/amica* 'friend_{M.SG/F.SG}'.

The treatment of coda /s/ requires particular attention. The loss of word-final /s/ in Eastern Romance is ultimately responsible for one of the most striking differences between Western and Eastern Romance, plural formation by the addition of /s/ vs. vowel change, e.g. Sp. *libro/libros* ‘book/books’ vs. It. *libro/libri*.² This phenomenon affected only word-final consonants and is thus different from the weakening of /s/ in coda position (both word-internally and word-finally) that historically operated in French and is active in a large number of present-day Spanish varieties, with different degrees of incidence. In French, the process is no longer operative, so that coda /s/ in the lexical items where it has been preserved (e.g. *espagnol* ‘Spanish’) is no longer subject to weakening. Its only synchronic remnant can be seen in the phenomenon of liaison, whereby resyllabification as a syllable onset has allowed a word-final consonant to survive, as in, for example, *les garçons* [legasõ] ‘the boys’ vs. *les enfants* [lezãfã] ‘the children’ (↗ Prosodic phonology and its interfaces; ↗ Phonology and morphology in Optimality Theory).

Besides French liaison, the voicing of resyllabified word-final /s/ is found in both Catalan and Portuguese and was undoubtedly found in Old Spanish (as it still is in Judeo-Spanish). In standard European Portuguese and some Brazilian varieties the treatment of word-final /s/ is particularly complex. Coda /s/ is palatalized to [ʃ], but if it resyllabifies it is realized as [z], e.g. *queres* [ʃ] ‘you want’, *queres algo* [z] ‘you want something’ (Mateus/d’Andrade 2000, 12, 145; Perini 2002, 15). Thus, both the voicing and the place of articulation of word-final sibilants are conditioned by phrase-level phonology in these varieties of Portuguese.

In Spanish dialects with aspiration and deletion of coda /s/ there are sometimes other associated phenomena. For instance, geminates may result from the assimilation of /s/ (and other consonants in the coda) to a following consonant as in Eastern Andalusian Sp. *isla* [iːla] ‘island’, *caspa* [ˈkaːpa] ‘dandruff’ (cf. Gerfen 2002). A recent phenomenon is the metathesis of the aspiration in Western Andalusian Spanish, e.g. *costa* [ˈkotʰa] ‘coast’ (cf. Torreira 2012; Ruch/Harrington 2014). In Eastern Andalusian, on the other hand, word-final /s/ is almost categorically deleted, but its underlying presence is manifested in the opening of the preceding vowels, e.g. *paso* [ˈpaso] vs. *pasos* [ˈpasɔ]; *tiene* [ˈtjene] ‘s/he has’ vs. *tiene* [ˈtjeneɛ] ‘you have’, with possible vowel assimilation in the word domain (cf. e.g. Hernández-Campoy/Trudgill 2002; Penny 2000, 122–126). For both the Canary Islands and Central America, it has been reported that after deleted /s/, voiced obstruents are realized as stops, so that, for instance, *las vacas* [laˈbːaka] ‘the cows’ may contrast with *la vaca* [laˈβaka] ‘the cow’ (cf. Amastae 1989; Dorta/Herrera 1993).

² Generally speaking, in Western Romance, the plural of nouns continues the Latin accusative plural (e.g. ROSĀS, MŪRŌS). The early loss of /-s/ in these forms in Eastern Romance made them identical to the singular, so that only the nominative could mark the plural (e.g. ROSAE > It. *rose* ‘roses’, MŪRĪ > It. *muri* ‘walls’).

In Romanian, weakening of coda consonants occurs only in a limited set of environments in spontaneous, casual speech. For instance, final stop clusters tend to be reduced before word-initial stops: *a[kt] [d]e ~ a[kd]e* ‘act of’, with an unreleased C1 and variable voicing assimilation in the two stops. A more systematic deletion affects the [l] of the masculine singular definite article, which is enclitic: *omul de pe stradă ~ omu de pe stradă* ‘the man in the street’. In casual speech [l] may delete even before a vowel-initial word: *omul a plecat ~ omu a plecat ~ om[w] a plecat* ‘the man left’, *omul ăsta ~ omu ăsta* ‘this man’ (Chitoran et al. 2014). This variation suggests the development of a more systematic, morphophonological change, whereby the marking of definiteness is transferred over to the vowel /u/. This vowel is the masculine singular desinence vowel. It only surfaces in cliticized forms (*om-u-l* ‘the man’, *om-u-l-ui* ‘to/of the man’) and in non-cliticized forms ending in a consonant cluster (*patru* ‘four’).

2.2.2 Coda nasal place neutralization and assimilation

Most Romance languages show a smaller number of phonemic oppositions among nasals in the coda than syllable-initially. Spanish has three nasal phonemes /m n ŋ/ in syllable-initial position. In word-final position, on the other hand, there is only /n/, which before a pause is realized as [n] or [ŋ] depending on the dialect, e.g. *pan* /pan/ [pan] ~ [paŋ] ‘bread’. Nasals assimilate in place to following consonants, both word-internally and across word boundaries: *so[m] pocos* ‘they are few’, *so[ŋ] grandes* ‘they are big’. In Catalan, unlike in Spanish, there is no coda neutralization. The labial, alveolar and palatal nasal contrast word-finally, *som* ‘we are’, *són* ‘they are’, *any* /aŋ/ ‘year’, and, in addition, there is a fourth surface contrastive nasal in word-final (but not in syllable-initial) position, velar [ŋ], *sang* [saŋ] ‘blood’. However, the alveolar nasal assimilates to the place of articulation of a following consonant, producing contextual neutralization with the other nasal phonemes: *só[m] petits* ‘they are small’ neutralized with *som petits* ‘we are small’, but *só[ŋ] grans* ‘they are big’ vs. *som grans* ‘we are big’.

Nasal place assimilation occurs in Romanian, as well. Romanian has two nasal phonemes /m n/. Word- or morpheme-final /n/ variably assimilates in place to a following stop, for example, the nasal in the preposition *în* [in] ‘in’: *î[ŋ] [k]asa* ‘in the house’, *î[m] [p]arc* ‘in the park’. The same type of assimilatory coarticulation takes place when a final cluster is reduced and the nasal becomes adjacent to the following word-initial stop, e.g. *sînt prieteni* → *sî[m] [p]rieteni* ‘they are friends’, *sînt pe drum* → *sî[m] [p]e drum* ‘I am on the road’, *sînt curat* → *sî[ŋ] [k]urat* ‘I am clean’.

In French, we find a quite different type of nasal assimilation, whereby oral stops become nasal in contact with a nasal consonant or vowel, e.g. *et demie* /edəmi/ → [enmi] ‘and a half’, *bombe atomique* /bɔ̃batomik/ → [bɔ̃matɔ̃mik] ‘atomic bomb’ (Walker 2001, 135).

2.2.3 Coda liquids

The alveolar lateral /l/ may be “light” (with the dorsum in the position for a front vowel, cf. Proctor 2011), as in Spanish, French and Italian, or “dark” or velarized (with the dorsum in the position for a back vowel), as in Portuguese and Catalan. Relaxation of the apical constriction of a “clear” lateral produces [j] in varieties of Dominican Spanish, e.g. *papel* [pa'pej], whereas, if the lateral is “dark”, its weakening results in [w], as in Brazilian Portuguese, e.g. *Brasil* [bra'ziw] vs. *brasil[ɫ]eiro* ‘Brazilian’. In the diachrony of the Romance languages both types of vocalization are abundantly attested, e.g. MULTU(M) > Por. *muito* ‘much’ (> Sp. *mucho*, with subsequent palatalization), ALTERU(M) > *[awtro] > Por. *outro* ‘other’, Sp. *otro*, Fr. *autre*, CABALLOS > Old Fr. *chevals* > Fr. *chevaux* ‘horses’.

The neutralization of lateral and rhotic liquids in the coda is also a common phenomenon, found, for instance, in Andalusian and Caribbean Spanish and in Rome Italian. In several Spanish varieties with liquid neutralization, coda liquids may assimilate to certain following consonants, e.g. *carne* ['kan:e] ‘meat’, *pulga* ['pug:a] ‘flea’.

2.3 Palatalization

The palatalization of consonants in contact with glides and front vowels is widely attested as a sound change in Romance. Whereas Classical Latin lacked palatals and prepalatals altogether, a whole range of these consonants arose in Romance via palatalization phenomena, sometimes later developing into sibilants and other consonants, e.g. DĪCIT /di:kit/ > Rom. *zice* /zitʃe/ ‘s/he says’, VĪNEA(M) > Port. *vinha*, Sp. *viña*, Cat. *vinya*, Fr. *vigne*, It. *vigna* ‘vine’, all with /ɲ/ (cf. Alkire/Rosen 2010 for a convenient summary of palatalization sound changes from Latin to Romance).

Palatalization has its source in coarticulation, and most frequently affects coronals and dorsals, as in the examples just given, but in some Romance languages even labials have palatalized historically, e.g. SAPIAT > Old Fr. /sapʲə/ > [saʃ] *sache* ‘(that) s/he know’, LŪPI > Rom. *lupi* [lupʲ] ‘wolves’. Universally, palatalization appears to follow a hierarchy of triggers [j] » [i] » [e]. Palatalization triggered by a (fronted) low vowel, as in French, e.g. CANTĀRE > Fr. *chanter* ‘to sing’, is less common. Similarly, the trigger usually follows, but palatalization by a preceding glide is found in developments like NOCTE(M) > /noʲte/ > Sp. *noche* ‘night’.

Historical palatalization has produced morphophonological alternations in many Romance languages, e.g. Fr. *blanc/blanche* ‘white_{M.SG/F.SG}’, It. *amico/amici* ‘friend_{M.SG/M.PL}’, Rom. *stradă/străzi* ‘street_{SG/PL}’.

As an active process of allophony, we find palatalization of /t/ and /d/ before /i/ in Brazilian Portuguese, e.g. *tia* [tʃia] ‘aunt’, *dia* [dʒia] ‘day’. The raising of word-final front vowels (e.g. *sublime* [sublimi]) results in palatalization before orthographic final <e>, e.g. BP *parte* ['pahtʃi] ‘part’, *verde* ['vehdʒi] ‘green’.

In Québec French, /t/ and /d/ are affricated to [ts] and [dz], respectively, before the high front vowels /i/ and /y/, e.g. *petit* [ptsi] ‘small’, *tu* [tsy] ‘you’. Recent socio-linguistic studies of urban continental French (cf. Lodge 2004; Fagyal 2010) document a type of palatalization/affrication that occurs before high front vowels and glides, but results in [tʃ, dʒ], as in Brazilian Portuguese, rather than the Quebec French [ts, dz]: *y a* [dʒy] *monde* ‘it’s crowded’, [tʃy] *m’as* [dʒi]t ‘you told me’. This phenomenon has been associated with the speech of working class youth of immigrant descent, but more recently has been reported in political discourse (cf. Trimaille 2008) and broadcast news (cf. Candea/Adda-Decker/Lamel 2013). The latter study, based on a large speech corpus, verifies that affrication occurs predominantly with the voiceless variant, before [j] and [i]. Some frequent examples are: *moi*[tʃ]é ‘half’, *chré*[tʃ]en ‘Christian’, *poli*[tʃi]que ‘politics’, *exécu*[tʃi]f ‘executive’. This tendency to palatalize dentals in contact with high front vowels in present-day French may be related to the high articulatory setting of its vowel system, as compared to, for instance, Spanish (Torreira/Ernestus 2011).

Probably as a universal phenomenon of coarticulation, velars have a more fronted place of articulation in contact with front vowels than in contact with back vowels (*car* vs. *key*). The exaggeration of this coarticulation produces distinctively palatalized allophones, like in Chilean Spanish, e.g. *mujer* /mu'xer/ [mu'çer] ‘woman’.

A common unconditioned weakening phenomenon repeatedly attested in the Romance family is the weakening of /tʃ/ to /ʃ/ and /dʒ/ to /ʒ/ (e.g. in the history of both Portuguese and French). Nowadays /tʃ/ is variably or systematically realized as [ʃ] in several Spanish varieties (Southern Andalusia, Northern Mexico, Panama, Chile).

2.4 Initial fortition

As already mentioned, consonant fortition has been observed to occur at the phonetic level as a correlate of the phrase-initial position (Fougeron/Keating 1997). Interestingly, a correlate of emphatic stress in French is consonant gemination: *quel* [k:]rétin ‘what an idiot!’, *c’est* [f:]ormidable ‘it’s great’ (cf. Walker 2001, 131). The phonologization of phrase-initial fortition (as word initial), however, appears to be rare. One example would be the fortition of rhotics in Spanish, where the trill occurs to the exclusion of the tap in word-initial position. Catalan also underwent fortition of word-initial /l/ (which later evolved to palatal /ʎ/, like word-internal geminate /l:/), and in Asturian/Leonese both word-initial /l/ and /n/ show this sound change, e.g. Cat. *llop* /ʎop/ ‘wolf’, Ast. *llobu* /ʎobu/ ‘wolf’, *ñome* /ɲome/ ‘name’, but this is no longer an active process in these languages.

Word- and syllable-initial yod strengthened in Late Latin, generally converging with the results of /g/ before a front vowel, e.g. IUNIUM > Fr. *juin*, Port. *junho*, It. *giugno* ‘June’. In modern Spanish both syllable-initial [j] and [w] undergo optional fortition, e.g. *yegua* [jɛɣwa] ‘mare’, *huevo* [ˈgweβo] ‘egg’.

3 Vowels

Having considered the main phenomena affecting consonants, in this section we examine other processes that target vowels. We classify these processes in three major types: vowel reduction in unstressed syllables, vowel-to-vowel coarticulation and assimilation (including coalescence and harmony), and vowel epenthesis. As we have done for the consonants, productive synchronic processes will be considered in the light of completed sound changes of the same type.

3.1 Vowel reduction in unstressed syllables

An important parameter of variation among the Romance languages is the extent to which unstressed vowels are reduced in their duration and centralized in their quality. Iberian Portuguese and Spanish offer a striking contrast in this respect. Even though these are two very closely related languages and their phonological syllable structure is rather similar, they have radically different rhythms. Whereas in Iberian Spanish differences in duration and vowel quality between stressed and unstressed vowels are relatively small, to the extent that it is difficult to identify systematic ways in which they differ in their quality (Nadeu 2014), in Iberian Portuguese, unstressed vowels are greatly reduced and often dropped, mirroring in many respects completed sound changes in a language like French.

Although most Spanish varieties have very little reduction of unstressed vowels, the reduction in duration, devoicing and deletion of unstressed vowels in certain positions is a feature of both Mexican (Lope Blanch 1963) and Andean Spanish (Delforge 2008), e.g. *cafecito* [kaf'sito] 'a little coffee'. A different type of reduction, with vowel raising, has been found in some varieties of Judeo-Spanish in contact with Slavic languages, such as that of Bulgaria, where both /a/ and /o/ raise in unstressed syllables (cf. Gabriel/Kireva 2014). This latter phenomenon finds a parallel in Central Catalan, where the seven-vowel system found in stressed syllables is reduced to /i ə u/ in most unstressed syllables, giving rise to many morphophonological alternations.

Schwa deletion in French is a very complex phenomenon. It is systematic, which qualifies it as a lexical phenomenon, but it is also subject to phonetic, prosodic, dialectal, idiolectal, sociolinguistic, and stylistic constraints. It has been extensively studied and is still not fully understood. Alternating schwas occur word-internally (*semaine* [səmɛn] ~ [smɛn] 'week') and across word boundaries (*je ne sais pas* [ʒənəsɛpa] ~ [zənəsɛpa] 'I don't know'). The conclusion at this point is that schwa alternation is lexical and phonological (cf. Bürki/Ernestus/Frauenfelder 2010). Variants without schwa are reported in careful speech as well as in casual speech (Côté/Morrison 2007). Nevertheless, Bürki et al. (2011), based on the analysis of a large spoken corpus, conclude that schwa in connected speech also undergoes phonetic reduction typical of interface phenomena.

In contrast with French, in Central Catalan, schwa, which replaces /a ε e/ in unstressed syllables (e.g. *renta* ['rentə] 's/he washes', *rentar* [rən'ta] 'to wash'), is a stable vowel and is not subject to deletion.

A recurrent phenomenon in Romance is the raising of mid vowels in pretonic syllables. This phenomenon has the status of a regular sound change in standard Italian, e.g. SECŪRU(M) > It. *sicuro* 'safe_{M.SG}', FENESTRA(M) > It. *finestra* 'window' (Alkire/Rosen 2010, 80). In Brazilian Portuguese it is a variable rule, where variants with pretonic high vowels are seen as less formal (without being stigmatized), and are subject to a number of phonological conditions and lexical marking, e.g. *perigo* [e]~[i] 'danger', *tomate* [o]~[u] 'tomato', but *verdade* [e], *[i] 'truth' (Perini 2002, 37–38). In Spanish and closely related dialects the phenomenon is nowadays stigmatized as “rural” and it is mostly found as an assimilatory phenomenon (cf. below), when the stressed vowel is high, e.g. *comer* [ko'mer] 'to eat' vs. *comería* [kumi'ria] 'I would eat' (Penny 1978, 86).

As for word-final unstressed syllables, the pan-Romance tendency is to have a smaller number of contrasts in this position than elsewhere. Thus Italian only has four word-final unstressed vowels /i e a o/, Spanish three (leaving aside a few exceptions) /e a o/, and Central Catalan also three /i ə u/. In several Spanish varieties, both in Spain and in Latin America, /e/ and /o/ tend to rise in this position. This is a stigmatized “rural” phenomenon in Spanish. In Brazilian Portuguese, on the other hand, this is a regular rule of pronunciation: mid vowels become high in unstressed word-final syllables, e.g. /gato(s)/ Sp. [ˈgato(s)] vs. BP [ˈgatu(s)] 'cat(s)'. This raising process feeds palatalization, BP *parte* [pahtʃi] 'part'.

Finally the devoicing of phrase-final (or word-final) vowels has different degrees of incidence or regularity in different Romance languages. Portuguese shows pervasive devoicing and deletion of word-final vowels and differs strikingly in this respect from Spanish. Phrase-final devoicing in French primarily affects high vowels and has been well documented and studied experimentally (cf. Fagyal/Moisset 1999; Smith 2003). It should be noted, however, that phrase-final devoicing is not considered an instance of vowel reduction in French, but rather a prosodic and discourse marker. Meunier/Espesser (2011) found that vowels in word-final syllables are less often reduced than preceding ones, in terms of duration and centralization. Similarly, Torreira/Ernestus (2011) show that in French phrase-medial devoicing shows characteristics of vowel reduction, such as shortening and increased coarticulation.

3.2 Vowel-to-vowel coarticulation

3.2.1 Vowel coalescence

Vowel coalescence in Romanian occurs in restricted environments in spontaneous speech. We will consider the example of vowel-final function words, such as the

prepositions *pe* ‘on’ and *de* ‘of’. Coalescence takes place between [e] and a following stressed [a] or [ʌ], but not with other vowels. The following are some representative examples from a casual style of speech: *p[e] [a]sta* ~ *p[ɛa]sta* / *p[a]sta* ‘on this one_F’, *p[e] [ʌ]sta* ~ *p[ʌ]sta* ‘on this one_M’. This type of coalescence does not seem to occur across lexical words, or at least it is not as salient. It should be noted that all the connected speech phenomena reported here still need to be studied experimentally, preferably in spontaneous speech corpora.

In Spanish, sequences of vowels are reduced in connected speech (cf. e.g. Hualde 2005, 89–94). Unstressed high vowels glide in contact with other vowels, e.g. *m[ja]migo* ‘my friend’, *t[wa]buelo* ‘your grandfather’, and sequences containing non-high vowels may be reduced to a single syllable in various ways, including deletion, coalescence and gliding, e.g. *te acuerdas* [ta'kwɛrðas] ~ [tja'kwɛrðas] ‘you remember’ (cf. Hualde/Torreira/Simonet 2008 for experimental results). In Portuguese these phenomena of syllable coalescence are perhaps more systematic. Thus, for Brazilian Portuguese Perini (2002, 50) states that when both vowels across a word boundary are unstressed, /i/ and /u/ become glides before a non-identical vowel and in all other cases the first vowel is deleted, as in his examples *bule amassado* ['buljama'sadu] ‘dented coffeepot’, *casa enorme* ‘huge house’ ['kazinɔhmi]. This situation seems to also obtain in European Portuguese (Mateus/d'Andrade 2000, 146; Vigário 2003, 104–114).

Within words, the reduction to diphthongs of sequences where an unstressed mid vowel is followed by another vowel is widespread in Latin American Spanish, e.g. *pelear* [pe'ljar] ‘to fight’. The phenomenon is subject to lexical and phonological conditions that are still not well understood. For instance, /ea/ is much more readily reduced to [ja] in, for example, *golpeamos* ‘we strike’ than in *leamos* ‘we read_{SBJV}’.

3.2.2 Vowel assimilation and harmony-type effects

A well-known vowel-to-vowel assimilation phenomenon in Italo-Romance is metaphony, which generally involves the raising or diphthongization of stressed vowels under the assimilatory effects of a word-final high vowel, e.g. /verde/ ‘green_{SG}’ vs. /virdi/ ‘green_{PL}’, /pɛde/ ‘foot’ vs. /pjɛdi/ ‘feet’. Metaphonic phenomena are found in both northern and southern Italo-Romance (cf. e.g. Maiden 1991), but not in standard Italian. Similar phenomena are also found in Asturian and Cantabrian dialects in northern Spain (e.g. in Lena Asturian /gata/ ‘she-cat’ vs. /getu/ ‘he-cat’; cf. Neira Martínez 1955; Hualde 1989; 1998).

Romanian morphophonology exhibits a process of diphthong/singleton alternation that fits the description of metaphony and has consequently been analyzed as such (cf. Chitoran 2002; Renwick 2012, including a comparative experimental study of Romanian and Italian). Such alternations can be found, for example, in nominal morphology in singular-plural forms (e.g. *poartă* ['poarta] ~ *porți* ['ports'] ‘gate/

gates') and in verb morphology (e.g. *treacă* ['treakΛ] 'he/they pass(es)_{SBJV}' – *trece* ['trefʃ] 'you pass_{IND}'). The stressed singleton vowel is conditioned by the high vowel in the following syllable, as in the classic case of metaphony, but also by the front vowel /e/: *treacă* ['treakΛ] 'he/they pass(es)_{SBJV}' ~ *trece* ['trefʃe] 's/he passes_{IND}', *deasă* ['deasΛ] 'thick_{F.SG}' ~ *dese* ['dese] 'thick_{F.PL}'. These systematic synchronic alternations are the morphologized outcomes of a sound change involving vowel diphthongization under stress (SERA(M) > Rom. *seară* ['searΛ] 'evening'); cf. Alkire/Rosen (2010) for a detailed account. A related phenomenon, the lowering of stressed mid vowels under the influence of final low vowels, is found in Portuguese, e.g. *fam*[o]so 'famous_{M.SG}' vs. *fam*[ɔ]sa 'famous_{F.SG}'.

In running speech, vowel-to-vowel coarticulation is attested variably in Romanian in forms such as *bun*[Λ] *ziua* ~ *bun*[e] *ziua* 'good day' (greeting), *uit*[Λ]-*te* ~ *uit*[e]-*te* 'look!'. As these examples show, a final central vowel tends to be fronted before a front vowel in the following word. 'To look' is a reflexive verb of the first conjugation (*a se uita*), and should regularly form the imperative in [Λ]. However, when the imperative of this verb is used without the reflexive pronoun, the form is exclusively *uite!* ['ujte]. This can be attributed to lexicalization of the effects of coarticulation originally induced by the reflexive pronoun *te*.

Vowel-to-vowel coarticulation can interact in Romanian with an effect of labial centralization, which is attested as a sound change, but is not known to be synchronically active. Historically, /e/ after a labial becomes central, unless the following vowel is front (Alkire/Rosen 2010, 258). This sound change explains forms such as *MĒLU > Rom. *măr* /mΛr/ 'apple' (cf. It. *mela*) vs. *MĒLE > Rom. *mere* /mere/ 'apples'. It is not clear what the phonetic basis of labial centralization may be, but casual spontaneous speech seems to exhibit a surprisingly similar tendency. A preliminary experimental study of this phenomenon based on a large corpus is presented in Chitoran et al. (2016). We report here some examples typical of a very casual style of speech, involving the vowel of the preposition *pe* 'on', *pe urmă* ~ *p*[Λ] *urmă* 'after that', *pe el* ~ [*p*Λ] *el* 'him_{ACC}', *pe la mama* ~ *p*[Λ] *la mama* 'at mother's house', *pe seară* ~ *p*[Λ] *seară* 'towards evening', *pe ziuă* ~ *p*[Λ] *ziuă* 'during the day', *pe iarnă* ~ *p*[Λ] *iarnă* 'during the winter'.

Notice that vowel centralization in Romanian is heard before both back and front vowels; therefore it cannot be attributed to vowel-to-vowel coarticulation, at least not exclusively. However, vowel backing is attested independently, consistent with the vowel fronting presented earlier. We can see this in the behaviour of the preposition *de* 'of', where no labial is present, e.g. *de unde* ~ *d*[Λ] *unde* 'from where'. This is most commonly observed in a very casual pronunciation of the very colloquial phrase *da de unde* ~ *da d*[Λ] *unde* 'on the contrary'. Evidence that this centralization is due to vowel backing comes from its absence when the following vowel is front, e.g. *de seară*, **d*[Λ] *seară*, as in *rochie de seară* 'evening dress', *de zi*, **d*[Λ] *zi* 'of the day', *de iarnă*, **d*[Λ] *iarnă* 'of the winter'.

More extensive phenomena of vowel harmony, characterizing in some cases whole phonological word domains, have been described for Asturian/Cantabrian Ibero-Romance (cf. e.g. Hualde 1989), for some Italo-Romance varieties (cf. e.g. Nibert 1998; Mascaró 2011), for Valencian Catalan (Jiménez 1998) and, as mentioned above, for Eastern Andalusian/Murcian (cf. Hernández-Campoy/Trudgill 2002).

The distribution of lower and higher mid vowels in Southern French is said to be dictated by the so-called *loi de position* ‘law of position’, i.e. high-mid vowels in open syllables, low-mid vowels in closed syllables. In other varieties of French the distribution is less predictable and depends in part on harmonic rules, e.g. *bête* [bet] ‘animal; silly’, but *bêtise* [betiz] ‘silliness’, where the vowel of the root raises under the influence of the high vowel /i/ in the following syllable (cf. Walker 2001, 54).

Above, in section 3.1, we made reference to the raising of pretonic mid vowels, which is sometimes an assimilatory phenomenon conditioned by the presence of a stressed high vowel. The opposite assimilatory phenomenon, the lowering of pretonic mid vowels, is found in Portuguese. In pretonic syllables there is no contrast between /e/ and /ɛ/ or /o/ and /ɔ/. Normally, mid vowels are pronounced as mid-high [e], [o] and may even be raised to [i], [u]. However, we find pretonic [ɛ] when the stressed vowel is /ɛ/, as in *Pelé* [pɛ'lɛ], and [ɔ] when the stressed vowel is /ɔ/, as in *bolota* [bɔ'lɔtɛ] ‘acorn’ (cf. Perini 2002, 37).

3.3 Vowel epenthesis

Perhaps the most remarkable phenomenon of vowel epenthesis in Romance is the prosthesis of /e/ before word-initial /sC/ clusters. In Spanish and Catalan this is a synchronically active, obligatory rule of pronunciation, a phonotactic constraint that applies to borrowings exceptionlessly (e.g. Sp. *estrés* ‘stress’) and is observable in the second-language pronunciation of native speakers of these languages. For Ibero-Romance speakers sequences like [st-] and [est-] are not distinct (for experimental evidence, cf. Hallé et al. 2013), so that, for instance, the English words *state* and *estate* may perceptually be homophones. Portuguese has the same neutralization, but in varieties with palatalization of preconsonantal sibilants, deletion of the initial vowel is frequent in colloquial speech, e.g. *espaço* [ʃpasu] ‘space’ (Mateus/d’Andrade 2000, 43).

Vocalic prosthesis before word-initial /sC/ clusters is a phenomenon with a surprisingly long pedigree. French does not have this phonotactic constraint, but evolutions like SPATHA(M) > Fr. *épée* ‘sword’, SPATIU(M) > Fr. *espace* ‘space’, etc., show that it once did. At some historical point, however, /sC/-initial sequences became acceptable in French and words like *statue* started being incorporated into the lexicon without adaptation. At most, one can speak of a lexical morphophonological rule in French relating words like *espace* ‘space’ and *spacieux* ‘spacious_{M.SG}’.

A historically related phenomenon functioning as a phonotactic rule in word sequences is found in some conservative varieties of Italian that display alternations like *strada* ‘road’, *in istrada* ‘on the road’, *scritto* ‘written’, *per iscritto* ‘in writing’ (cf. Sampson 2010).

4 Conclusion

We have provided a general overview of phonetic/phonological phenomena in Romance. We have chosen examples that we think are particularly common in the Romance languages or particularly interesting, since obvious reasons of space prevent us from being exhaustive in this chapter. An interesting fact, already noticed by Delattre (1946), is that, often, what appears as a variable process at the phonetics-phonology interface in one Romance language may mirror a completed sound change in another (e.g. syllable or word-final /s/ aspiration).

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