Weakening and strengthening in Romance revisited

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This paper investigates the extent to which segmental substitutions traditionally attributed to articulatory weakening and strengthening through changes in constriction degree are, in fact, caused by aerodynamic, perceptual or other articulatory mechanisms. For that purpose the articulatory, acoustic and distributional characteristics of consonants participating in the implementation of several sound change processes in Romance (lenition, occlusivization, fricativization, voicing/devoicing, affrication/deaffrication, vocalization, rhotacism, nasalization, lateralization, aspiration, glottalization, elision and place substitutions) are carefully reviewed. Data show that, while appropriate for segmental replacements involving articulatory reduction, the notion 'weakening' cannot always account for consonant changes involving backing, vocalization, aspiration and elision. Other factors besides articulatory reduction may also play a role in the implementation of consonant changes traditionally attributed to weakening, i.e., gestural decomposition, acoustic equivalence, and the perceptual categorization of the vowel transitions or of intermediate phonetic realizations between those of the input and output consonants. On the other hand, articulatory strengthening appears to be a plausible strategy for segmental substitutions occurring in strong positions but not so for sound changes involving devoicing.

1. Introduction

Traditionally, consonantal weakening has been claimed to account for sound changes involving a decrease in constriction degree, i.e., deaffrication, degemination, fricativization and approximantization, rhotacism, vocalization, aspiration, glottalization and elision, as well as for voicing and nasalization and for segmental replacements affecting place of articulation[1] (Alonso 1967; Hock 1988; Lavoie 2001; Straka 1964, 1965a, 1965b, 1968). The goal of this paper is to show that these changes cannot always be treated as instances of weakening since they often depend on aerodynamic requirements, on acoustic factors or on production mechanisms different from those intervening in articulatory reduction.

The weakening of lingual consonants is expected to occur in word and syllable positions known to favor articulatory reduction (e.g., syllable finally) and is believed to proceed through a decrease in closure or constriction degree and through articulatory retraction

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(Fougeron 1999; Recasens submitted). The former maneuver does not alter significantly the tongue body configuration for the original consonant, e.g., it may yield the glide [j][2] out of palatal consonants such as [Z] and [¥], and a tap or an approximant out of dental and alveolar consonants. The latter mechanism could account for the palatalization and aspiration of an alveolar fricative and for the uvularization of an alveolar rhotic (Straka 1964, 1965b).

However phonetic outcomes arising through weakening are not always consistent with those initial predictions. Thus, vocalization may yield unexpected realizations (e.g., [j] out of non palatal [z] and [ɾ]) or different glides for the same consonant (e.g. [w], [j] out of labial [ɪ]), and operate on the initial consonant in homosyllabic clusters where articulatory reduction is not as prone to occur as syllable finally (e.g., S. American Sp.[3] *aular* and *maire* for *hablar* and *madre* in addition to *ausoluto* and *afeuto* for *absoluto* and *afecto*; Lipski 1994a: 74, Malmberg 1971: 397, 409). Moreover, phonetic changes often attributed to weakening may be associated with production strategies other than gestural reduction such as an increase in the temporal distance between articulatory gestures (e.g., in the case of the vocalization or elision of word final [Ú]; Goldstein 1994, Recasens & Farnetani 1994) or the failure to fulfil the appropriate aerodynamic requirements for the implementation of specific manners of articulation (e.g., in the case of trill assibilation; Solé 2002).

Another issue of interest is whether the sound changes under consideration apply in a dependent fashion or independently of each other. Thus, according to Mowrey & Pagliuca (1985), stop weakening may proceed through fricativization and optional voicing ([p^h] > [(p)F] > [(p)f], [ɪ]; [t^h] > [(t)s]/[T] > [z]/[D]; [k^h] > [(k)x] > [*f*]), or else through voicing without fricativization ([p^h] > [p] > [b] > [ɪ]; [t^h] > [t] > [d] > [D]; [k^h] > [k] > [g] > [*f*]). Also, vocalization, aspiration or elision cannot be taken to be the last stages of a gradual articulatory weakening evolution if associated with the perceptual categorization of acoustic cues (see below) or operating directly on a reduced realization of the original consonant (e.g., [p^h] > [^{p}] > Ø).

The present investigation is also concerned with the extent to which specific pairs of segmental changes should be regarded as cases of consonantal weakening and strengthening, e.g., vocalization/approximantization and occlusivization/fricativization, voicing and devoicing, and degemination and gemination (Lavoie 2001). In the present study, two opposite segmental replacements will be attributed to weakening and strengthening if occurring in segmental contexts and/or word positions favoring one change or the other, e.g.,

the substitutions of intervocalic [Z] by [j] and of word initial [j] by [Z] will be associated with weakening and strengthening, respectively. Instead, it will be hypothesized that two mirror substitutions occurring in the same environmental conditions may have proceeded through intermediate phonetic realizations between the input and output segments, e.g., both intervocalic changes [z]> [ɾ] and [ɾ]> [z] may be implemented through [ɾ^{z}], [z^{r}] particularly so in geographical domains where the rhotic and the fricative exhibit similar phonetic realizations (see section 4.2).

As pointed out above, acoustic factors may play a relevant role in consonant replacements usually characterized as instances of weakening. Spectral similarity can be at the origin of the vocalization of grave consonants into [w] ([Ú], labials, back velars) and of clear consonants into [j] ([l], palatals, front velars), and of the substitution of dentoalveolar approximants by alveolars allowing continuous airflow (i.e., [D]> [ɾ], [l], [n]). It is doubtful however that acoustic equivalence should be advocated in order to account for non reversible substitutions, e.g., [Ú]> [w] is widely attested but [w] > [Ú] is not and [D]> [ɾ] occurs much more often than [ɾ]> [D].

Consonantal vocalization may also result from the categorization of the VC or CV formant transitions as glides followed by elision of the target consonant. Glide categorization occurs in VC sequences with consonants requiring anticipatory production mechanisms (e.g., lip closing for labials, tongue tip raising for alveolars, and predorsum lowering and postdorsum raising for velars and [Ú]), and in VC and CV sequences with consonants implemented through gestures exhibiting substantial anticipatory and carryover articulatory activity (e.g., tongue dorsum raising for palatals) (Recasens, 1998; Recasens *et al*. 1995). Thus, e.g., the vocalization of [Ú] and [s] may have been preceded by the intermediate stages [VwÚ] and [Vjs], as revealed by forms still available in Romansh (Bonaduz [awÚt] ALTU; Haiman & Benincà 1992: 55) and Occitan (*crei(s)to* CRISTA, [mejs] MENSE, [tQej(s)] TRES; FEW II: 1351, Lafont 1983: 28, Ronjat 1930: 120, 366).

In summary, processes which have been assigned traditionally to weakening and strengthening may be associated with articulatory and acoustic factors unrelated to articulatory reduction and an increase in constriction degree, respectively. In order to investigate the array of mechanisms involved in the implementation of those general sound change processes in Romance, several types of consonant substitutions will be taken into consideration, i.e., lenition, voicing and deaffrication (section 2), vocalization (section 3), rhotacism, nasalization and lateralization (section 4), aspiration, retraction and

glottalization (section 5), elision (section 6) and place of articulation replacements (section 7).

2. Lenition, voicing and deaffrication

2.1. Stops

Temporal compression may cause stops to lenite through a decrease in constriction degree and to acquire passive voicing (Kohler 1984; Ohala 1983). Regarding syllable initial stops in Western Romance, this action is favored by preceding segments allowing airflow both in the case of the voiceless stop voicing process (Sp. *saber* SAPERE, *maduro* MATURU, *seguro* SECURU; Lausberg 1970: 347) and of voiced stop lenition (e.g., Cat. ['kaD@] *cada*, ['bujD@] *buida*, [@zD@'ıe] *esdevé*, ['eɾı@] *herba*, ['sElı@] *selva*, Cal. [a 'DOnna] *la donna*, [i 'Ïatti] *gli gatti*; Recasens 1993: 187-188, Rohlfs 1966: 204, 207). Moreover, lenition and voicing may operate on syllable final stops, even when rendered syllable initial before a word initial vowel (Log. [si zetsiD in s:u Davo'l:ĩu] for /si zetsit in s:u tavOl:ínu/, Sp. [oıte'neQ] *obtener*, [seT] *sed*, Val. [kaı a'munt] *cap amunt*; Bolognesi, 1998: 46, Navarro Tomás 1972: 84, 103, Recasens 1996a: 184).

Stop voicing appears to affect velars rather than labials and dentals (Bustos Tovar 1960; Cravens 1984). Data from the Romance languages indicate that velar stop voicing may have been favored by a following low or back rounded vowel, [w], [Q] or [l], and by preceding [z] or [˜]. This trend may be illustrated with forms taken from Cat. (*gàbia* CAVEA, *graelles* CRATICULAS, *gorb* CORVU, *gleda* KLETA, *regonèixer* RECOGNOSCERE, *esguma* *SCUMA, *engalçar* from CALCE; Recasens 1996a: 248-249), Romanesco (*guasi* QUASI; Rohlfs 1966: 222), Portuguese (*gamela* CAMELLA, *rústego* RUSTICU; Leite de Vasconcellos 1987: 99, Paiva Boleo & Santos Silva 1961: 227) and Old Spanish (*riesc/go* from RESECARE, *asco/usgo* from *OSICARE vis-à-vis *obispo* EPISCOPU, *costura* *CONSUTURA; Ranson 1999). Voiceless stop fricativization is also prone to affect velars (Old Tuscan; Cravens 1984), and may be followed by vocalization syllable finally in consonant clusters (Log. [i'çQiEQE] SCRIBERE, Occ. *aiga* AQUA, Francoprov. [ç¥u] CLAUDIT, N.W. Cat. [fEjt] FACTU, [ejʃ] AXE; Contini 1987: 295, Grandgent 1905: 62, Jeanjaquet 1931: 40, Recasens 1996a: 236, 287)[4].

In agreement with the weakening hypothesis, it may be hypothesized that back velars are prone to undergo voicing and lenition since

they are articulated with a widespread and undefined occlusion at the soft palate, which could also explain why their voicing and manner of articulation status may be hard to identify (González Ollé 1972; Salvador 1968). As pointed out in section 2.3, an alternative account based on aerodynamic constraints would predict the opposite outcome: a higher back cavity pressure level for velars vs labials and dentoalveolars (and for low vs high vowel contexts) should cause the former to be more resistant to voicing than the latter (Docherty 1992; Ohala 1985; Ohala & Riordan 1979; Smith 1978)[5].

Moreover, the fact that dental stops may lenite more often than velar stops in syllable final position suggests that consonant reduction may be implemented through different articulatory mechanisms if taking place syllable initially or syllable finally. In syllable initial position, articulatory reduction affects mostly velars and involves some dorsal contact loss in the adjacency of open segments. Syllable finally, on the other hand, the sound change of interest may proceed through a decrease in tongue front contact at the place of articulation if occurring at the end of the word (clearly so for consonants articulated with apical contact such as dental stops) or else through gestural overlap if taking place in heterosyllabic clusters (in the case of consonants involving fast or no tongue front activation, i.e., dentals and velars).

2.2. Fricatives and affricates

Fricative voicing occurs intervocalically, as for [s]> [z] and [f]> [v] in Western Romance, presumably through contextual assimilation in constriction opening and in line with the fact that shortened fricatives and affricates may yield a voiced percept (Cole & Cooper 1975; Lavoie 2001). Voiced fricative lenition may apply to a postvocalic labiodental, and to [z] and [dz] between vocalic segments or before a voiced consonant. The former change accounts for Campidanese [su 'ɪQaDE] FRATER and for E. Catalan [k@'ɪa¥] CABALLU (Contini 1986: 529; Recasens 1996a: 196). The latter may be exemplified with data from Ladin (['tseD/da] CASA; Tagliavini 1926: 58), Old French (['aDne] ASINU, [meD'leQ] MISCULARE; Pope 1934: 151) and Gascon from the Luchon area (*arradim* RACIMU, *ade* ASINU, ['kawdo] CAUSA; FEW, II: 541, Michel 1956: 114, Ronjat 1932: 122).

The fact that fricativization processes such as [ɪ]> [v] and [D]> [z] are documented in environmental conditions analogous to those just described runs against the weakening hypothesis, and is in support of the possibility that both lenition and fricativization have operated on intermediate phonetic realizations between approximant and

fricative realizations (i.e., [ɪ^{v}], [D^{z}]). Indeed, [ɪ]> [v] has taken place postvocalically in lexical forms with an etymological voiceless or voiced labial stop, as revealed by examples from French (*avril* APRILE, *cheval* CABALLU; Pope 1934: 139) and N. Italian (Lig. [ka'vEli] CAPILLI, ['fQEve] FEBRE; Rohlfs 1966: 278, 373). This replacement may be assisted by an increase in tongue constriction narrowing before [i], as exemplified by E. Cat. [@Âvi'sjo] AMBITIONE, [pu'vi¥] PUPILLU (Recasens 1996a: 203-204; see also Ohala and Lorentz 1978 regarding [w]> [v], [ɪ]). On the other hand, [D]> [z] may occur intervocalically after stress, before a nasal, after [l] and [n] and word finally, as shown by phonetic variants from Catalan (*malesa* MALITIA, *alosa* ALAUDA, *salze* SALICE, *onze* UNDECIM, Old Cat. *dezme* DECIMU; Coromines 1980-91, III: 105), Old Occitan (*legisme* LEGITIMU, [aD], [az] AD; Grandgent 1905: 79, Ronjat 1932: 257) and Old French (*Rosne* RHODANU; Pope 1934: 149).

The weakening of affricates applies most frequently in intervocalic and syllable final position, and results in the loss of the stop component or, less often, of the frication element (see also Lavoie 2001 regarding the fricativization of English affricates in spontaneous speech)[6]. Defricativization may have affected [ts] (Leng., Lim. [put] PUTEU, [dEt] DECE; Ronjat 1932: 91), as well as [dZ] before [i], presumably through a decrease in tongue contact at the central palate (Poit. *ardil* ARGILLA, dial. Cat. *donoll* GENUCULU, *esbardit* for *esbargit* from SPARGERE; FEW, I: 137, Recasens 1996a: 216). Deocclusivization of alveolar and palatal affricates may be illustrated with phonetic variants from Spanish (['pjeTa] PETTIA, And. [mu'ʃaʃo] *muchacho*; Lapesa 1980: 511), Italian dialects (Ven. ['TEnto] CENTU, ['DEnaQo], ['zEne] GENERU, Piedm. [saQ'vEl] CEREBELLU, Tusc. ['kQoʃe] CRUCE; Rohlfs 1966: 202, 210, 289) and Gascon ([saws] SALICE, [hews] FILICE; Rohlfs 1970: 141), and with the change [dZ] > [Z] after a word final vowel in W. Catalan areas (e.g., [dZen] GENTE but [l@ 'Zen]; Recasens 1996a: 292).

The fact that the affrication of fricatives or the failure for affricates to drop the stop component occurs in positions and contexts different from those just mentioned suggests that the presence of fricatives and affricates may be associated with weakening and strengthening, respectively. Consistently, [Z] > [dZ] appears to have taken place word initially and after an occluded consonant in W. Catalan ([dZow] IUGU, [es'pOndZa] SPONGIA; Recasens 1996a: 285, 296) and posttonically in Old Catalan ([ku'rEddZ@] CORRIGIA; Coromines 1980-91, II: 965).

2.3. Exceptional cases

While stop, fricative and affricate voicing is associated with a decrease in segmental duration and contact degree, consonant devoicing appears to be mostly related to aerodynamic requirements. Indeed, devoicing may fail to occur when oral air pressure buildup causes a longer time for the transglottal pressure difference to reach the level at which voicing might commence (Docherty 1992; Ohala 1983). As discussed below, this may be associated with manner of articulation, a long closure duration, a small back cavity size and a low subglottal air pressure level.

Devoicing affects fricatives, affricates and rhotics. Fricative and affricate devoicing accounts for [Z] > [ʃ] (Argentinian Spanish; Malmberg 1950: 106-107) and for [dZ]> [tʃ] (E. Cat. [k@'litʃ@] CALIG I NE; Recasens 1996a: 216). Rhotics may devoice whether alveolar or uvular, i.e., [®] (Cuban and Dominican Republic Spanish; Lipski 1994b: 256, 364), /tQ/ > [tʃ] (Chilean Spanish; Alonso 1967: 123), [R] > [X] (Puerto Rican Spanish, Portuguese; Goman 1981: 145, Parkinson 1988: 138), [R] > [ʃ], [ç], [h] (Ardenne; Bruneau 1913: 348-349, 363). The tendency for these consonants to devoice is due to the precise mechanisms involved in tuning high air velocity through the constriction and continued voicing, as well as to additional demands on closure formation for affricates (Docherty 1992; Ohala 1985; Pensado 1993, 2000; Widdison 1998).

A trend has been observed for fricatives to voice more often than stops, affricates and stop clusters in word final position before a word initial vowel. Indeed, the alveolar fricative becomes [z] in these circumstances in Logudorese, French, Portuguese, Catalan, N. Italian and Occitan (Jones 1988: 323; Lausberg 1970: 430; Parkinson 1988: 138; Recasens 1993: 171; Rohlfs 1966: 284; Wheeler 1988: 252). On the other hand, prevocalic word final stops remain voiceless in languages such as Catalan and Occitan (Recasens 1993: 171; Wheeler 1988: 252), and affricates as well as non-nasal stop clusters ending in an alveolar fricative may fail to voice as well (e.g., Prov. *nue*[tʃ] *e jorn*, as opposed to Leng. *pue*[dZ] *agut*; Wheeler 1988: 252). While being in disagreement with the general observation that fricatives and affricates devoice at least as frequently as stops (Docherty 1992; Haggard 1978; Ohala 1985), these data appear to be more in accordance with differences in intraoral air pressure level between fricatives and stops and with the observation that fricative devoicing is a passive process occurring when speakers do not generate sufficient

airflow to maintain a transglottal pressure drop (Smith 1995).

Voicing is harder on long consonants produced with a closure or narrow constriction than on those exhibiting free airflow, presumably since the former allow oral air pressure enough time to equalize with subglottal pressure and cause voicing to stop (Jaeger 1978). Indeed, voicing did not affect Latin long voiceless stops and fricatives (Cat. *copa* CUPPA, *gota* GUTTA, [p@'sa] PASSARE; Lausberg 1970: 407). Moreover, voiced stops may have undergone devoicing either because they were long originally (Cat. *retre* REDDERE, *gepa* GIBBA; Badia 1951: 231, Coromines 1980-91, VII: 290) or else because they lengthened in the adjacency of a stressed vowel often in consonant clusters (Leng. ['bjats/tʃo] *VIATICAT, ['pOp(:)le] *poble*, ['sek(:)le] *segle*, E. Cat. ['met:ʃ@] MEDICU, Mil. ['kapja] *gabbia*; Jungeman 1956: 334, Recasens 1996a: 215, Rohlfs 1966: 387, Ronjat 1932: 244)[7]. Stop lenition and voicing may also fail to be implemented after heterosyllabic consonants preventing free airflow from occurring, e.g., in the case of homorganic clusters (Cat. [m@l'da] *maldar*, [e¥ 'diw] *ell diu*, [baf 'bO] *baf bo*, Sic. ['lo˜ku] LONGU; Recasens 1993: 187-188, Maiden & Parry 1997: 370) but also in the Latin sequences LV, RV (see section 3.1) and in clusters with a voiced stop preceded by [l z Q j w] (S. American Spanish dialects; Lipski 1994a: 67).

Aerodynamic constraints may also account for the simplification of intervocalic geminates and for instances of consonant lengthening in clusters. Geminate simplification applies to voiceless stops rather than to voiced sonorants[8], though consonants allowing oral airflow are more prone than stops to shorten across a word boundary, i.e., word medial [ll] keeps the geminate realization while /s##s/, /ʃ##ʃ/ and /r##r/ undergo simplification in Catalan, Occitan and other Romance languages. On the other hand, stop lengthening may take place before [l], [j] and [w] rather than before [Q], presumably in line with differences in constriction degree and in intraoral pressure level associated with these consonants. Illustrative examples may be found in Catalan (['pObbl@] *poble*, ['seggl@] *segle* as opposed to ['kOıQ@] *cobra*, ['maÏQ@] *magre*; Recasens 1996a: 191, 240) and Tuscan (['gabbja] CAVEA, [pa'lattso] PALATIU, ['saddZo] EXAGIU, ['febbQe] FEBRE, ['akkwa] ACQUA[9] but ['patQe] PATRE, ['neQo] NIGRU; Rohlfs 1966: 370, 372, 386, 395, 409, 416). This hypothesis runs counter to the possibility that stop gemination in those consonant sequences has occurred syllable finally after syllabic reassigment of the stop consonant, i.e., VC-VV > VC-CVV (Coromines 1936; Murray & Vennemann 1983; Pensadő, 1986).

Stop devoicing applies mostly to velars in line with the small back cavity size involved (e.g., dial. Cat. *cangrena* for *gangrena*, Sal. *carbu* for *garbo*, *cumma* for *gomma*, [ka'lEtta] *galetta*, ['kQanni] *grande*; Recasens 1996a: 249, Rohlfs 1966: 208, 252)[10], which also explains why voiced velars are less common than voiced apicals and labials in world languages (Ohala 1985). Differences in back cavity size and in airflow may also explain why fricative devoicing affects alveolars and palatals rather than labiodentals and dentals (Haggard 1978), as well as the failure of stops to voice after [w] rather than after [j] (e.g., Sp. *supe* SAUPI, *poco* PAUCU, *coto* CAUTU, N. It. ['Oka] AUCA, Ven. [aw'tuno] AUTUMNU; Menéndez Pidal 1968: 141, Rohlfs 1966: 269, 274). Analogously to the voicing and geminate simplification scenarios referred to above, the fact that [s] has regularly undergone voicing after the two glides may be associated with differences in intraoral air pressure level between fricatives and stops ([z] in Occ. *pausa* PAUSA, Old Sp. *cosa* CAUSA, *osar* AUSARE; Grandgent 1905: 53, Menéndez Pidal 1968: 141).

A low subglottal air pressure level and a slight vocal fold abduction (Ohala 1985) account for the devoicing of sentence final stops, fricatives and affricates in dialectal areas where these consonants show up word finally, i.e., Catalan (Recasens 1993: 170), Rhaetoromance (Lausberg 1970: 442), Occitan (*amic* AMICU, *ris* RISU; Grandgent 1905: 45), N. Italian (Lomb. [OQp] ORBU, Piedm. [øf] OVU, Romagn. *nut* NUDU; Rohlfs 1966: 423-424), French (*chef* CAPU; Lausberg 1970: 442) and Castilian Spanish ([biQ'tuT] *virtud*; Navarro Tomás 1972: 103).

3. Vocalization

3.1 Syllable initially

The vocalization of consonants has been attributed to articulatory weakening to the extent that it may result from a decrease in constriction degree (Alonso 1967; Harris-Northall 1990; Maiden 1995; Malmberg 1971; Straka 1964, 1965a, 1968). This interpretation becomes most feasible when the phonetic endproduct exhibits an articulatory configuration analogous to that of the original consonant, i.e., [j] for palatals and [w] for labials and back velars (see *Introduction*).

The outcome [j] is associated with intervocalic and, less so, with word initial palatals. Illustrative evolutions may affect [ˉ] (Dacorom.

['vije] VINEA, Port. ['tẽ̈u] < ['tẽ˜u] TENEO; Sala 1976: 83, Hajek 1997: 168), [J] (Friul. [pa'ja] PACARE, Sp. ['ju*f*o] IUGU, Rosh. ['pla:ja] PLAGA; Iliescu 1972: 62, Lausberg 1970: 328, Lutta 1923: 184), and [dZ] (Log. ['dZaE] CLAVE but [sa 'jaE]; Contini 1986: 527). A decrease in degree of dorsopalatal contact may also account for the change [¥] > [j] in the adjacency of a high vowel (Rom. ['jepuQe] LEPORE, [g@'in@] GALLINA, Camp. ['juna] LUNA, Laz. ['suju] SOLU; Mallinson 1988: 396, Nandris 1963: 231, Rohlfs 1966: 216, 309), and renders the production of specific consonant clusters easier (W. Cat. ['seg¥/je] SECALE, ['k¥/jeza] ECCLESIA; Recasens 1996a: 312). Intervocalic labials and velars appear to vocalize much more rarely than intervocalic palatals, while dentoalveolars do not undergo vocalization in this contextual condition (Cors. [a 'wola] *la gola*, Tusc. ['fawa] for ['fava] FABA, Gasc. [ta'wa] TABANU, ['bewe] BIBERE; Cravens 1987, Rohlfs 1966: 293, Rohlfs 1970: 128).

A reversed strengthening action causes approximants to become stops, affricates or fricatives in positions and contexts favoring an increase in constriction degree. Palatal [j] may yield a palatal stop, fricative or affricate word initially and after a nasal stop (Fr. *vendange* VINDEMIA, Sp. [(un)'Juǰo] (*un) yugo*; Lausberg 1970: 400, Navarro Tomás 1972: 128), a palatal fricative intervocalically (Arg. ['maZ/ʃo] MAIU; Malmberg 1950: 106-107) and a velar stop syllable finally (Rosh. [vikf] VIVU, [sekt] STELLA; Lausberg 1970: 221, Meyer-Lübke, 1974: 102). On the other hand, highly constricted or fricativized labiovelars may change into labials or velars (Ohala & Lorentz 1978) whether word initially (Old Pad. *vardar* WARDAN, Old Piedm. *visa* WISA; Rohlfs 1966: 231), after a velar stop in homosyllabic clusters (Sard. ['Ebba] EQUA; Contini 1987: 68), syllable finally (Lad. [aft] ALTU, Rosh. [kru/okʃ] CROCE, Sard. ['avQa] AURA; Guarnerio 1918: 103, Lausberg 1970: 234, Tuttle 1991: 576), and after a heterosyllabic consonant involving closure or central contact (Cat. *calb* CALVU, *corb* CORVU, Old Occ. *valg* *VALUI, *sec* SEDUI, Sp. *conviene* CONVENIT, *mangual* MANUALE; Pensado 1986).

Syllable initial vocalization may also be attributed to acoustic equivalence if the original consonant and the glide output exhibit an analogous F2 frequency or overall spectral structure. Acoustic similarity between grave spectra may be indeed called forth in order to justify the vocalization of [Ú] into [w], assuming that apical consonants are not expected to undergo a decrease in lingual contact at the alveolar place of articulation in syllable initial position (Ohala 1974, Ohala & Lorentz 1978). Moreover, additional F2 lowering may contribute to the same change in a grave vowel environment, i.e., after

[u] in S. Italian areas (Pugl. ['tavu@] TABULA; Rohlfs 1966: 309) or after stressed [a] in Romanian (*steaua* STELLA ILLA; Lausberg 1970: 411) and Occitan (Leng. *auo* ALA; Ronjat 1932: 144). Vocalization through acoustic equivalence is prone to occur in the absence of a straight articulatory relationship between the original consonant and the output glide, as in the case of the substitution of clear [l], [z] and [Q] by [j] (Essen 1964; Ohala 1978). Illustrative examples may be found in intervocalic position (Wal. ['stwaj] STELLA; ALW 1953: 139) as well as in homosyllabic and heterosyllabic clusters (Tusc. ['tempjo] TEMPLU, ['aja] AREA, Laz. ['peQja] *PIRULA, Sic. ['fjati] FRATRE; Maiden & Perry 1997: 373, Rohlfs 1966: 355, 400).[11]

As argued in the following section, specific vocalization outcomes for labials and velars before dentoalveolars may be attributed to the glide categorization of the vowel transitions, and show up in examples from Catalan (*taula* TABULA; Badia 1951: 216), Portuguese (*inteiro* INTEGRU; Williams 1938: 84), Gascon and Occitan (Gasc. ['rEwlo] REGULA, Occ. *flairo* FLAGRAT, *roire* ROBURE**,** Vivaro-Alpin [peQ'sEwQe] PERSEQUERE; Ronjat 1932: 227-228, 239, FEW, X: 433), and Italian dialects (Abr. ['najQ@], Cal. ['niuQu] NIGRU; Rohlfs 1966: 196, 372). According to this explanatory hypothesis, C1 vocalization does not need to be preceded by a resyllabification process causing a syllable initial consonant to become syllable final.

3.2. Syllable finally

3.2.1. Dark consonants

Dark consonants ([Ú], labials, back velars) yield [w] quite frequently in syllable final position, as shown by examples taken from Catalan (*deute* DEBITU, *Jaume* IACOMU, *beu* BIBET; Badia 1951: 219-220, 229), Gascon (*sau* SALE; Rohlfs 1970: 152), Occitan (*fau* FAGU, *jou* JUGU, Drôme [tʃaw] CALDU; Bouvier 1976: 237, Ronjat 1932: 101)[12], Brazilian Portuguese ([sOw] SOLE; Parkinson 1988: 135) and Old French ([es'pawl@], ['mOwl@] from [es'pall@] SPATULA, ['mOll@] MODULU; Pope 1934: 149). This sound change may be implemented through contact retraction and loss at the place of articulation, which in the case of [Ú] may be favored by a following non-conflicting labial or velar consonant (e.g., dial. Cat. *auba* ALBA, *auqueria* for *alqueria*, Prov. *seuvo* SILVA, Rhod. ['sewkle] from ['selkle] CIRC(U)LU; Recasens 1996a: 314-315, Ronjat 1932: 205, 243). Moreover, the replacement of [Ú] by [w] may also be obtained through an increase in the temporal separation between the dorsal and apical

gestures of this complex consonant, so that the occurrence of the latter gesture, after voicing resumes, renders [w] audible and the alveolar lateral inaudible (Hardcastle & Barry 1985; Recasens & Farnetani 1994). The vocalization of dark consonants may have a perceptual basis. It may be caused by the confusion of equivalent spectra in line with these consonants becoming darker syllable finally, and by voiced bilabials and [w] exhibiting similar formant transition slopes and durations in this syllable position (Espy Wilson 1992). Another perceptual mechanism contributing to the vocalization process is the integration of the falling or low frequency VC transitions as /w/, which is in accordance with the existence of phonetic variants still exhibiting both the inserted glide and the triggering dark consonant (see *Introduction*).

Glide insertion through segmental categorization of the F2 transitions may also account for specific vocalization outcomes out of grave consonants before a dentoalveolar. In this particular scenario, it may be claimed that listeners hear /w/ or /j/ depending on whether emphasis is put on the low frequency component or on the rising component of the vowel transitions, respectively. Several relevant sound changes may be identified in this respect:

(a) [m]> [w] only before [n] and after [a] in Occitan (*dauno* DOM(I)NA; Ronjat 1932: 213), Romanian (*daun* DAMNU; Lausberg 1970: 374) and Catalan (*llauna* LAM(I)NA, *escon* SCAMNU; Coromines 1974: 262).

(b) [Ú]> [w] often after [a], and [Ú] > [j] often after a back rounded vowel. The former substitution may be illustrated with examples from Old Occitan (*mout* MULTU, *dous* DULCE; Grandgent 1905: 70), Spanish (['soto] SALTU; Menéndez Pidal 1968: 54), Old French (*ueutz* OCULOS; Pope 1934: 154) and Piedmontese (['OtQu] ALTERU; Rohlfs 1966: 37). Examples of the latter change are Port. *muito* MULTU, Occ. *coitivar* CULTIVARE, *coisna* *CUCINA (Lausberg 1970: 372; Straka 1968: 298).

(c) [F ɪ x Ï] > [j], [w] often after a back rounded vowel in dialectal areas such as Occitan (Old Occ. *joine* JUV(E)NE, *coide* CUBITU, *eus*, *eis* IPSE; Grandgent 1905: 77, Ronjat 1932: 166, 169, 255), Portuguese (['ka(j)ʃa] CAPSA, *noi/ute* NOCTE, *outubro* OCTOBRE; Williams 1938: 76, 84-85), S. American Spanish (*recei/ución* for *recepción*, *caráí/uter* for *carácter*; Malmberg 1950: 68, Zamora Vicente 1989: 383) and S. Italian dialects (Luc. ['aj@n@] AGNU, ['lEwna] LIGNA; Rohlfs 1966: 368).

An articulatory interpretation of the vocalization of [Ú] and velars into [j] based on their palatalization is of doubtful validity in the light of palatographic evidence showing that [Ú] does not exhibit greater dorsopalatal contact before dentoalveolars than before labials and velars (Recasens 1996b). The outcome [ujC] in some of the forms referred to above may also have been generated after consonantal vocalization through the dissimilation [uwC] > [ujC], in a fashion similar to substitutions such as *ouro*, *dous* > *oiro*, *dois* in Portuguese (Malmberg 1971: 361; Pensado 1984: 492).

3.2.2. Clear consonants

Clear consonants undergo vocalization into [j] in syllable final position, as exemplified by data for original palatals whether stop (Rosh. [la/Ej] LACU, Old Fr. [mej'tje] from *[meJe'tate] MEDIETATE; Haiman & Benincà 1992: 70, Pope 1934: 132), affricate (Old Occ. [roj] RUBEU; Grandgent 1905: 63), fricative (Old Occ. [baj] BASSIU; Appel 1918: 87), nasal (Friul. [raj] ARANEU, Gasc. [baj] BALNEU; Iliescu 1972: 75, Sampson 1999: 153) or lateral (Old Fr. [kun'sejts] from [kun'se¥ts] CONSILIOS, Auverg. [Zaj] GALLU; Pope 1934: 155, Ronjat 1932: 314). Also alveolar clear [l] and [Q] may yield [j] (S. American and S. Peninsular Sp. *cueipo* CORPU, *goipe* COLAPHU, *comei* COMEDERE, *papei* for *papel*, Tusc. ['sajddu] SALTU, Sic. ['sujddu] SURDU; Alonso 1967: 254-255, Lapesa 1980: 521, Malmberg 1971: 391, Rohlfs 1966: 345, 376).

This process may be attributed to a decrease in tongue contact degree and to articulatory retraction, as suggested by electropalat ographic data (Recasens, submitted). An articulatory rationale based on apical contact loss is presumably at the origin of [l] and [Q] vocalization in those dialectal regions where this change occurs exclusively before non conflicting labials and/or velars, e.g., in Italian and Sardinian zones (Romagn. ['ejba] *alba*, Emil. [dojk] *dolco*, Lig. ['bajba] *barba*, ['ajku] *arco*; Rohlfs 1966: 346, 376) and in Andalusian Spanish areas (*aigo* for *algo*, *poique* for *porque*; Alonso 1967: 254, Quilis-Sanz 1998: 155). The sound change of interest may also be accounted for through phonemic categorization of the rising and high frequency vowel formant transitions in line with the existence of phonetic variants still exhibiting traces of the palatal glide, e.g., in the case of the replacement [Q] > [j] after [e] in Francoprovençal (For. [sa'bi] SAPERE; Gardette 1941: 143) and perhaps in Marais Vendéen French ([aʃ'tej] *acheter*; Morin 1977: 139). Differently from the vocalization of [Ú] into [w], the substitution of clear [l] by [j] cannot be associated with gestural decomposition, given that this consonantal

variety is not a complex segment involving two separate lingual gestures; indeed, articulatory data for Italian clear [l] in word final position reveal that the periods of alveolar and palatal contact occur simultaneously in this case (Recasens & Farnetani 1994)[13].

Both vocalization outcomes [w] and [j] are also documented for [D] and [z].

(a) Dental [D] may yield either [w] syllable finally, or else [j] in syllable initial and syllable final position preferably before an alveolar consonant. One or both final realizations may be exemplified with phonetic variants from Catalan (*creure* CREDERE, *cau* CADIT; Badia 1951: 218, 229), Old and Modern Occitan (*raizon* RATIONE, *dei / ume* DECIMU, *lei / uda* LICITA, *caire* QUADRU, ['¥jEjQo], ['¥EwQa] HEDERA; FEW, IV: 397, Grandgent 1905: 68, Michel 1956: 127, Ronjat 1932: 226), Romansh (*prau* PRATU; Bourciez 1967: 608), French (*plaisir* PLACERE; Pope 1934: 126), Portuguese (*cadeira* CATHEDRA; Menéndez Pidal 1968: 142) and Chilean Spanish (*maire* for *madre*, *pieira* for *piedra*; Malmberg 1971: 409).

(b) On the other hand, [z] vocalization occurs exclusively in syllable final position and may be conditioned by the preceding vowel, i.e., it may yield [w] after a back vowel and [j] after a mid front vowel. Illustrative examples may be found in Gascon and Occitan (Gasc. *aine* ASINU, *espaumá* from SPASMU, Lim. ['libQej] *livres*, Prov. *peile* PESSULU, Old Occ. *broidar* germ. *BRUZDON, Auverg. *omouno* ELEMOSYNA, *eime* from ADAESTIMARE, Haute Loire ['kowta] COSTA, ['kQEjto] CRISTA; FEW, XII: 137, Marshall 1984: 25, Michel 1956: 125-127, Nauton 1974: 1974: 226-227), dial. French (Lorr. [gQOw] GROSSU; FEW, IV: 274), Francoprovençal (Vaud *t(e)ita* TESTA, *fen(e)itra* FENESTRA; Guarnerio 1918: 184) and Catalan (*almoina* *ELEMOS(I)NA, N. Cat. *aibre* ARBORE; Badia 1951: 216, Recasens 1996a: 270).

It is highly plausible that the segmental substitutions in (a) and (b) have been generated through perceptual integration of the vowel transitions rather than through the articulatory retraction process [sC]> [çC] > [jC] (Rousselot 1891). Supporting evidence derives from phonetic variants still exhibiting the inserted glide (Occ. ['zownej] *jeunes* and [zownej'Zomej] *jeunes hommes*, [mej(s)] MENSE, *trei(s)* TRES; Lafont 1983: 28, Marshall 1984: 25, Ronjat 1930: 120, 366), and from palatographic data showing that contact retraction at the place of articulation does not clearly apply to highly constrained alveol-

ar fricatives in syllable final position (Recasens, submitted). The possibility that the replacement [D]> [w] is based on acoustic equivalence between the input and output segments is in accordance with a trend for [T] and [D] to be heard as /f/ and /v/, but runs against the finding that the reversed misperception occurs much more rarely (Locke 1983; Ohala 1993).

4. Rhotacism, nasalization and lateralization

4.1. Dentals

The rhotacism of [D] may occur systematically in intervocalic position (Alg. *sera* SAETA, Pot. ['praQ@] PRATU, Cal. ['niQu] NIDU; Recasens 1996a: 208, Rohlfs 1966: 275, 295) and, occasionally, in syllable final position whether word finally (Spanish from Paraguay; Lipski 1994b: 330) or before a heterosyllabic voiced consonant (Rosh. [ruQ'le:Q] ROTULARE, [taQ'le:Q] TITULARE, colloquial Rom. [lo'goQn@] *logodnÎ*, [po'viQl@] *povidlÎ*, dial. Cat. *corna* for *cotna* *CUTINA, *surja* for *sutja* *SUDIA; Lutta 1923: 201, Nandris 1963: 128, Recasens 1996a: 211, 214) [14]. The opposite substitution is documented in intervocalic position in Lengadocian, in Corsican and in areas of Central France where [D] may fall afterwards (Leng. ['¯Eda] NIGRU, Cors. ['nEÎu] NIGRU, [eÎa 'ÎuÎu] *era duru*, Bourg. [ED] AREA; Bloch 1927: 95, 105, Dalbera-Steffanaggi 1991: 125). The same change may take place whenever there is another rhotic in the same word, as exemplified by lexical variants from Lengadocian and Spanish from Santo Domingo (Leng. [s@'Diz@], [s@'DjEjda] CERESIA, Sp. *basudero*, *rudal* for *basurero*, *rural*; FEW, II: 598, Malmberg 1950: 150). The fact that the two replacements occur in analogous contextual conditions is in support of the possibility that they are implemented through an intermediate phonetic realization, while running against the notion that [D] rhotacism and even the reverse replacement should be viewed as instances of weakening (see Posner 1996: 294).

Other reversible changes such as [D] > [l] and [l] > [D] could also proceed through an intermediate [Q]-like realization since they operate in similar contextual conditions, which is in disagreement with the suggestion that [D] > [l] should be seen as a case of strengthening (see Marotta 1993). On the one hand, [D] > [l] is found intervocalically and before a heterosyllabic voiced consonant in dialectal zones such as Valencià (*rèlit* REDITU, *melecina* MEDICINA, *colna* for *cotna*

*CUTINA; Recasens 1996a: 211, 228), Ischitano (*cola* CODA, *u lit* DITU; Rohlfs 1966: 204, 297), dial. Spanish (*almirar* for *admirar*; Malmberg 1950: 149) and Leonés (*portalgo* PORTATICU, *vilva* VIDUA; Zamora Vicente 1989: 152). On the other hand, [l] > [D] also occurs in intervocalic position (Cal. [a 'Dana] LANA, ['paDa] PALA; Rohlfs 1966: 217, 309).[15]

4.2. Alveolar fricative

The rhotacism of [z] is favored by apicality in the alveolar fricative (see Contini 1986: 537 for Logudorese, and Romero, unpublished, for Catalan), and may be attributed to articulatory undershoot and subsequent friction loss (see Solé 1992 for perceptual evidence). It may take place in intervocalic position and before [l], [n], [m] and other voiced consonants in line with these contextual segments causing a decrease in air pressure during the articulation of the fricative consonant (Haggard 1973; Lorenzo 1975). Illustrative examples may be found in Old Picard (*marle* MASCULU, *arne* ASINU; Gossen 1970: 107), Occitan (Old Occ. *dis/rnar* DISJEJUNARE, Rou. *dumergue* DOMESTICU, *esparme* SPASMU, *irlo* INSULA; Grandgent 1905: 53, Michel 1956: 124, Ronjat 1932: 160), S. Spanish (['miQmo] *mismo*, ['dEQDe] *desde*, ['nEQɟa] *nesga*; Torreblanca 1976: 156-157) and Sardinian (Log. [saQ 'dentes] IPSAS DENTES; Blasco 1984: 39, Lausberg 1970: 429, Maiden & Parry 1997: 378). Rhotacism may also be favored by apicality in the following consonant ([QT] in colloquial Sp. *ascenso*; Navarro Tomás 1972: 111).

The opposite change [Q] > [z] applies in analogous contextual conditions to those just described, as shown by phonetic variants from Occitan (Old Occ. *gir/sar* GIRARE, Niç. ['Ewza] HED(E)RA; Grandgent 1905: 53, Ronjat 1932: 142) and 16th cent. French (*frère/fraise* FRATER, *chaire/chaise* CATHEDRA; Posner 1997: 289). This suggests that rhotacism and fricativization may have been generated through intermediate realizations between the rhotic and the fricative, thus disconfirming the assumptions that [z] rhotacism involves weakening and that [Q] fricativization may be obtained through weakening (Posner 1996: 294) or strengthening (Goman 1981: 129). Such realizations exist in dialectal domains of [Q] fricativization, namely, in Occitan and French zones where the fricative has a [Q]-like realization and the rhotic has a [z]-like quality (Bloch 1927; Lorenzo 1975).

A trill and a preconsonantal rhotic may also be realized as a lingual fricative before consonants such as [n] and [l] in Spanish

dialects (And. *mislo*, *piesna*, Nuevo México *pesla* for *mirlo* MERULU, *pierna* PERNA, *perla* PERULA; Alonso 1967: 258). Rhotic fricativization is also found word finally before a voiceless consonant in Logudorese areas where rhotacism of the alveolar fricative occurs before a voiced consonant, i.e., in addition to the rhotacism of *sos* IPSOS in [sOQ 'gatOs], ['batOQ] QUATTUOR is realized ['batOs] in [batOs 'kanEs] (Jones 1988: 323). The same substitution affects the clusters *tr*, *str* (N.E. Sic. [ÊŒ] > [ß], as in ['paßi] PATRE, Old Sp. *nuesso* NOSTRU, *maesso* MAGISTRU; Maiden & Parry 1997: 371, Menéndez Pidal 1968: 145). Evidence against articulatory retraction in syllable final trills (Recasens, submitted) suggests that the fricativization process of interest cannot be attributed either to strengthening or to articulatory relaxation through tongue tip lowering and possible formation of a palatovelar constriction (Straka 1965b). Instead, it appears to be associated with aerodynamic factors, i.e., with the failure to instantiate vibration as resistance at constriction location and airflow decrease or as an increase in constriction degree causes apical tension or air velocity to rise (Solé 1992; Widdison 1998).

4.3. Alveolar lateral

Syllable initially, the change [l] > [Q] may apply systematically in intervocalic position and after a tautosyllabic consonant (Sass. ['saQi] SALE, Log., Campid. ['pQenu] PLENU, Alg. [vu'Qa] VOLARE, [pQat] PLATTU, Nap. ['vufaQo] *bufalo*, Sic. from San Fratello ['bQa˜ku] BLANK; Contini 1987: 353, Lausberg 1970: 332, Recasens 1996a: 313, Rohlfs 1966: 242, 310). It may also take place exclusively in one position or in the other, namely, intervocalically (Drôme ['aQo] ALA, Lad. ['EQa] ILLA, Rom. ['soaQe] SOLE; Bouvier 1976: 217, Haiman & Benincà 1992: 74, Lausberg 1970: 362) or else after a homosyllabic consonant (Leon. *igrésia*, *branco*, Port. ['fQako] FLACCU, [sem'bQaQ] SIMILARE; Menéndez Pidal 1968: 199, Williams 1938: 63, 90). Retroflex [ÒÒ] may also undergo rhotacism perhaps through [(Î)Î] (Gasc. ['bEQa] BELLA, [ga'Qio] GALLINA, Cal. [ka'vaŒu] CABALLU, Camp. ['keQa] ECCU ILLA; Bec 1968: 38, Rohlfs 1966: 333-334, Ronjat 1932: 149). In syllable final position, [l] undergoes rhotacism more or less systematically before any consonant in some dialectal areas (Log. [al/Q'bE*f*E], S. American and S. Peninsular Sp. *argo*, *arquiler* for *algo*, *alquiler*, Tusc. *cardo* CALIDU, *morto* MULTU; Contini 1987: 364, Lapesa 1980: 521, 575, Rohlfs 1966: 342), or just before a non-interferring labial or velar in others,

which suggests that the sound change of interest may be caused by articulatory reduction (Lig. *vurpe* VULPE, *surcu* SULCU, Roman. ['saQvo] SALVU, [si'puQkQu] SEPULCRU; Grassi et al. 1997: 116, Rohlfs 1966: 342)[16]. The fact that the change of [l] into an alveolar rhotic may apply intervocalically rather than word finally (e.g., in Franc-Comtois as opposed to Andalusian Spanish; Dondaine 1972: 176-177, Quilis-Sanz 1998) could be related to the clearer nature of the alveolar lateral in the former vs latter context condition.

The opposite substitution [Q] > [l] occurs essentially in intervocalic position (dial. Cat. *faligola* for *farigola*, *salampió* SIRIMPIONE; Recasens 1996a: 338), after a homosyllabic consonant and preconsonantally (S. Sp. *cuelpo* CORPU, *talde* TARDE, *reflán* for *refrán*, *vinagle* for *vinagre*, dial. Cat. *flare* FRATER, *multra* MURTA; Alonso 1967: 220-222, Lapesa 1980: 506, Recasens, 1996a: 338), and word finally (Extr. [mu'hel] *mujer*; Alonso 1967: 221). The lateralization of preconsonantal [s] could also be accounted for by assuming that rhotacism has previously applied, though lateral fricatives are possible sound types (Dalbera-Steffanaggi 1991: 132; Ladefoged & Maddieson 1996: 203). It is documented in Livorno (*fialco* for *fiasco, quelto* ECCU ISTE; Rohlfs 1966: 380) and occasionally in other domains (Val. *deldeny* for *desdeny*; Recasens 1996a: 270), and operates in word final position before a voiced consonant in Logudorese areas (e.g., *trel*, *sal* for *tres*, *sas* in the sequences [trEl 'manOzO], [sal 'dEntEzE]; Contini 1986: 538).

The finding that [l] > [Q] and [Q] > [l] take place quite often in the same word positions and segmental contexts is in support of an acoustic motivation of both replacements. This interpretation is consistent with the absence of clear acoustic differences between [l] and [Q], mostly so when the lateral is clear and the rhotic is a tap (Espy Wilson 1992; Maddison 1984). Evidence in support of the alternative hypothesis that [l] > [Q] but not [Q] > [l] is associated with articulatory weakening (see however Straka 1965b according to whom [Q] > [l] should also be viewed as a case of weakening) derives from the observation that lateral rhotacism may be implemented through alveolar contact reduction and may occur more frequently than rhotic lateralization in dialects exhibiting the two substitutions (e.g. in preconsonantal and postconsonantal position in Sardinian, and syllable finally along the Pacific Coast in S. American Spanish; Jones 1988: 322, Lapesa 1980: 575).[17]

The replacements [l] > [n] and [n] > [l] may apply preconsonantally (Sp. *comulgar* COMMUNICARE, Old Occ. *molge* MONACHU, Sic. *santu* SALTU, *anzari* ALTIARE, Lim. *espanlo* SPATULA;

Coromines 1954-57, I: 874, Grafström 1958: 194, Rohlfs 1966: 346, Ronjat 1932: 151). Both changes have been attributed to the acoustic similarity between the alveolar lateral and the alveolar nasal, namely, to the presence of analogous spectral anti-resonances and vowel transitions involving sudden spectral and amplitude discontinuities (Grenlee & Ohala 1980; Ohala 1975). The fact however that the implementation of these two changes is subject to important differences is in support of an articulatory motivation, i.e., [l] > [n] occurs more often than [n] > [l] and is favored by a following dentoalveolar, while [n] > [l] but not [l] > [n] is prone to be generated through a reduced [Q]-like realization. Another instance of lateral nasalization is [¥] > [˜] in word final position (Gasc. [hi˜] FILIU, [su'Qe˜] SOLICULU; Rohlfs 1970: 151, Ronjat 1932: 321).

4.4. Alveolar nasal

Nasal rhotacism occurs presumably through an intermediate nasalized tap and appears to be associated with gestural reduction rather than with acoustic equivalence (Hajek 1997). It may operate intervocalically, before a voiced consonant or after a heterosyllabic consonant often with the help of a dissimilatory or assimilatory action, as shown by phonetic variants taken from Italian (colloquial Tusc. *auturno* for *autunno*; Rohlfs 1966: 461), Occitan (Old Occ. *arma* AN(I)MA, *morgue* MONICU, Modern Occ. *urdre* ORD(I)NE, Piedmont *bur an* BONU ANNU; Grandgent 1905: 83-84, Ronjat 1932: 141, 258), Spanish (*sangre* SANG(UI)NE, *hombre* HOMINE; Menéndez Pidal 1968: 156) and other dialectal regions (Campid. ['kavuQa] for ['kavuna], Francoprov. ['lyQa], Istrorom. ['lur@] LUNA; Contini 1987: 398, Sampson 1999: 133, 313). The fact that the rhotacism of [n] applies more frequently than the opposite substitution [Q] > [n] is also in support of an articulatory motivation of the former sound change ([Q] > [n] may take place syllable finally in Andalusian Spanish *me*[h]*ón* for *mejor*, *vingen* for *virgen*; Alonso 1967: 263, Lapesa 1980: 505).

4.5. Alveolar trill

It has been stated that alveolar trills and taps differ regarding degree of strength, i.e., trills are 'stronger' than taps (Posner 1996: 288). This view is supported by the distribution of rhotics of different degrees of complexity according to context and word or syllable position. On the one hand, the alveolar trill or [R] shows up word initially

(in Sardinian, S. Italian, Spanish, Catalan, Portuguese, Occitan; Lausberg 1970: 313) and after a heterosyllabic consonant (e.g., Portuguese, Spanish, Catalan, Occitan; Parkinson 1988: 138, Navarro Tomás 1972: 122, Recasens 1993: 176-178, Wheeler 1988: 250), and even after a tautosyllabic consonant (Alguerese Catalan, Old Romanian; Recasens 1996a: 326, Sala 1968: 80). On the other hand, preconsonantal and sentence final rhotics may be implemented as taps or approximants (Spanish, Valencià) or else as trills or trill-like realizations often exhibiting only one alveolar contact (Mexican Spanish, Eastern Catalan; Malmberg 1971: 436, Recasens 1996a: 327). Moreover, it should be noticed that word final alveolar rhotics are prone to be produced as taps if occurring before a vowel or [j] in dialectal domains where they are realized as trills before a pause (Cat. *mar agitada*, *llur iogurt*; Recasens 1993: 177).

The replacement of a trill by a tap may thus be seen as an instance of weakening, in agreement with the fact that it may take place intervocalically in domains such as N. Italian, Romanian ([‘t^{s}aQ@] TERRA; Lausberg 1970: 411) and Corsican (Bastia ['sEQa] SERRA; Dalbera-Stefanaggi 1991: 124, Guarnerio 1918: 479). The occasional simplification of the trill before a high front vowel is rather associated with the difficulty involved in performing two successive antagonistic tongue dorsum gestures, i.e. tongue dorsum lowering and retraction for [r] and tongue dorsum raising and fronting for [i] (W. Cat. *suriac* for *xurriaca* *EXCORRIGIATA, *coriola* for *corriola* from CARRU; Recasens 1996a: 336).

5. Aspiration, retraction and glottalization

5.1. Back and front consonants (except for the alveolar fricative)

The possibility that aspiration is achieved through a decrease in constriction degree appears to work out for back velars in view of the similarity between the vocal tract configurations for an unconstricted velar and for a glottal fricative. This explanatory account may hold for the processes [x] > [h] (S. American Spanish; Lipski 1994b: 256, 290, 311), [k] > [h] after a vowel whether word initially or word medially (Log. [e'nuhQu] GENUC(U)LU, Tusc. [la 'hjave] *la chiave*, [la haQne 'hQuda] *la carne cruda*, [la 'hwa¥¥a] *la quaglia*; Contini 1987: 320, Rohlfs 1966: 199, 222, 246), and perhaps [*f*] > [h] as well (Abruzzese ['mah@] *mago*; Rohlfs 1966: 299). An articulatory account

of fricative aspiration is more problematic for fronter consonants, namely, [T] which may become [h] in Spanish and Francoprovençal (Vaux [daoh$^{@}$] DULCEA, S. Sp. [la 'nweh] *la nuez*, [o'rohko] *Orozco*; Méndez D́osuna 1987: 32, Zamora Vicente 1989: 72), and [f] which has undergone aspiration word initially in Spanish and word initially and medially in N. Italian areas, Calabria and Gascon (Sp. ['etʃo] FACTU but ['fwe*f*o] FOCU, ['fjeQo] FERU, Lomb. [ha'Qina] FARINA, ['ʃtEhen] STEPHANU, Cal. ['hQagula] FRAGULA, Gasc. ['hEsto] FESTA, [h(e)'Quto] FRUCTU, [aha'mat] from FAME; Menéndez Pidal 1968: 122, Rohlfs 1966: 206, 249, 303, Rohlfs 1970: 145, 147-148). The aspiration of a voiceless labiodental fricative may have been generated through perceptual confusion between a labialized realization of [f] and [h] in back rounded vowel contexts, as suggested by alternations between [h], [x] and [f] in dial. Spanish (['h/x/fweQte] *fuerte*; Lapesa 1980: 469, Penny 2000: 87) and by available mirror substitutions such as [hw] > [fw] and [w] > [f] (Grenlee & Ohala 1980; Ohala & Lorentz 1978).[18] An alternative hypothesis advocates that [f] aspiration has been generated through articulatory retraction from an intermediate palatal fricative [ç] still available in Francoprovençal and Occitan (Valais ['ç(¥)ãma] FLAMMA, Auverg. from Puy-de-Dôme [çjo] FOCU, ['çi¥O] FILIA; Jeanjaquet 1931: 40, Naro 1972: 439).

The rhotic and [l] may also undergo aspiration in S. American and Andalusian Spanish both word finally (*cantar*, *árbol*; Alonso 1967: 255) and before a voiced consonant (*carne*, *perla*, *el gato*; Quilis-Sanz 1998: 148-150, Zamora Vicente 1989: 320). Moreover, except for (labio)dentals, consonants which are prone to undergo aspiration may also undergo glottalization, e.g., in Colombian Spanish (intervocalic [s], [k]; Lipski 1994b: 236) and in Barbagia and other Campidanese areas (['mus?a] MUSCA, [sa '?una] LUNA; Contini 1987: 119, 124).

In addition to aspiration and glottalization, the replacement of alveolar rhotics and nasals by [R] and [˜] have been characterized as an instance of weakening involving tongue tip lowering and tongue postdorsum retraction and raising (Penny 2000: 151, Straka 1965b). Articulatory retraction may also yield a back fricative or approximant in the case of rhotics, e.g., in Ardenne ([loʃ] *lard*, [poh] *port*; Bruneau 1913: 348, Remacle 1972: 363), Corsican ([u '*f*itʃu] ERICIU; Dalbera-Steffanaggi 1991: 456) and Puerto Rican Spanish and Brazilian Portuguese ([r]> [x], [X]; Lipski 1994b: 356, Parkinson 1988: 138). On the other hand, the substitution [n] > [˜] occurs word finally and before a dental or a labial stop (Gasc. [pa˜] PANE, [bi˜] VINU, Rosh. [caw˜] CANE, ['ca˜ta] CANTAT, N. It. [mã], [ma˜] MANU,

Piedm. [ku˜'tQoa] *contrada*, ['ko˜pu] CAMPU, Rhod. [ẽ˜'tẽ˜dRe] INTENDERE; Bec 1968: 50, Lutta 1923: 96, 255, Rohlfs 1966: 383, 427, Sampson 1999: 150).

Convincing arguments may be adduced against the weakening hypothesis in this case. On the one hand, experimental evidence shows that rhotics are reluctant to undergo articulatory retraction syllable finally (Recasens, submitted). Rather than reflecting a weakening strategy, tongue body hollowing and postdorsum elevation towards the soft palate appears to be an effective strategy for reducing tongue tip tension and thus resistance to airflow (Widdison 1998). The transformation [l] > [R], [g] may also be related to manner requirements, i.e., to the need to facilitate the passage of airflow through the sides of the oral cavity (Campid. ['sORi] SOLE, Auverg. from Haute Loire [fjaR] FILU, Pugl. [k@'gawQ@] *colore*; Blasco 1984: 204, Nauton 1974: 199, Maiden & Parry 1997: 342). On the other hand, the presence of [˜] in the place of [n] should be attributed to the restoration of a nasal consonant out of a nasalized vowel in view of the fact that both [Ṽ] and [˜] exhibit high frequency spectral antiresonances (Sampson 1999). Other original nasals may yield [˜] perhaps through segmental restoration as well, i.e., [˜] (Gasc. [hi˜] for [hi˜] FILIU, Prov. [pu˜] PUGNU, Friul. [le˜] LIGNU; Millardet 1910: 173, Ronjat 1932: 298, Sampson 1999: 225) and, less so, [m] (Friul. [O˜] HOMO, [fã˜] FAME; Francescato 1966: 63, Iliescu 1972: 71).

5.2. Alveolar fricative

It has been stated that articulatory weakening may cause [s] aspiration through an increase in alveolar constriction width (Romero 1995), and perhaps through evacuation of predorsal contact and elevation of the postdorsum towards the palatovelar zone (Straka 1964; Widdison 1997). In agreement with this hypothesis, [s] > [h] operates most frequently in syllable final position where articulatory reduction is more prone to occur than word initially and intervocalically (Honduran Sp. [la he'mana] *la semana*, Arg. ['dehDe] *desde*, Wal. *ma/ohon* MANSIONE, Lomb. ['vEhpa] VESPA, [dih'na] DISJEJUNARE, [hak] SACCU, [hpi] SPINA, Gasc. [lah 'bEhtis], And. ['krusEh] *cruces*; Lipski 1994b: 291, Malmberg 1950: 160, Remacle 1972: 323, Rohlfs 1966: 226, 258, 380, 382, Ronjat 1932: 279, Zamora Vicente 1989: 318)[19]. Preference for syllable final vs syllable initial aspiration is consistent with the scenario in Argentinian and Cuban Spanish and in other dialectal areas where [s] becomes [h] more often before a heterosyllabic consonant than prevocalically or prepausally

(Méndez Dosuna 1987; Seklaoui 1989: 33-52; Terrell 1979). Moreover, distributional factors suggest that [s] aspiration may be preceded by palatalization and thus by articulatory retraction (Walsh 1985): indeed, analogously to [ʃ], [s] palatalization applies in syllable coda position whether absolute finally (Ardenne [baʃ] *bas*, European Port. [vOʃ] *voz*, [seZ$^{@}$] *seis*; Bruneau 1913: 399, Paiva Boleo & Santos Silva 1961: 339, Parkinson 1988: 138), before any consonant (European Portuguese; Parkinson 1988: 138), before a voiceless stop or fricative (Campid. [duZEntu 'ʃ:ra˜kus] for /duZEntOs frá˜kos/, S. It. ['feʃta] FESTA, Sic. ['ʃErra] *sferra*; Bolognesi 1998: 49, Rohlfs 1966: 262, 379) or just before a stop not interferring with apicality (Log. [sOʃ 'p/kanEzE], Old Sp. and Judeo-Sp. *cas/xco*, N./S. It. ['ʃkala] SCALA; Contini 1986: 536, Menéndez Pidal 1968: 197, Rohlfs 1966: 257, Zamora Vicente 1989: 356).

The supraglottal origin of [s] aspiration through weakening also appears to be in accordance with the articulatory properties of the adjacent contextual segments both regarding the frequency of occurrence and the spectral quality of the aspiration noise. Thus, [s] aspiration happens to be favored by a preceding open segment (namely, a vowel or a glide) and may be perceived as /ç/ after a high vowel and as /x/ after a back vowel (Vosges [veç'ti] VESTIRE, Gasc. [eç'pawle] SPATULA, Arg. ['fQeçko], ['kaxko]; Bloch 1917: 68, Fleischer 1912: 41, Malmberg 1950: 160). Regarding the following segment, [s] aspiration occurs often before a voiceless labial or velar stop not interferring with tongue tip raising for the alveolar fricative (dial. Sp. [lO^{h} ^{p}pa'^{t}torEh] *los pastores*, ['ahko] *asco*, Occ. ['pQEhtQe] PRESBYTER, ['pahto] PASTA, Wal. *hale* SCALA, [mOh] MUSCA, Lomb. ['fEhta], [peh'ka]; Alonso 1962: 51, ALW 1953: 201, FEW, IX: 357, VII: 744, Remacle 1972: 323, Rohlfs 1966: 380), but also before a voiced liquid or nasal in specific dialectal areas such as Old Wallon (*ahnesse* 'Fr. ânesse'; Alonso 1962: 49) and Gascon (Allières 1955). A decrease in constriction degree may also cause [s] to undergo glottalization (Spanish from Antilles ['et?to] *esto*, ['ded?de] *desde*, Colombian Sp. *lo*[?] *amigos*; Lipski 1994b: 236, Seklaoui 1989: 96).

An alternative hypothesis advocates that aspiration does not arise through articulatory reduction but is associated with the perceptual categorization of anticipatory glottis opening and breathiness in the preceding vowel (Widdison 1995). This view accounts for quality changes induced by glottal friction in the preceding vowel (e.g., mid vowel lowering and low vowel raising word finally, as in Andalusian Spanish ['lusEh] *luces*, [mæ] *más*; Llorente Maldonado 1962: 232, Zamora Vicente 1989: 318) and for data showing that the

glottal fricative derived from intervocalic [s] becomes voiced before fading away (i.e., [VsV] > [VhV] > [V˙V] > [V], as in Andalusian Spanish where *casa* may be realized ['ka˙a] CASA; Llorente Maldonado 1962: 231). Evidence in support of the perceptual hypothesis also derives from phonetic variants where the opposite replacement has taken place (e.g., Gasc. [ez/h'lu] FLORE; Fleischer 1912: 48-49), though this change is not widespread and could also be associated with anticipatory tongue front raising for the alveolar consonant following [h].

Arguments against an articulatory account of aspiration apply to tongue retraction rather than to lingual constriction opening. Indeed, linguopalatal contact data indicate that [s] may be articulated with a wider constriction but no further tongue retraction syllable finally vs syllable initially (Recasens, submitted). Moreover, there is some evidence that [s] palatalization and aspiration may operate before different consonant classes in the same dialect (e.g., in Gascon, [s] > [ʃ] occurs before a voiceless consonant, while aspiration and vocalization into [j] apply before a voiced consonant; Allières 1955). Furthermore, the replacement of [s] by [ʃ] may be associated with acoustic factors rather than with articulatory ones, i.e., with a lower frequency noise in syllable final position and before [k] and [p] resulting from an increase in front cavity size and from oral closing (Menon et al. 1969; Redford & Diehl 1999).

6. Elision

6.1. Syllable initially

Gestural reduction accounts for the elision of intervocalic [D] whether derived from Latin voiceless and voiced dental stops (Fr. *vie* VITA, *pied* PEDE, Ven. [de'al] DITALE, *coa* CODA; Lausberg 1970: 358, Posner 1997: 220, Rohlfs 1966: 273, 295) or just from a Latin voiced dental stop (Rosh. [pE] PEDE, [vajQ] VIDERE, Port. [se] SEDE, Abr. [lu 'Ente] *il dente*; Lutta 1923: 182, Parkinson 1988: 139, Rohlfs 1966: 205). In several dialectal areas, [D] elision may take place in different prosodic and contextual conditions, e.g., before stress (Cat. *suar* SUDARE; Coromines 1974: 253), in posttonic position and before and/or after open vowels (endings *-ado* in colloquial Spanish and *-ada, -ador* in Valencià; Menéndez Pidal 1968: 100, Recasens 1996a: 231), or else in the adjacency of front vowels (Old Sp. *fe* FIDE, *juez* IUDICIU as opposed to *crudo* CRUDU, *vado* VADU; Lloyd 1987: 375). In some of

these dialectal regions, intervocalic [ɪ] and [*f*] may occasionally drop[20].

Other approximants and fricatives may also undergo deletion in intervocalic position. This is to be observed with the rhotic variety in N. Italian (Lig. ['dyu] DURU, ['ʃua] FLORE; Rohlfs 1966: 313), S. Spanish (And. [ma'taon] *mataron*, [pu'sjeon] *pusieron*; Lapesa 1980: 506) and Campidanese after stress ([kom'mai] *comare*, [kom'pai] *compare*; Blasco 1984: 218). This is also the case for [j], both systematically in Minorcan Catalan, Sardinian and S./N. Italian areas (Campid. ['OE] HODIE, ['mau] MAIU; Contini 1987: 426, Jones 1988: 324), and mostly after a stressed vowel in Friulian (['fia] FILIA, [le'a] LIGARE; Francescato 1966: 58, Iliescu 1972: 63, 75) and Ladin (['bQaa] BRACA, ['doa] DOGA, ['foa] FOLIA, ['paa] PALEA; Guarnerio 1918: 392, Maiden & Parry 1997: 289). The elision of intervocalic [z] is uncommon and could be related to the [Q]-like quality of the frication noise (Central France areas [e'glij] *église*, [u'ij] *oseille*, Prov. *cauvo* CAUSA, *camio* CAMISIA; Bloch 1927: 147, FEW, II: 140, 541). The elision of intervocalic [l] is also rare (N.W. Cors. ['sOE] SOLE, [a 'a˜a] ILLA LANA; Dalbera-Steffanaggi 1991: 445).

The glottal fricative [h] may drop just word initially, as revealed by Spanish (['umo] FUMU; Lloyd 1987: 516-517), Italian in Germanic loanwords (*anca* HANKA, *arpa* HARPA; Rohlfs 1966: 212) and Gascon ([lu 'yk] FOCU, [las '(h)ennos] FEMINAS, [etʃ '(h)wek] FOCU; Bec 1968: 123-124, Ronjat 1932: 423). The elision of [h] may also take place word initially and medially in intervocalic position in Western Tuscan (Lucc. [du a'valli] *cavalli*, [a'mio] *amico*; Rohlfs 1966: 199, 266), and should be attributed to the absence of a supraglottal constriction and to the low intensity level of the aspiration noise[21].

6.2. Syllable finally

In agreement with trends in articulatory reduction (see section 2.1), word final stops drop mostly if dental in domains such as N. Italian (Mil. [ma'Qi] *marito*; Rohlfs 1966: 434), colloquial Spanish (*verda(d)* VERITATE; Zamora Vicente 1989: 384) and Occitan (Drôme [pra] PRATU, Occ. *mercé* MERCEDE, Prov. [sE(t)], [tu(t)] though [sE't Omes], [tu't Ome]; Bouvier 1976: 291, Grandgent 1905: 49, Ronjat 1932: 424). This elision pattern also operated in Latin, where velars were eliminated in functional words only (e.g., Occ. [O] HOC, Sp. [si] SIC; Grandgent 1905: 78, Menéndez Pidal 1968: 167), and in Old French, where word final elision affected [T] and [x] derived from original dental and velar stops (Hock 1976; Vaissière 1996). Dentals also drop more often than other stops before another consonant in

heterosyllabic clusters (e.g., Campid. [p:odia DQo'miQi] for /pOdiat drOmí/; Bolognesi 1998: 192), while labials and velars are prone to delete before dentoalveolars rather than before consonants of other places of articulation (e.g. Val. *dissa(b)te* DI-SABBATI, *re(c)tor* RECTORE, Port. [(k)s] in *auxílio*, *máximo*; Recasens 1996a: 236, Williams 1938: 87). A similar pattern applies to word final clusters (Cat. [gus(t)], [in'dul(t)], [vEr(t)] but [kask], [kalk], [fork], [serp]; Recasens 1993: 167-169).

Stops and consonants of other places of articulation exhibit a tendency to undergo elision in complex word medial clusters if their primary articulatory gesture coincides with that for the adjacent consonants (Campid. ['nostu] NOSTRU, Sp. [kan'saQ] CAMPSARE, Old Berg. *pesnaga* PASTINACA; Contini 1987: 410, Menéndez Pidal 1968: 146, Rohlfs 1966: 384), or in view of the difficult articulatory transition involved in passing from one consonant to the next (Ardenne [fQa] from [fQwa] *froid*, Fr. *dort* DORM(I)T; Bruneau 1913: 380, Lausberg 1970: 416).

Other consonants undergoing elision syllable finally are [Q] and [s]. The rhotic may be deleted in word final position, both systematically (e.g., in Catalan and Occitan, with the exception of monosyllables such as *per* PER, *mor* MORIT, *car* CARU; Recasens 1993, Ronjat 1932: 302) and only in infinitives and specific lexical forms (e.g., in S. American Spanish and N. Italian zones; Lipski 1994b: 321, 343, Rohlfs 1966: 1966, 430). The elision of [Q] may also occur before another consonant (e.g., before apicals in Vosges; Bloch 1917: 17) and, in particular, before lingual fricatives in view of the fact that these consonants may affect the articulatory and aerodynamic requirements needed for the production of rhotics (Ardenne [e'koʃ] 'Fr. écorce', Sic. ['usu] URSU; Bruneau 1913: 397, Rohlfs 1966: 339, Solé, 2002). The elision of [s], possibly through [h], applies most frequently before voiced [l], [n] and [m], another fricative, or a labial and a velar consonant not involving front lingual activity. Illustrative examples may be found in Old French (where variants such as ['il@] INSULA are documented prior to cases such as ['fEt@] FESTA; Pope 1934: 151), Occitan (Lim. *care(s)ma* QUADRAGESIMA, *di(s)nar* DISJEJUNARE, Drôme ['makle] MASCULU, ['vEpQe] VESPERU; Grandgent 1905: 53, Bouvier 1976: 199), Portuguese (*chamas* but *chama-lo*; Lausberg 1970: 430) and Sardinian (Barbagia [i(f)frit'taQE] from [isfrit'taQE]; Contini 1987: 219). It also occurs word finally in French[22] and to different degrees in Italian, Rhaetoromance and

Spanish dialects (Lausberg 1970: 428-433), as well as in Provençal, where elision may also affect word final stops and [tʃ] ([sE] SEPTE, [vÁe] OCTO, though *se*[t] *an*, *vue*[tʃ] *ouro*; Ronjat 1932: 424-425).

6.3. Complex consonants

The elision of [l] occurs word finally rather than intervocalically. Word final elision may be illustrated with examples from Ardenne ([bja] BELLU, [fi] FILU; Bruneau 1913: 374), N. Italian (Piedm. [ky] CULU, [maQ'tE] MARTELLU; Rohlfs 1966: 426), Occitan (Drôme [ma] MALE, [tsa'va] CABALLU; Bouvier 1976: 225, 229) and Franc-Comtois ([˜a] NIDALE; Dondaine 1972: 233). On the other hand, intervocalic elision has taken place in Old Portuguese (*sair* SALIRE, *dor* DOLORE; Wlliams 1938: 68), Romanian before stress ([ste'a] STELLA; Lausberg 1970: 411) and N.W. Corsican (['sOE] SOLE, [a 'a˜a] ILLA LANA; Dalbera-Steffanaggi 1991: 445) [23]. If operating on [Ú], word final elision may have an acoustic motivation (i.e., listeners may fail to identify the lateral consonant after a spectrally similar back rounded vowel) or else an articulatory origin (i.e., elision may be associated with gestural reduction or facilitated by a long delay of the alveolar closing gesture with respect to voicing offset; Goldstein 1994). The process of interest may also have been preceded by glide insertion, as suggested by the coexistence of pairs of lexical forms with and without [w] in specific dialectal zones (Fr.-Comt. [˜a/O], [˜aw] NIDALE, [sa/O], [saw] SALE; Dondaine 1972: 233) and by Rousselot's account of phonetic variants without word final [l] in Limousin ([ʃ@'va] CABALLU, [ku'te] CULTELLU, [ko] COLLU; Rousselot 1892). The alveolar lateral may also drop through gestural reduction in preconsonantal position (Cat. [pam] PALMU, N. Cat. [bOs] *vols*; Recasens 1996a: 316).

The elision of intervocalic [n] is related to articulatory reduction often after inducing nasalization in the preceding vowel, and may be exemplified in Gascon (['lyo] LUNA, ['pleo] PLENA; Rohlfs 1970: 156), Italian areas (Sic. ['lẽu] LINU, [ka'dẽa] CATENA, Piedm. *bui* for *buoni*; Rohlfs 1966: 312), Portuguese (['boa] BONA, ['mão] MANU; Williams 1938: 71,73), dial. Spanish (Leon. *ter* for *tener*, *lúa* for *luna*), and Campidanese after word stress (['bĩũ] VINU, ['prũã] PRUNA; Contini 1987: 454). Word final [n] is often absent in Romance, though monosyllables may have kept the consonant (Old Occ. *re(n)* REM, Sp. *quien* QUEM, *tan* TAM, Cat. [mon] MUNDU, Pot. [pa] PANE, Port. ['não] NON; Grandgent 1905: 79, Menéndez Pidal 1968: 166, Recasens 1993: 162-164, Rohlfs, 1966: 428, Williams 1938: 92)[24]. Rather than being attributed to the slight salience of [˜] issued from

[n] (i.e., [n] > [˜] > [j] / [^{n}] > zero; Hajek 1997), the elision of word final [n] may be associated with the low perceptibility of stop consonants in VC sequences with large degrees of vowel nasalization. A similar argument may be used in order to account for nasal elision before a homorganic consonant, mostly a fricative (Sp. [pe'saQ] PENSARE, N. Cat. [t@'ıe] *també*, dial. Occ. ['uflo] INFLO; Menéndez Pidal 1968: 136, Recasens 1996a: 252, Ronjat 1932: 211).

7. Changes in place of articulation

Exchanges between syllable final stops and nasals of different places of articulation may be accounted for through perceptual confusion in the light of the fact that those allophonic realizations exhibit weak bursts and nasal murmurs, short and flat vowel transitions and non-abrupt VC spectral changes (Ohala & Kawasaki 1984; Redford & Diehl 1999; Repp & Svastikula 1988). In agreement with this hypothesis, the place substitutions of interest often happen to be reversible, and involve consonants produced at distant articulatory locations or exhibiting similar spectral configurations in specific contextual conditions (Zee 1981).

With respect to stops, labials and velars may be replaced by dentals rather than viceversa, as exemplified by data from Catalan (*cort* CORVU, *art* ARCU, *présset* PERSICU but also *ànec* ANATE, *carc* CARDU; Recasens 1996a: 193, 223, 228, 243, 248) and from Occitan, Francoprovençal and Poitevin ([luk/t] LUPU, [kOt] COLAPHU, *limat* LIMACE, [ZOt] IOCU but also [nik] NIDU, [nup/k] NUDU; FEW, II: 867, V: 42, 339, 457, VII: 120, 228). Exchanges between labials and velars occur less often, e.g. the replacement of labials by velars is documented in Argentinian and Cuban Spanish (*consep/csión*, *concep/cto*, *ab/cstracto*; Malmberg 1950: 79-80, Mowrey & Pagliuca 1985: 69)[25], while instances of the opposite substitution are found in Romanian and Catalan dialects (Rom. [opt] OCTO, [pumn] PUGNU, ['koaps@] COXA, Cat. *gorp* GURGU, *doptor* for *doctor*; Lausberg 19$\tilde{7}$0: 380, 384, Nandris 1963: 152, Recasens 1996a: 236, 243)[26]. Changes affecting velar stops are in agreement with perceptual data showing that unreleased [k] tends to be identified less accurately than unreleased [t] and [p], at least after certain vowels (Malécot 1958; Malécot & Lindheimer 1966). Moreover, acoustic equivalence may explain why velar stops may be confused with dental stops in the context of front vowels and with labial stops in the context of back rounded vowels (Ohala 1978).

Regarding nasals, processes such as velarization (i.e., [n] > [˜]) and depalatalization (i.e., [˜] > [(j)n]) are of no concern here since they do not involve the replacement of one segment by another, i.e. they presumably result from segmental restoration in the case of the former process and from gestural reduction or glide categorization of the vowel transitions in the case of the latter. More relevant word final changes are [m] > [n] in Latin monosyllables and in Romance lexical forms (Old Fr. *rien* REM, *mien* MEUM, Sp. *con* CUM, *álbun* from *álbum*; Lausberg 1970: 425, Menéndez Pidal 1968: 166, Navarro Tomás 1972: 88), [n] > [m] (Trent. *pam* PANE, *bom* BONU, dial. Cat. *rem* from *ren(t)*, *dillums* DI-LUNAE, Gasc. [faw'kum] FALCONE, [pa'um] PAVONE; Maiden & Parry 1997: 261, Recasens 1996a: 261, Rohlfs 1970: 158) and, less often, [˜] > [n], [m] and [n] > [˜] (dial. Cat. *jum* IUNCU, *blan* BLANCU, Lomb. [vi˜] VINU, Gasc. [ple˜] PLENU; Recasens 1996a: 261, Rohlfs 1966: 429, Rohlfs, 1970: 158). These changes could proceed through segmental restoration or else be associated with the similarity between the murmur spectra and the vowel transitions for the input and output nasal consonants in specific contextual conditions. Thus, the murmur and the vowel transition for [m] resemble those for [n] after front vowels, while the ones for [n] resemble those for [m] after back rounded vowels.

8. Summary and discussion

8.1. Weakening

Our review of sound change processes reveals that the notion 'weakening' should be applied exclusively to segmental replacements resulting from a decrease in duration and in constriction degree, and from a change in glottal activity yielding voicing. Those actions are prone to occur in favorable positions and contexts, i.e., syllable initially after a vowel or a consonant involving oral opening (e.g., in the case of the lenition process [b], [d], [g] > [ɪ], [D], [*f*]), and syllable finally often before a voiced consonant or before a labial or a velar not interferring with the tongue front articulator (e.g., in the case of the changes [l] > [Q], [Ú] > [w] and [s] > [h]). The weakening scale ensures that occluded and highly constricted voiceless realizations may undergo essentially fricativization, voicing, aspiration and glottalization, while voiced and open consonantal realizations may undergo approximantization, gliding and elision as well as rhotacism (in the case of dentoalveolars) and alveolarization (in the case of dorsopalatals). Articulatory weakening is achieved essentially through

shortening if affecting long consonants involving a high air pressure level, i.e., geminate voiceless stops and fricatives, affricates (through deocclusivization and defricativization) as well as trills.

The possibility that weakening may be obtained through articulatory retraction is more problematic. Other explanations have been proposed instead: [f] > [h] may be accounted for through the intermediate realization [f^{w}]; [n] > [˜] may be associated with segmental restoration; [s] > [h], [r] > [R], [X] and [Ú] > [R], [g] may be due to the failure to fulfil precise manner requirements. These alternative interpretations are consistent with electropalatographic data showing that highly constrained fricatives and trills are not prone to undergoing articulatory retraction syllable finally.

If occurring in analogous contexts and positions, other changes traditionally attributed to weakening and their reversed substitutions are better accounted for through perceptual confusion of acoustically equivalent cues, or else may be taken to derive from a single intermediate phonetic realization. Spectral or articulatory similarity may indeed be at the origin of changes in manner and place of articulation affecting dentoalveolars (including clear [l]), i.e., lateralization of [D n Q], rhotacism of [D n l z], nasalization of [l Q ¥], dentalization of [l Q], fricativization of [Q], and exchanges between [ɪ] and [v], between [D] and [z], and between stops and nasals of different places of articulation in specific vowel contexts. Strictly speaking, however, many of the substitutions just referred to could also be attributed to weakening to the extent that they are non reversible or happen to operate less often than their corresponding mirror processes. Indeed, [D n l z] > [Q] occurs more frequently than [Q] > [D n l z], and the same holds for [D] > [l] and [l] > [n] as opposed to [l] > [D] and [n] > [l]. The articulatory hypothesis is also consistent with the observation that most of these changes tend to be implemented before a voiced consonant or in non conflicting contextual conditions, e.g. rhotacism of [D l n z], and the replacements [D] > [l], [z] > [D], and [Q D] > [z].

Vocalization is prone to operating on long, vowel-like voiced consonants (e.g., on voiced labials, palatals, velars and [Ú]), and applies most often in contexts where other weakening processes occur as well (e.g. in syllable final position).

The vocalization of syllable initial consonants may result from a decrease in constriction degree (e.g., the transformation of palatals into [j] and of [Ú], labials and back velars into [w]) though instances of consonant vocalization in favorable contextual conditions could have an acoustic motivation instead (e.g., the replacement of [Ú] and labials by [w] in the context of back rounded vowels and [a]). On the

other hand, the vocalization of consonants in syllable coda position may be accounted for on articulatory and acoustic grounds: according to the former hypothesis, this vocalization process may be related to either articulatory reduction and, thus, to the failure to achieve constriction location (in the case of palatals and dark consonants), or else to gestural decomposition and simplification (in the case of complex [Ú]); according to the latter hypothesis, consonantal vocalization may be achieved through perceptual equivalence or glide categorization of the vowel transitions, as suggested by the existence of phonetic variants still exhibiting traces of inserted [j] (e.g., in VC sequences with clear alveolars and palatals) or of inserted [w] (e.g. in VC sequences with dentals and [Ú]).

A perceptual account based on acoustical equivalence or on the integration of the vowel formant transitions provides the most convincing explanation for instances of consonantal vocalization yielding unexpected glide outcomes. Acoustic equivalence is presumably at the origin of [l Q z] > [j] syllable initially. The phonemic categorization of the vowel formant transitions, on the other hand, may account for instances of syllable final vocalization giving rise to [j] out of [Ú], [D] and a bilabial or a velar before a dentoalveolar and often after a back vowel, to [w] out of [Ú] and [m] before a dentoalveolar and after [a], and to [j] or [w] out of an alveolar fricative depending on the preceding vowel context. The vocalization of clear and dark consonants before a dentoalveolar in syllable initial position (e.g., affricates, C1 = [ı D *f*] in clusters with C2 = [Q], [l]) may also be accounted for through segmental integration of the vowel formant transitions rather than through syllabic reassignment.

The possibility that vocalization may be achieved through phonemic categorization of the vowel transitions renders this sound change process different from other weakening mechanisms. If cooccurring with other weakening strategies, consonantal vocalization could however be attributed to articulatory reduction. This would be so for [l] > [j] in word final stressed syllables in Dominican Republic Spanish, where the same consonant is deleted in word final unstressed syllables (Lipski 1994b: 365), and for [Q] and [l] vocalization in Andalusian Spanish, where both consonants may also drop and participate in the replacements [Q] > [l] and [l] > [Q] (Quilis-Sanz 1998), and in Puerto Rican Spanish, where they may undergo aspiration and assimilation as well (Lipski 1994b: 355).

Consonantal elision takes place in open segmental contexts and word positions, i.e., intervocalically and syllable finally. Contrary to previous suggestions in the literature, it is not the case that elision

needs to be preceded by vocalization or lenition (see Escure 1977, and also Cravens 1984, according to whom the elision of intervocalic [k] in Central Italian subtypes has proceeded through [k] > [g] > [*ɟ*] > [w]). Instead, the elision of voiceless stops may proceed through extreme degrees of segmental shortening and possible glottalization (Hooper 1976; Shannon 1987).

Consonant erosion applies to specific places of articulation in a way which is consistent with the weakening hypothesis. Thus, in comparison to consonants of other places of articulation, velars undergo a considerable number of sound changes traditionally taken to involve weakening (fricativization, approximantization, aspiration, glottalization, voicing), presumably since they are produced with an extensive tongue dorsum closure or constriction and a slow release. Elision affects preferably unconstricted and apical realizations not specified for high production requirements (approximants, [ɒ], [l], [n], [ɋ], [h]). Changes in place of articulation also affect dental stops and alveolar nasals rather than their labial and velar correlates. These data run against the hypothesis that velars ought to delete more frequently than labials and dentals (Escure 1977; Harris-Northall 1990), as exemplified by dialectal domains where [n] is more prone to be elided than [ˆ] word finally (N. Italian, the Lower Cross group of languages, Chinese; Connell & Hajek 1991) and by others where word final [ɋ] is also prone to get deleted (e.g., Catalan). The observation that those consonants most prone to undergoing lenition (i.e., velars) are not the ones that are dropped most often (i.e., dentals and alveolars) is in agreement with the existence of different articulatory reduction mechanisms for the two classes of consonants. Thus, dentoalveolars should be weaker than velars and labials whenever consonantal reduction involves an increase in the speed of articulatory movements, since the former segments are produced with a fast tongue tip excursion, while the latter require slower tongue body and lip movements (see also Hooper 1976 and Marotta 1993).

8.2. Strengthening

Strengthening results in an increase in constriction degree, as for the affrication of fricatives, the occlusivization and fricativization of approximants, and the occurrence of trills rather than taps in strong positions and after occluded consonants. Consonant devoicing and the failure for voiceless consonants to voice may be associated with segmental strengthening when occurring in positions favoring articulatory reinforcement, but with aerodynamic factors when relat-

ed to long closure or constriction durations (in the case of stops, fricatives and affricates, often in favorable prosodic and contextual conditions), to a small back cavity (in the case of velars and stops after [w]), to manner requirements (for fricatives and affricates) and to a low subglottal pressure level (for consonants in sentence final position). Oral pressure characteristics could explain why voicing may be more frequently associated with fricatives than with stops, and why trills may undergo fricativization.

8.3. Processes affecting the alveolar fricative

The fact that the alveolar fricative may be affected independently by many of the processes reviewed so far (vocalization, aspiration, rhotacism, elision, retraction, assimilation) suggests that those processes cannot be unified as instances of weakening.

In principle, vocalization should be associated with articulatory retraction (presumably so in the Alps where [sp], [st] and [sk] appear to have yielded [(j)f], [(j)s/T] and [(j)x], respectively, through [çf], [çs/T] and [çx]; Rousselot 1891) and could be related to rhotacism, assimilation and elision to the extent that these three processes are also favored by a following voiced consonant. However, the fact that [s] vocalization may be obtained through glide insertion in specific vowel contexts (e.g., through [j] insertion after [e]) renders this process independent of the sound change mechanisms just referred to. This possibility is also consistent with the fact that [s] becomes [ʃ] before voiceless C2 and [j] before voiced C2 in Gascon (Allières 1955), and undergoes assimilation, palatalization and possible rhotacism but not aspiration and rarely vocalization in Sardinian (Contini 1987).

Rhotacism and aspiration of the alveolar fricative may apply on an independent basis, as suggested by the fact that, while aspiration operates typically before voiceless C2, rhotacism occurs most frequently before voiced C2 in the progression [l], [n], [m] > [d]/[D], [g]/[*ɟ*].

The relationship between assimilation and rhotacism appears to be more straightforward. Indeed, [s] assimilation through gestural overlap may operate on a reduced [Q]-like realization of the alveolar fricative (S. Sp. ['muz*ɟ*o] *musgo*> ['muQ*ɟ*o] > ['mu*ɟɟ*o], as for ['kaQne] *carne* > ['kanne]; Torreblanca 1976: 156), as confirmed by the cooccurrence of rhotacized and assimilated solutions in specific dialectal zones (Old Pic. *vas/rlet*, *vallet*, *valet* *VASSILLETTU, S. Sp. ['dEQDe], ['dEDDe] *desde*, ['nEQ*ɟ*a], ['nE*ɟɟ*a] *nesga*; Gossen 1970: 107, Torreblanca 1976: 157). Moreover, the fact that the alveolar fricative

undergoes rhotacism before [b d(z) g f v] and assimilation before nasals and liquids in Logudorese may imply that rhotacism was replaced by assimilation before sonorants and extended to stop and fricative contexts later on. In Campidanese, however, [s] assimilates to the majority of the following consonants just referred to, which suggests that assimilation and rhotacism are not necessarily related (Lorenzo 1975).

It has been argued that aspiration and assimilation of the alveolar fricative may apply sequentially through the same weakening mechanism before [p t k m n l] in S. Spanish ([oˈɪihpo]> [oˈɪippo], ['mihmo] > ['mi⁻mo], ['mimmo]; Lapesa 1980: 502, Llorente Maldonado 1962). Moreover, aspirated, assimilated and vocalized forms may coexist in Gascon, i.e. [(E/e)h/zl], [(E/e)ll] and [ejl], as in [El'lamo] FLAMMA, [ejlu'Qi] FLORIRE (Fleischer 1912). However parallel to rhotacism and assimilation, aspiration and assimilation are not necessarily related: indeed, as a general rule, the alveolar fricative undergoes aspiration before voiceless consonants and assimilation before voiced ones, and assimilation but no aspiration may occur in Sardinian.

The fact that [s] aspiration and palatalization may occur in analogous contextual conditions suggests that the application of the latter process may precede the application of the former, i.e., aspiration takes place before voiceless stops, before [k] and word finally and, less so, before voiced consonants (e.g. [m n l]), and palatalization occurs word finally and before [k] and, less so, before [p] (see also section 8.3). There is however no reason why [s] aspiration and elision before a heterosyllabic consonant must be achieved through the retracted realization [ʃ]. Indeed, [s] aspiration may be achieved through glottal abduction rather than through tongue retraction. Moreover, in addition to electropalatographic evidence showing that the lingual fricative does not undergo backing syllable finally (see section 5.2), [s] palatalization may occur in dialects where the alveolar fricative does not turn into [h] or the two processes may differ regarding the phonetic characteristics of the following contextual consonant (e.g., in Gascon, where the alveolar fricative may become [ʃ] before a voiceless consonant and [h] before a voiced one; Allières 1955).

The elision of [s] may take place after aspiration or assimilation though this is not necessarily the case. Elision may apply after the change [s] > [h] at a stage in which frication occurs at the glottis rather than at the vocal tract, and may be favored by a following consonant not interferring with apical activity ([sm] > [hm] > [m], as in

Arg. [la^{h} ˈ⁻aDQe^{h}] *las madres*; Malmberg 1950: 163). However, the fact that both processes typically operate in different contextual conditions suggests that they may apply independently, i.e., elision happens to be favored by a voiced C2 (in the progression [m n l] > [d]/[D], [g]/[*f*]), while aspiration is most prone to occur before a voiceless consonant. Elision may also be preceded by assimilation without aspiration (Old Pic. *vaslet*, *vallet*, *valet* *VASSILLETTU; Gossen 1970: 107), though it may also operate directly on a shortened realization of the alveolar fricative (Seklaoui 1989). The latter possibility is confirmed by data from Andalusian Spanish indicating that the zones where the fricative tends to remain instead of becoming [h] are precisely those where elision applies most frequently (Moreno 1996-97).

In summary, elision of the alveolar fricative may originate from aspiration, vocalization, rhotacism or shortening, and may apply after assimilation has taken place. Weakening could account for [s] rhotacism and shortening (but not necessarily for [s] aspiration and vocalization), for straight elision of an aspirated, vocalized, [Q]-like or shortened variety of [s], and for the simplification of an assimilated realization of preconsonantal [s].

9. Conclusions

A critical evaluation of several sound changes in Romance reveals that segmental weakening may account for consonantal substitutions involving more or less extreme degrees of articulatory reduction and shortening. However, weakening is not a plausible mechanism for: (a) consonant changes obtained through alveolar contact retraction, (b) the aspiration of front fricatives and perhaps [s], (c) exchanges between dentoalveolar consonants and consonants of little acoustic salience, (d) specific instances of consonant elision, and (e) instances of consonant vocalization, particularly when giving rise to unexpected phonetic outcomes. Other strategies may also play a role in these and other changes, namely, gestural decomposition, acoustic equivalence, or perceptual categorization of the vowel transitions or of intermediate phonetic realizations between the input and output segments. Consonant strengthening appears to be associated with an increase in constriction degree in strong positions but with aerodynamic factors in scenarios where voicing is involved.

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Notes

[1] Though characterized as instances of phonetic weakening by some scholars (Hooper 1976), assimilatory processes will be excluded from the present investigation. This is so since assimilatory changes do not proceed through gradual articulatory decay but involve categorical segmental replacements.

[2] In the present paper, input, output and intermediate forms are given in phonetic transcription. More occasionally, slashes are used for the representation of perceptual categories. Regarding the transcription of alveolar rhotics, the symbol [Q] is generally used word finally, preconsonantally and after a homosyllabic consonant, and the symbol [r] in word initial position. The alveolar fricative is transcribed with the IPA symbol [s] or [z] depending on the sound change under investigation (see sections 3.2.2 and 4.2 for [z] and sections 5.2 and 6.2 for [s]). The base notation [s] refers to both voiced and voiceless alveolar fricative realizations in section 8.3.

[3] The following language and dialect abbreviations are used throughout the paper: Abr. (Abruzzese); Alg. (Catalan dialect from l'Alguer); And. (Andalusian Spanish); Arag. (Aragonés); Arg. (Argentinian Spanish); Auverg. (Auvergnat); Berg. (Bergamasco); Bourg. (Bourguignon); Camp. (Campano); Campid. (Campidanese); Cal. (Calabrese); Cat. (Catalan); Cors. (Corsican); Dacorom. (Dacoromanian); Emil. (Emiliano); Extr. (Extremeño); Fr. (French); Fr.-Comt. (Franc-Comtois); For. (Forézien); Francoprov. (Francoprovençal); Friul. (Friulian); Gasc. (Gascon); Istrorom. (Istro-romanian); It. (Italian); Lad. (Ladin); Laz. (Lazio dialect); Leng. (Lengadocian); Leon. (Leonés); Lig. (Ligure); Lim. (Limousin); Log. (Logudorese); Lomb. (Lombardo); Lorr. (Lorrain); Luc. (Lucano); Lucc. (Lucchese); Mil. (Milanese); Nap. (Napoletano); Niç. (Niçard); Occ. (Occitan); Nuor. (Nuorese); Pad. (Padovano); Pic. (Picard); Piedm. (Piedmontese); Poit. (Poitevin); Port. (Portuguese); Pot. (Potentino); Prov. (Provençal); Pugl. (Pugliese); Rhaet. (Rhaetoromance); Rhod. (Rhodanien); Rom. (Romanian); Romagn. (Romagnolo); Roman. (Romanesco); Rosh. (Romansh); Rou. (Rouergat); Sal. (Salentino); Sard. (Sardinian); Sass. (Sassarese); Sic. (Sicilian); Sp. (Spanish); Trent. (Trentino); Tusc. (Tuscan); Val. (Valencià or S. Catalan); Ven. (Veneziano); Wal. (Wallon). Additionally, the following abbreviations appear: dial. (dialectal), ALW (Atlas Linguistique de la Wallonie), FEW (Französisches Etymologische Wörterbuch).

[4] An alternative possibility is that the outcome [¥] of CL in forms such as Cat. [u¥] OC(U)LU has been obtained through [(x)¥] rather than through [(j)¥] (Repetti & Tuttle 1987).

[5] Velar stop voicing may also be related to small intensity differences between the bursts for [k] and [g] (Zue 1980). Other voicing correlates such as VOT pre-

dict, however, that velar stop devoicing should occur more often than velar stop voicing, i.e. in comparison to labial and velar stops, voiceless velar stops show longer VOT lags and voiced velar stops show shorter prevoicing times.

[6] Contrary to these trends in sound change, stop closures have been reported to be more stable than fricative noises at changes in speaking rate during affricate production (Isenberg 1978). A related finding is that lengthening the frication noise causes affricates to be heard as fricatives and requires more closure silence in order for the final product to be heard as an affricate (Repp *et al*., 1978).

[7] Stop lengthening before [j] could also account for voicelessness in phonetic outcomes for CY (Cat. *acer* ACIARIU, Sard. ['aTTa], ['att(s)a] ACIE, S. It. ['vQat:su] BRACCHIU, Tusc. ['fat:ʃa] FACIE; Badia 1951: 210, Lausberg 1970: 395, Rohlfs 1966: 387) and for PY in Catalan lexical items (Cat. *sépia* SEPIA, *api* APIU as opposed to *ràbia* RABIE, *flabiol* *FLABEOLU, *àvia* AVIA, *nuvi* NOVIU; Coromines 1980-91, VI: 45). An increase in articulatory effort may account for other instances of devoicing (Arag. *ch/xinebro* IENIPERU; Zamora Vicente 1989: 223).

[8] Sardinian (['gat(t)u] GATTU, ['nEtta] NEPTA; Contini, 1987: 83) and C./S. Italian (Lausberg 1970: 406) are exceptional in this respect.

[9] Lengthening may affect other consonants in addition to stops in Italian and Sardinian (['janna] JANUA, Campid. [mul'lEQi] MULIERE; Jones 1988: 324) and stress position may have affected the lengthening process (e.g., [nw] has yielded [nn] after stress and [n] before stress in Tuscan, as in ['tenni] TENUI, [te'nisti] TENUISTI; Pensado 1985: 41).

[10] Stops of other places of articulation devoice less often than velars, i.e., labials (Port. [pofe'tada] *bofetada*; Leite de Vasconcellos 1987: 95) and dentoalveolars (Sal. ['tOQmu] *dormo*; Rohlfs 1966: 205).

[11] It appears however that the change [l] > [j] after a homosyllabic consonant has taken place through the intermediate stage [¥] in Romance (Repetti & Tuttle 1987). The generation of [j] out of [l] in the same clusters could also be associated with tongue dorsum raising, though acoustic data for Italian are not in support of this possibility (Javkin 1979).

[12] The Occitan forms *fau* FAGU, *jou* IUGU may also be accounted for through absorption of [*f*] by the adjacent back rounded vocalic element.

[13] In addition to the vocalized output [j], palatals may have yielded alveolar outcomes through dorsal contact loss in word final position (Old Occ. *gen/geny* INGENIU, Sp. *desdeñar/desdén*, *aquellos/aquel*, Alg. [an] ANNU, Occ. [ban] BALNEU; Grandgent 1905: 66, Menéndez Pidal 1968: 169, Recasens 1996: 26, Ronjat 1932: 298) or before a consonant in the endings [¥s] (Old Fr. *genolz* GENUCULOS, Gasc. [wels] OCULOS, [bjels] VETULOS; Lausberg 1970: 446, Rohlfs, 1970: 151) and [¯s] (Old Fr. *anz* ANNOS; Lausberg 1970: 446).

[14] The change of interest may also apply word initially through the influence of the preceding word final segment (Campid. [sa 'reula] from ['teula] TEGULA, Cal. [rOQ'mere] DORMIRE, Luc. [rEnd] DENTE; Contini 1987: 478, Rohlfs 1966: 204). Rhotacism may also affect a syllable final velar consonant in S. Spanish (['diQno] *digno*, ['aQto] *acto*; Zamora Vicente 1989: 341).

[15] The approximant or fricative [D] may also replace [¥] (Francoprov. from Valais ['paD@] PALEA, Vaud ['foD@] FOLIA; Guarnerio 1918: 395, Jeanjaquet 1931: 40) and [j] in homosyllabic clusters (Vaud [pTõ] PLUMBU, [bDa] 'Fr. blé', Auverg. from Haute Loire [fTa] for [fja] FILU; Séguy 1954, Straka & Nauton 1947: 219).

[16] A particular dissimilatory case is [ll] > [Ql] (Gasc. [es'paQle] SPATULA; Ronjat 1932: 151).

[17] In any case, the neutralization between the alveolar lateral and the alveolar rhotic may yield both realizations after a homosyllabic consonant and syllable finally. The former contextual possibility is found in Andalusian Spanish

(Salvador 1978). The latter possibility is documented in Sardinian, where [l] prevails over [Q] in E. Logudorese and the rhotic prevails over the lateral in Nuorese (Blasco 1984: 199). Syllable final neutralization is also frequent in Spanish dialects whether before a consonant (e.g., in the Dominican Republic and Puerto Rico where the prevailing realization is [l], and in Honduras where [Q] prevails; Lipski 1994b: 290, 355, 364) or word finally before a pause (e.g. in Andalusian Spanish where the lateral may prevail upon the rhotic; Quilis-Sanz 1998).

[18] In accordance with this scenario, Penny (1972) has suggested that the change [f] > [h] in Spanish originated from an allophonic scenario in which [f] was realized [F] before [i e a Q l j] and less constricted [h(F)] before [o u w].

[19] In Old French, a retracted realization of apical [s] gave rise to [h] in syllable final position (and zero later on), while a fronter variety and a dorsal variety of the alveolar fricative merged elsewhere (Joos 1952).

[20] Indeed, elision in intervocalic position may apply to voiced labials in Romanian (*cal* CABALLU, *cheie* CLAVU; Lausberg 1970: 356) and in Ladin after word stress (-['aa] for -ABAT, ['noo] NOVU; Haiman & Benincà 1992: 72), and to voiced labials, dentals and velars word medially and word initially in Sardinian and in S. Italian areas (Sard. ['niE] NIVE, Campid. [su 'Oi] BOVE, [sa 'Omu] DOMO, Marche [la 'aka] VACCA, Nap. [a 'att] CATTA, Sic. [pa'aQi] *pagare*; Contini 1986: 525, Lausberg 1970: 356, Rohlfs 1966: 207, 229, 270).

[21] The presence of word initial [h] in Old French accounts for the absence of vowel elision in *la honte* and of liaison in *les haches* in Modern French (Lausberg 1970: 329-330).

[22] In French, the word final alveolar fricative stays in monosyllables and before a word initial vowel in cohesive morphological and syntactic word formations ([dis] *dix*; *les arbres*, *dix hommes*), thus suggesting that [s] elision applied first in preconsonantal position (Lausberg 1970: 430). In Campidanese Sardinian, the alveolar fricative may drop before voiceless obstruents ([dEp:eu(s) p:E'sai] for /dEpEus pEsái/; Bolognesi 1998: 166).

[23] It seems unrealistic to assume that the elision of intervocalic [Ú] and [n] in the Portuguese-Galician domain may have taken place after resyllabification, i.e., V-LV> VL-V and V-NV>VN-V>V[˜]-V (Brandão de Carvalho 1988).

[24] The elision of word final [n] may operate before a word initial consonant (in the case of the particles *in*, *quin*, *non* before a fricative or a liquid in Sardinian, e.g. [il 'letu]; Jones 1988: 326) or before a word initial vowel (in a Gascon area where word final [n] exhibits a velar nasal realization, e.g., [y 'Ome] as opposed to [y˜ 'ka], [ym 'paj]; Bec 1968: 53).

[25] It has also been suggested that the transformation of a syllable final labial stop into [j] in sequences such as PS (> [(j)ʃ]), PL ([¥], [j]) has taken place through an intermediate velar stop (see section 3.2 for an alternative account). Other related changes are documented in S. Italian, i.e., PL- > [ktʃ] (Nap. *chiatto*, *chiòvere* for *piatto*, *piovere*), SPL- > [skj], [ʃk] (Nap. *schiegare,* Cal. ['ʃkuma] for *spiegare*, *schiuma*) and [pj] > [kkj] (Cal. *cacchiu*, *acchianari* for *cappio*, *appianare*) (Rohlfs 1966: 253, 261, 355).

[26] Intermediate solutions such as [k^{w}t] (Posner 1996) or [ht] > [ft] (Bourciez 1967) for the Romanian sound change CT > [pt] do not appear to have a solid phonetic basis.

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