The Phonetic Origin and Phonological Extension of Gallo-Roman Palatalization[*]

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In this paper I discuss the relationship between two sound changes in Gallo-Roman: the fronting of /a/ in stressed open syllables, and the palatalization of /k, g/ before /a/ in addition to /i, e, ɛ/. I argue that allophonic Fronting created the original phonetic conditions for Palatalization, but that the phonological structure of the language led to extension of palatalization to non-fronted tokens of /a/, despite the lack of articulatory motivation in that context. The explanation for the change is therefore partly phonetic and partly phonological.

Section 1 below provides basic background on the relevant sound changes in Romance and French. Section 2 focuses on the reflexes of Latin /a/, in particular the contexts in which it eventually led to front mid /ɛ, e/. Section 3 discusses the palatalization of velars before this vowel, and theories about the relationship (if any) to the change in vowel articulation. In section 4 I argue for Fronting as the essential cause of Palatalization, with spread to all tokens of the category /a/. Section 5 is a brief conclusion.

1. Background

The early history of French can be divided into several periods (Einhorn 1974). It is the Gallo-Roman period that is the primary focus of this paper.

(1) Proto-Romance   up to the late 5th century
     Gallo-Roman   late 5th to mid 9th century
     Early Old French   mid 9th to late 11th century
     Later Old French   late 11th to early 14th century

Significant attestation of the language begins in the Early Old French period, and there is a large corpus available for Later Old French; but there is virtually no direct written record of Gallo-Roman. The sound changes under discussion here precede the clearer data of the Old French period, so that many of the details are known only indirectly.

In the change from Classical Latin to Vulgar Latin or Proto-Romance, the quantitative distinction of Latin was reinterpreted as a qualitative distinction, with various mergers.[1]

(2) Classical Latin	ī	ĭ	ē	oe	ĕ	ae	ā	ă	ŏ	ō	ŭ	ū
Proto-Romance	i		e			ɛ		a	ɔ		o	u

Quantitative differences, phonemic in Latin, became predictable in Proto-Romance, as vowels were noncontrastively lengthened in stressed open syllables. Since it is a main interest of this paper, I

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[1] More precisely, this vowel system reflects Proto-Western-Italo-Romance, since in Sardinia a slightly different set of vowel mergers occurred (cf. Hall 1976).

follow other authors in using the notation A to refer to the merged reflexes of Latin long and short /a/, and Á[for any such reflex in a stressed open syllable (where it is lengthened). Similarly, KA stands for /k, g/ followed by /a/.

There were two changes in Gallo-Roman whose interaction is discusssed here. First, /a/ in a stressed open syllable — that is, Á[— was raised and fronted to eventual /ɛ, e/ in Modern French, depending on the syllable structure. The change in the vowel will be called Fronting here.

(3)   <u>Proto-Romance</u>   <u>Modern French</u>

    a. má.re   [mɛr]   *mer*   'sea'
    b. prá.tu   [pre]   *pré*   'meadow'

Second, /k, g/ before inherited /a/ were palatalized and affricated to /tʃ, dʒ/ by the time of Old French, with the modern fricative reflexes [ʃ, ʒ]. This Palatalization occurred whether or not the /a/ was in a Fronting environment, so that modern French in some cases preserves the vowel intact.

(4)   a. kát.tu   [ʃa]   *chat*   'cat'
    b. gám.ba   [ʒãb]   *jambe*   'leg'
    c. ká.sa   [ʃe]   *chez*   'house (of)'
    d. ká.ru   [ʃɛr]   *cher*   'dear'

The main questions to be addressed here are: What is the relationship between these changes? What are the implications for the interaction between phonetic motivation and phonological patterning?

The palatalization triggered by A was also triggered by /i, e, ɛ/, but as discussed below there are rather few examples of the change in this context, because of a previous change in Proto-Romance. It is important to distinguish the Gallo-Roman, or "Second" Palatalization in (4), from the earlier but similar First Palatalization, which affected Proto-Romance in the 3rd century (with the notable exception of Sardinian; cf. Hall 1976). This change also applied to /k, g/, but before the front vowels of Proto-Romance, namely /i, e, ɛ/. The eventual outcome of the First Palatalization was /ts, dʒ/ in Old French, which have become /s, ʒ/ in the modern language.

(5)   <u>Proto-Romance</u>   <u>Old French</u>

    a. kí.ra   [tsirə]   *cire*   'wax'
    b. kɛ́n.tu   [tsɛnt]   *cent*   'hundred'
    c. kɛ́.lu   [tsi̯ɛl]   *ciel*   'sky'
    d. gin.gí.wa   [dʒɛntsivə]   *gencive*   'gum'
    e. gɛ́.lu   [dʒi̯ɛl]   *giel (gel)*   'frost'
    f. ar.gɛ́n.tu   [ardʒɛnt]   *argent*   'silver, money'

Note that these transcriptions of Old French (Hall 1976) represent a slightly earlier pronunciation (Early Old French); in particular they precede the loss of [ð], a sound absent from the later, more standard spellings given in many cases (Later Old French). When the modern spelling differs, it is given in parentheses; a dash means that the word is absent from the modern language.

The output for voiceless /k/ does not merge with the result of the First Palatalization of Common Romance, which at this stage had become /ts/ in Gallo-Roman. Voiced /g/ does, however, have the same outcome [dʒ] in both palatalizations. The following chart outlines the stages, with sound changes highlighted.

(6) Latin

	k			g	

First Palatalization 2nd–3rd century	ts	k	dʒ	g	

Second Palatalization 5th century	ts	tʃ	k	dʒ	dʒ	g

Deaffrication 13th century	s	ʃ	k	ʒ	g	

An important question, then, is why the Second Palatalization, two centuries later in Gallo-Roman, was triggered by /a/ as well as the more obviously front vowels; I return to this question in section 3.

2. Outcomes of Latin A

Several contexts are to be distinguished for the outcomes of Proto-Romance A in Gallo-Roman (Fouché 1958: 125). The first is a stressed open syllable. As indicated above, Á[was fronted. I assume that the fronted vowel was phonetically [æ] in both Gallo-Roman and Old French, and that its raising occurred later; see section 2.1 below for more discussion. Allophonic lengthening of vowels in stressed open syllables is not indicated here, since it is predictable.

(7) a. pá.dre   [pæðrə]   *pedre (père)*   'father'
     b. má.re   [mær]   *mer*   'sea'
     c. pas.sá.re   [pasær]   *passer*   'to pass'
     d. lá.bra   [lævrə]   *levre (lèvre)*   'lip'
     e. klá.we   [klæf]   *clef (clé)*   'key'

In a closed syllable, the vowel remains /a/ through Modern French; I argue below that its quality is essentially unchanged since Proto-Romance. This is true for stressed closed syllables (7) as well as unstressed closed syllables (8). Note that the persistence of Latin gemination into the Gallo-Roman period is essential for determining syllable structure at this time.

(8) a. pás.su   [pas]   *pas*   'step'
     b. grán.de   [grant]   *grand*   'big'
     c. pár.te   [part]   *part*   'part'
     d. flám.ma   [flamə]   *flamme*   'flame'
     e. ár.bo.re   [arbrə]   *arbre*   'tree'

(9) a. blan.dí.re   [blandir]   *blandir (—)*   'to flatter'
     b. ɛs.kap.pá.re [ɛstʃapær]   *eschaper (échaper)* 'to escape'

The fate of /a/ in an unstressed open syllable depends on its position in the word. In a word-initial syllable, the vowel remains [a]. (For the cross-linguistic strength of initial syllables, see Beckman 1998.)

(10)	a.	ma.rí.tu	[marið]	*mari*	'husband'
	b.	a.mí.cu	[ami]	*ami*	'friend'
	c.	a.bé.re	[ave i̯r]	*aveir (avoir)*	'to have'

Elsewhere in the word, i.e. in medial or final position, the vowel ends as [ə] or is deleted; sometimes it is presumed to have passed through a stage as another vowel such as [ɛ] (Matte 1982).

(11)	a.	or.na.mén.tu	[ɔrnəmɛnt]	*ornement*	'ornament'
	b.	ar.ma.tú.ra	[arməðurə]	*armeüre (armure)*	'equipment'
	c.	la.wa.tú.ra	[lavəðurə]	*laveüre (lavure)*	'washing'
	d.	pɛk.ka.tó.re	[pɛtʃəðou̯r]	*pechedor (pécheur)*	'sinner'
	e.	pɔ́r.ta	[pɔrtə]	*porte*	'door'

The central observation is that only some tokens of /a/ underwent fronting. The important remaining question is the status of the other tokens of /a/ at the time of the Second Palatalization: were they somehow phonetically fronted, perhaps to a lesser degree, but still low? Or had they become mid vowels? For some evidence on this point, we must examine the reflexes of /a/ in Old French.

2.1. Fronted A in Old French

Assonances in Old French poetry are an imporant source of evidence regarding the distinctness of various non-high front vowels in the post-Gallo-Roman period. Based on sets of words that are permitted in positions of assonance — which depends on the identity of the stressed vowel — it is uncontroversial that fronted Á[had not yet merged with /ɛ, e/; despite the fact that all were spelled with <e>, this letter actually labels three different assonance classes (Herslund 1976: 11; cf. Fouché 1958: 261, Walker 1981a: 20, Nyrop 1935: 201).

(12)	/e/	*duchesse, promesse, met, ele, cele, dete*
	/ɛ/	*pel, novele, bele, apele, terre*
	/æ/	*mere, clere, pere, cruel, el, prenez*

Anticipating my later claim, the third vowel is given here as /æ/. There is, however, controversy regarding the actual pronunciation of Á[in Old French.

One view assumes that the third vowel is long and mid, either /ɛ:/ or /e:/, to keep this vowel distinct from short /ɛ, e/ (cf. Schwan-Behrens 1914: 48, Pope 1934: 106, Fouché 1958: 261, Einhorn 1974: 6, Zink 1986: 56). This position is dubious because length appears to be otherwise noncontrastive in Old French, and such an analysis would require the long mid vowel even in a closed syllable (though it was open in Gallo-Roman, e.g. *paret > pert*). For example, the following two words belong to different assonance classes (Herslund 1976: 12).

(13)	a.	*pert*	[pɛrt]	'loses'
	b.	*pert*	[pært] or ?? [pe:rt]	'appears'

A second view, which I adopt here, treats the third vowel as low and front. In other words, at the time of Old French, fronted Á[was still a low vowel /æ/, that later underwent raising to merge with /ɛ, e/ after the 12th century (cf. Walker 1981a,b, Herslund 1976:10–12, Nyrop 1935: 201, Price 1971: 66, Hall 1946: 579, 1976).

It is important to note that this Á[also does not assonate with /a/, the closed-syllable reflex of A. Changes in syllable structure — i.e. vowel loss resulting in Á[in new closed syllables — mean /æ/ and /a/ now have to be treated as separate phonemes (cf. *pert* in (13)), although a morphophonemic rule relates them (cf. Herslund 1976: 60, Walker 1981a: 26, Klausenburger 1982):

(14)   a. *lavons*   [lavɔ́ns]   'we wash'
       b. *levent*   [lǽvənt]   'they wash'

The back /ɑ/ still found in some modern varieties of French is a later development (around the 15th century) from lengthened /a:/, such as by compensatory lengthening when a following coda /s/ was lost (Fouché 1958: 244).

(15)   a. bas > ba: > bɑ   *bas*   'low'
       b. pastə > pa:tə > pɑtə > pɑt   *pâte*   'paste, dough'

Thus the backness of that vowel does not bear on the discussion of Old French, much less Gallo-Roman.

2.2. How fronting occurred

In Classical Latin (Allen 1970: 50) and Proto-Romance (Hall 1976: 18), the low vowel /a/ was phonetically central. By what path did this A, lengthened as Á[in a stressed open syllable, come to be /æ/ in Old French?

According to one view, the central fact is diphthongization. Common proposals have some version of the following sequence of events (cf. Fouché 1958: 227f, Haudricourt and Juilland 1970: 54, Zink 1986: 56, Joly 1995: 55).

(16)   á > áa > áɛ > ɛ́ɛ (> ée)

The scenario suffers from the need to suppose a long front vowel in closed syllables in Old French (cf. (13)). The arguments in favor of the intermediate [aɛ] stage, made most explicitly by Fouché, are all subject to other explanations. For example, the fact that Á[became the diphthong [ai̯] before a nasal (*fá.me > faim* 'hunger') does not mean that every token of Á[went through a diphthongal stage: it might have occurred only to nasalized vowels, which often follow different spectral paths than oral vowels (Hajek 1997). Other arguments appeal to the fact that fronting occurred in open syllables only, but the common thread is vowel length — an extremely common change in a stressed open syllable — and not necessarily diphthongization.

Another approach involves simple fronting. Hall (1946: 579) notes that "phonetically [æ] is far the most likely transitional sound between [a] and [ɛ]." This is my position not only because it is the most direct, but also because (as discussed below) it provides the front vowel necessary as the most plausible trigger for the palatalization of velars.

(17)   á > á: > ǽ: (> ɛ́, é)

Diphthongization is not inconsistent with fronting, of course; one might propose a combination (cf. Matte 1982: 104). In such a case, however, diphthongization is not the primary phenomenon.

(18)   a: > æ: > æɛ > ɛ

Here noncontrastive lengthening in a stressed open syllable was a precondition for fronting (rather than for diphthongization). For supporting evidence based on vowel shifts in general, see Labov (1994: 116): Long vowels typically move up in the vowel space, and back vowels move forward; thus it is typologically natural for [a:] to move to [æ:] and [ɛ:].

3. The Second Palatalization

As mentioned above, the Gallo-Roman or Second Palatalization was a new process in the late 5th or early 6th century. Its most striking aspect is that it changed /k, g/ to Old French /tʃ, dʒ/ primarily when followed by /a/, which is not a typical trigger for such a change. As noted above, the Second Palatalization occurred before all reflexes of A, including those that stayed non-fronted as /a/, and those that were (eventually) reduced to /ə/.

(19)	a.	kár.ru	[tʃar]	*char*	'wagon'
	b.	kám.pu	[tʃamp]	*champ*	'field'
	c.	kar.bó.ne	[tʃarbɔn]	*charbon*	'coal'
	d.	kan.tá.re	[tʃantær]	*chanter*	'to sing'
	e.	gám.ba	[dʒambə]	*jambe*	'leg'
	f.	gál.bi.nu	[dʒalnə]	*jalne (jaune)*	'yellow'

(20)	a.	ka.bál.lu	[tʃəval]	*cheval*	'horse'
	b.	ka.nú.ra	[tʃənurə]	*chenure*	'gray hair'
	c.	ga(l).lí.na	[dʒəlinə]	*geline*	'hen'

(21)	a.	wák.ka	[vatʃə]	*vache*	'cow'
	b.	búk.ka	[boṷtʃə]	*bouche*	'mouth'
	c.	lár.ga	[lardʒə]	*large*	'broad (f.)'

The sequence /au/ monophthongized to /o/ soon after the Second Palatalization, as reflected in the Old French pronunciation; but it was clearly the first half of the diphthong that triggered the rule.[2]

| (22) | a. | kau.sa | [tʃozə] | *chose* | 'thing' |
| | b. | gau.dia | [dʒoi̯ə] | *joie* | 'joy' |

Where the vowel A fronted, we of course also find palatalization.

(23)	a.	ká.sa	[tʃi̯æzə]	*chiese (chez)*	'house (of)'
	b.	ká.ru	[tʃi̯ær]	*chier (cher)*	'dear'
	c.	ká.ne	[tʃi̯æn]	*chien*	'dog'

| (24) | a. | pur.gá.re | [purdʒi̯ær] | *purgier (purger)* | 'to purge' |
| | b. | naw(i).gá.re | [nadʒi̯ær] | *nagier (nager)* | 'to swim' |

The introduction of the onglide [i̯] in these forms is due to Bartsch's Law, a later change, probably in the 6th century (Machonis 1990: 96). There were two relevant effects on vowels following a palatalized consonant:

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[2] Hall (1946: 579) even suggests that /a/ before a coda /l/ was probably the back vowel [ɑ], due no doubt to the velarization of /l/ in that syllable position, e.g. *chalt* [tʃɑlt] 'hot'. Matte (1982: 104) argues, however, that [æu] and [əu] as dialectal realizations for English /o/ show the plausibility of the change from [æu] to [o], eliminating the need to suppose the stage [ɑu].

(25)   a.   Insertion of a glide element [i̯] before Á in an open syllable, e.g. *chiese*.

                In Middle French, the glide was "absorbed" by the palatal (*chier > cher*), except if it was nasalized (*chien*).

    b.   Raising of A to [e] in an unstressed open syllable, e.g. *cheval*.

                Eventually reduced to [ə].

Ordering evidence discussed by Fouché (1958: 449) suggests that Bartsch's Law follows both fronting of A and palatalization of KA — in fact, it follows affrication of the palatal [kʲ] to [tʃʲ]. For example, raising to [e] was blocked in *canale > chanel*, not **chenel* (which Fouché attributes to a "dissimilation préventive"). Thus the interaction with the onglide is probably subsequent to the main interest of this paper.[3]

    Although the dialect situation for Old French and Provençal is complex, and involves considerable contact, in general it seems that the Second Palatalization occurred only where Fronting also occurred.[4] In particular, both are absent from Provençal, at least the southern variety. In Northern Provençal, with influences from Old French, González (1985: 195ff) reports a mixture of palatalization and fronting, which is likely the result of dialect contact. For Norman and Picard, the early spelling <kie> suggests coarticulation before fronted A, but no affrication (Nyrop 1934: 397).

(26)

	Old French	N. Provençal	S. Provençal	Picard	
a.	*chievre*	*chevra, chavra*	*cabra*	*kièvre*	'goat'
b.	*chier*	*cheira*	*cara*	*kier*	'dear'
c.	*chien*	*chen, chin*	*can*	*kien*	'dog'
d.	*chiese*	*chas, chies*	*casa*		'house (of)'
e.	*champ*		*camp*	*camp*	'field'

In its broad strokes, the pattern supports the idea that Palatalization occurred only in the presence of Fronting, or in proximity to a dialect with Fronting. It seems highly likely, therefore, that Fronting played a crucial role in the Second Palatalization.

3.1. A unified change

Because [a] is crosslinguistically unusual as a palatalization trigger, and yet very well attested as one in French, KA is typically emphasized in the literature discussing this change. But the Second Palatalization was in fact triggered by **all** front vowels, and the rule must be understood from that perspective.

    Due to the effects of the First Palatalization in Proto-Romance, there were few sequences of a velar plus a front vowel (schematically, KI or KE) remaining in the vocabulary of Gallo-Roman. We must look at later borrowings, primarily from Germanic, to see the application of the Second Palatalization before these vowels (Fouché 1958: 197, 1966: 554f, 701, Pope 1934: 128, Matte 1982: 104).

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[3] Some authors do, however, seem to treat it as part of the process of Fronting; and it has been suggested that step (25b) may have been directly [a] > [ə]. The exact relation of these changes to the claims in this paper remains to be explored.
[4] I have not investigated palatalization of KA in Rhetic and Lombard-Alpine dialects (Fouché 1966: 556).

(27)   a. skerpa   [ɛstʃɛrpə]   *escherpe (écharpe)*   'scarf'
       b. skîna   [ɛstʃinə]   *eschine (échine)*   'spine'
       c. kip(f)e   [tʃipə]   *chipe (chiffe)*   'rag'
       d. re + kînan   [rətʃiɲi̯ær]   *rechignier (rechigner)*   'to grimace, balk'
       e. meskin   [mɛstʃin]   *meschin*⁵   'a youth'

Borrowed words at the time with KA also undergo the change, of course (Nyrop 1935: 396).

(28)   a. marka   [martʃə]   *marche*   'border country'
       b. Karl   [tʃarləs]   *Charles*   'Charles'
       c. gard-   [dʒardin]   *jardin*   'garden'

It should be noted that after the Second Palatalization, as late as the 12th century (Zink 1986: 148) though perhaps much earlier (Joly 1995: 94), /kw, gw/ were simplified to /k, g/, so that sequences such as /ka, kæ, ki/ arose again, and /tʃ, dʒ/ were certainly now contrastive.

(29)   a. kwát.to.ro   [katrə]   *quatre*   'four'
       b. kwá.le   [kæl]   *quel*   'which'
       c. kwí   [ki]   *qui*   'what'
       d. gwér.ra   [gɛrrə]   *guerre*   'war' *(Germanic)*

Some authors, such as Pope (1934: 124), clearly treat the Second Palatalization as a new, independent process that was triggered by all the front vowels. This is my position as well. Many authors, however, minimize the facts regarding KI, KE, preferring to treat the Second Palatalization as some kind of weaker continuation of the First that simply added KA to the set of triggers (cf. Straka 1965: 142f, de la Chaussée 1974: 69f, Blondin 1975: 157, Geisler 1992: 128). The operative notion is apparently the following: Since the vowel A is less anterior, it causes a less dramatic change in the consonant, i.e. to palatal /tʃ/ rather than dental /ts/.

   This attitude has no real phonetic basis: [tʃ] is **more** palatal than [ts], albeit less "front" in an unhelpful sense. I suspect that the Proto-Romance change, because widespread throughout the family, is taken to be the norm, while the Gallo-Roman, because limited in geographic scope, is thought to require special explanation. But the real difference in outcome for the velars seems to lie in the fact that Proto-Romance palatalized [kʲ] merged in Gallo-Roman with the palatalized [tʲ] from other sources (cf. *plattya > place, fakya > face*), and from there [tʲ] > [ts] (Ringenson 1922, Fouché 1966: 911f, Pope 1934: 120ff). The "delay" in A asserting its palatalizing nature is, I claim, due to the fact that Á[was not fronted until this later period.

3.2. The trigger

In my view, then, the reason KA undergoes palatalization is that many of these sequences were actually [kæ] at the time, not [ka]. This basic point of view is shared by Posner (1997: 245): "For this [palatalization] to have happened as an assimilatory process, we must assume a front articulation of *a*...." A simple illustration of the well-known coarticulatory effect of front [e] vs. central [a] can be seen for the West African language Ewe, where the place of articulation of [k] responds to the frontness of the surrounding vowels; the following diagram shows movement of the tongue towards the roof of the mouth in the two contexts (Ladefoged and Maddieson 1994: 34).

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⁵ The modern French *mesquin* [mɛskɛ̃], without palatalization, means 'stingy, petty' and is a later borrowing from Italian *meschino* [meskino]. Both the Old French and the Italian words originate in Arabic *meskīn* 'poor, humble'.

(30)
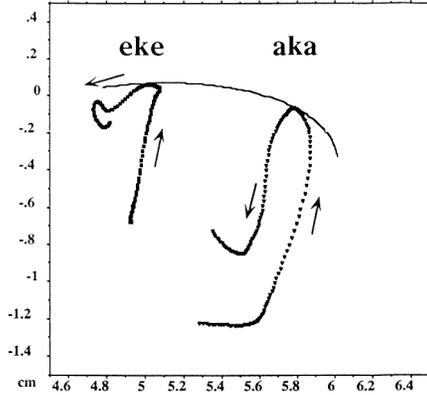
Although [i] and [e] are more typical triggers for this process cross-linguistically, palatalization of velars next to [æ] is well-attested for languages with this vowel. For example, in Persian, /k, g/ are palatalized allophonically next to a tautosyllabic front vowel /i, e, æ/ (Nye 1954: 9, Majidi 2000: 19).[6]

(31) kʲif   'bag'   kur   'blind'
      kʲerm   'worm'   kon   'make'
      kʲæm   'a little'   kɑr   'work'

Similarly, in Late Old English, spirantized [ɣ], written *g*, became [y] after a front vowel and [w] after a back vowel, whether long or short (Wright and Wright 1928: 128f). The Modern English spellings indicate which change occurred; clearly /æ/ patterns with the other front vowels.

(32) stigel   'stile'   fugol   'fowl'
      weg   'way'   boga   'bow'
      dæg   'day'   lagu   'law'

Consider now Modern Greek, a language lacking /æ/ but with allophonic palatalization of the velars /k, g, x/ before /i, e/ but not /a/ (Eleftheriades 1985: 15).

(33) kʲíklos   'circle'   kunó   'move'
      kʲe   'and'   kózmos   'world, people'
      —   kalós   'good'

In each language, it is all and only the front vowels that trigger the process. In particular, the Greek /a/, a central vowel similar to modern French /a/, does not trigger palatalization. The same is true for the /a/ of Proto-Romance during the First Palatalization. These vowel charts show the phonological systems, with palatalization triggers boxed in bold.

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[6] Palatalization also occurs syllable-finally regardless of adjacent sounds: [xɑkʲ] 'earth', [suskʲ] 'beetle'. This aspect of the alternation is not assimilatory.

(34)   *Persian*   *Old English*   *Greek*   *Proto-Romance*

i	u
e	o
æ	ɑ

i	u
e	o
æ	ɑ

i	u
e	o
	a

i	u
e	o
ɛ	ɔ
	a

If Gallo-Roman Á[similarly had a truly front articulation as [æ], then the Second Palatalization makes phonetic sense. Otherwise, it stands in surprising contrast to the more usual pattern illustrated by Greek and Proto-Romance.

4. A in Gallo-Roman

The question then arises: Were all tokens of A that triggered palatalization themselves fronted? This matter has generally been neglected or treated unclearly in the historical literature. Part of the problem appears to be a general lack of distinction made between two potential phonetic realizations.

(35)   a.   [a], a central vowel unlikely to trigger palatalization (cf. Proto-Romance)

        b.   [æ], a front vowel more likely to trigger it (cf. Gallo-Roman)

That is, much of the literature assumes a concept of the vowel space with one or two low vowels — cf. the traditional IPA notation, with two (cf. Pullum and Ladusaw 1986: 3). However, a more nuanced view must admit three low vowels in principle, with different expected effects on adjacent velar consonants — as in typical Americanist use of these symbols.

(36)   *One low vowel*   *Two low vowels*   *Three low vowels*

```
     i     u              i       u              i       u
   e     o              e       o              e       o
    ɛ   ɔ                ɛ     ɔ                ɛ     ɔ
      a                  a   ɑ                 æ  a  ɑ
```

In particular, a one- or two-vowel scheme cannot even accommodate the notion of a vowel that has moved forward from central [a], but remains low.

    Consider three scenarios for the vowel inventory of Gallo-Roman at the time of palatalization (ignoring diphthongs composed of these elements): that all tokens of A were central; that all tokens were fronted; and that only some of them were fronted, as an allophonic property of /a/. The phonetic triggers of palatalization are here boxed in bold.

(37)   I. *No Fronting*   II. *Complete Fronting*   III. *Allophonic Fronting*

i		u
e		o
ɛ	ə	ɔ
	a	

i		u
e		o
ɛ	ə	ɔ
æ		

i		u
e		o
ɛ	ə	ɔ
æ	a	

I discuss each of these approaches in turn.

4.1. No Fronting

Under Scenario I, there was no fronting of Á[at the time of the Second Palatalization. This position is apparently the most widespread view in the Romance literature, though the assumption is often inexplicit. In this camp we find, for example, the proposal of diphthongization and then smoothing as the mechanism of vowel fronting (cf. (16)), where the first element remains central (Fouché 1958, Joly 1995, etc.).

(38)   a > aɛ > ɛ

For Zink (1986: 116), palatalization is clearly not caused by Fronting, since Fronting (via diph-thongization) occurs later (cf. Nyrop 1935: 200, Bourciez 1967: 134, Joly 1995: 91).

(39)   a. *caru*   kʲaru > tʃʲero > tʃʲi̯ero > tʃi̯er
        b. *carru*   kʲarru > tʃʲarro > tʃar
        c. *caballu*   kʲavallu > tʃʲevallo > tʃeval > tʃəval
        d. *baccalare*   bakkʲalare > battʃʲelaɛre > batʃəlɛr

This is also the position of those who argue that the trigger of the Second Palatalization is the over-all structure of the phonological system — one in which [ki, ke, kɛ] have largely disappeared from the lexicon due to the First Palatalization — rather than consonant-vowel coarticulation (cf. Haudricourt and Juilland 1970 and criticism by Spence 1965, Matte 1982: 56f).

There are two fundamental problems with this approach. First, it lacks a good explanation for why central [a] should participate as a trigger of palatalization, despite ill-defined reference to "articulatory force" and the like (Straka 1965, etc.). Certainly it is possible for palatalization to occur in less typical contexts: some varieties of modern French have a fronted [kʲ] in a word like *quatre* 'four' with a relatively central vowel.[7] In other languages palatalization can occur regardless of adjacent vowels, such as the change of Semitic /g/ to /dʒ/ or eventual /ʒ/ in most modern Arabic dialects (cf. Martinet 1959). But these situations cannot be used confidently as analogies without knowing more about the way each change has arisen and spread. This leads us to the second and more important objection to the "No Fronting" view: It fails to relate the very real process of A-fronting to palatalization by A. Consequently I reject the No Fronting scenario.

4.2. Complete Fronting

Under Scenario II, there was wholesale fronting of A by the time of the Second Palatalization, regardless of whether the A eventually merged with E. For example, Matte (1982: 103) claims that by the 5th century all tokens of A had become either [æ], when stressed or initial, or [ɛ], when pretonic or final. It is specifically these front vowels that trigger Palatalization.[8]

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[7] Thanks to Paul Boersma and Yves Charles Morin for pointing this case out to me. I have not investigated the situation in detail, but it may be historically related to the opposition between anterior [a] and posterior [ɑ], a socially marked variable in Paris (Mettas 1979). Regarding /k/ in one sociolect, Mettas (p. 260) reports that "l'occlusion paraît se situer plus en arrière que dans le parler neutre", so that fronting in *quatre* may reflect broader facts about velar consonants and not simple assimilation. Ringenson (1922) gives a survey of other palatalizations in Modern French dialects, though not before /a/.

[8] Spence (1965) and Posner (1997) may have similar views, but their descriptions are not explicit enough to be certain.

(40) a. vakka > vækk^{j}ɛ > vætʃtʃə   'cow'
      b. kapra > kapræ > kabrɛ > k^{j}ævrɛ > tʃi̯evrə   'goat'

For Matte, only in the 17th century do the remaining [æ] vowels revert to central [a]. (Subscripts indicate the century in which the change took place.)

(41)   tabla >$_4$ tablæ >$_5$ tæblɛ >$_8$ tæblə >$_{17}$ tabl(ə)

Other scholars have generally assumed an unchanged central vowel when Proto-Romance [a] survives in Modern French as [a]: "[á] entravé ... s'est conservé inchangé jusqu'en français moderne" (Joly 1995: 42; same for Bourciez 1967: 57).[9]
     There are three problems with the Complete Fronting scenario. First, there is no independent evidence for fronted [æ] in contexts where it did not later merge with /ɛ/; closed Á is distinct in fate from open Á. Second, this approach assumes a skewed vowel inventory where the only low vowel that exists is front. Such an inventory is not impossible, but it is highly marked (cf. Maddieson 1984). Third and most importantly, Complete Fronting cannot account for the assonance classes of Old French in (14) without assuming either contrastive length or five front vowels: /i, e, ɛ, æ$_1$, æ$_2$/.[10] In the absence of persuasive evidence for fronting and then backing of /a/, and in the face of these problems, I assume the null hypothesis: this reflex [a] remained faithful to Proto-Romance.

4.3. Allophonic Fronting

Finally, under Scenario III, there was allophonic fronting of Á in open but not closed syllables. Specifically, the low vowel /a/ had two allophones, front [æ] and central [a]. While these sounds split into separate phonemes by the time of Old French, in Gallo-Roman the syllable structure allows predictable allophones. The intepretation of the Second Palatalization then has two distinct parts. First, palatalization of /ki, ke, kɛ/ was always phonetically conditioned, but for /ka/ the expected environment was found only in stressed open syllables, where the phoneme /a/ was realized phonetically as lengthened [æ:]. Second, phonologization of the rule led to its application before all tokens of the phoneme /a/, whether fronted or not.
     This position is necessary if we accept two assumptions, motivated above. First, fronting of Á[was a precondition for its participation in palatalization of /k, g/. (This position is shared by Scenario II.) Second, other tokens of A were not fronted, but rather remained [a]. (This position is more or less shared by Scenario I.) Given speakers' knowledge that [æ] was just a variant of the category /a/, the process was extended to all variants of /a/, including those that were not fronted. In other words, once the phonetic fact of palatal coarticulation in [k^{j}æ] had been phonologized as a rule of velar fronting, it was susceptible to the abstract connection between the fronted allophone [æ] and the non-fronted [a], both variants of the phoneme /a/.
     This explanation relies on a clear distinction between the phonetic origin of a sound change — in this case the coarticulatory effect between the fronted vowel and a fronted velar consonant — and the abstract phonological structure of the grammar that is created by the learner. Possibly this generalization was supported by the fact that for the nonlow front vowels /i, e, ɛ/ every allophone

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[9] Pope (1934: 90) assumes fronting of all A's as well, but from a poorly motivated Proto-Romance back /ɑ/ (p. 74) to arrive at a vowel like the modern central /a/. It is this central vowel, called "front" and "palatal" (p. 127), that for her triggered palatalization of /k, g/. For Pope, true fronting of Á[to /e:/ was subsequent to palatalization (p. 106), thus similar to Scenario I.
[10] Matte's specific approach seems to neglect the assonance facts entirely, since he represents words from different classes with /ɛ/ at this time period, e.g. *apporter* from Proto-Romance /a/ and *belle* from /ɛ/. An alternative is almost immediate re-centralization of phonetically short /a/ in Gallo-Roman.

was a front vowel, i.e. these phonemes consistently triggered the rule without any kind of phono-
logical extension; and thus the palatalization rule was seen as applying at the level of phonemes,
making more general /a/ rather than more limited [æ:] the relevant undergoer.

5. Conclusion

Because the stages of this change are lost in time, with no meaningful attestation of the vernacular in
the Gallo-Roman period, we may never know exactly what happened. I have argued for a particular
view of the change that respects usual patterns of velar palatalization, but also requires us to posit an
extension based not on phonetics but on the phonological structure of the language.

    Support for this view will come not from additional data regarding Gallo-Roman (an
impossibility) but rather from a better understanding of the mechanism of sound change in general.
Are better-documented historical changes amenable to a similar explanation? Can we find a similar
extension in work on sound change in progress? Is the nature of the change a matter of
phonological overgeneralization in the course of language acquisition?

    The present analysis of the Second Palatalization, if correct, helps us tease apart the respective
contributions of articulation and cognition to the course of language change. Phonetic co-
articulation created the original alternation between [k] and [kʲ], while phonological categorization
enabled the extension from the sound context [æ] to [a] within the mental construct /a/. Notably,
this extension was unimpeded by the lack of phonetic motivation for the change in the new
environment, emphasizing the abstract nature of the cognitive system of language.

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