Phonological change and grammaticalization in HPSG: The case of French final consonants

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Abstract

This paper explores the use of HPSG for modeling historical phonological change and grammaticalization, focusing on the evolution of the pronunciation of word-final consonants in Modern French. The diachronic evidence is presented in detail, and interpreted as two main transitions, first from Old French to Middle French, then from Middle French to the modern language. The data show how the loss of final consonants, originally a phonological development in Middle French, gave rise to the grammaticalized external sandhi phenomenon known as consonant liaison in modern French. The stages of development are analyzed formally as a succession of HPSG lexical schemas in which phonological representations are determined by reference to the immediately following phonological context.

1 Introduction

The prevalence of silent final consonants is a striking feature of French orthography. Even English speakers with no direct knowledge of French may be aware of this, if they know the approximate spelling and pronunciation of familiar loan words such as those in (1a). On the other hand, the equally familiar examples in (1b) show that final consonants are pronounced in some French words.

(1) a. s'il vous plaît [si(l)vuplɛ], merci beaucoup [mɛʁsibokᴜ], rendez-vous [ʁɑ̃devu], faux pas [fopɑ], coup d'état [kudeta]

b. cul-de-sac [sak], bonjour [bɔ̃ʒuʁ], apéritif [apeʁitif], Noël [nɔɛl]

As we will see in more detail below, the final consonants in all of these words correspond to sounds that were pronounced in older stages of French, but were then subject to a process of deletion that targeted different consonants and different series of words to varying degrees. The resulting distribution of pronounced vs. silent consonants was further complicated by normative pressure and orthographic influences ("spelling pronunciation"), as well as analogical tendencies, with significant but haphazard effects.

The preservation of silent final consonants in French orthography is thus motivated by historical considerations, and enforces distinctions in writing that are no longer made in speech. For instance, the singular and plural nouns in (2a) and the verb forms in (2b) all share the same pronunciation:

(2) a. cou/cous "neck(s)", coup/coups "strike(s)", coût/coûts "cost(s)" [ku]

b. couds/coud [ku] (from *coudre* "sew")

More significantly, the consonants in question may be silent in some contexts but pronounced in others, giving rise to synchronically active ∅∼C alternations. First, the addition of a (vowel-initial) inflectional or derivational suffix can "reactivate"

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the stem-final consonant. For example, the masculine singular adjective *bourgeois* is pronounced [buʁʒwa], but the feminine *bourgeoise* [buʁʒwaz] and the derived form *bourgeoisie* [buʁʒwazi] both contain a pronounced intervocalic "s" (realized as [z]). Further examples of this morphological alternation are shown in (3):

(3) découpage [dekupaʒ] *vs.* coup [ku]
débutante [debytãt] *vs.* début [deby]

Similarly, and most importantly for our purposes, a normally silent final consonant may be pronounced in connected speech when followed immediately by a vowel-initial word. This ∅∼C alternation is a well-known feature of French pronunciation known as "consonant liaison". The examples in (4) are all plural NPs in which both words carry the plural marker "s", which as illustrated in (2a) above is normally silent. However, because the second word in (4a) begins with a vowel, the liaison consonant [z] appears as a contextually-licensed phonological realization of plural marking. This [z] cannot appear in (4b), where the second word is consonant-initial.

(4) a. Champs-Élysées [ʃãzelize], États-Unis [etazyni]
b. champs fleuris [ʃãfløʁi] ("flowery fields"),
États Généraux [etaʒeneʁo] ("Estates-General")

Further examples of liaison in [z] can be found in the expressions *Beaux-Arts* [bozaʁ] and *vis-à-vis* [vizavi]. Other frequently occurring liaison consonants are [t] (*prêt-à-porter* [pʁɛtapɔʁte]) and [n] (*bon appétit* [bɔnapeti], vs *bon voyage* [bɔ̃vwajaʒ]).

The analysis of consonant liaison has been the subject of active debate, particularly in generative phonology. An early approach assumed underlying phonemic forms containing a final consonant, which was then deleted in the appropriate contexts — i.e., before another consonant or before a prosodic boundary — by a "truncation" rule (Schane, 1968). The data above can be dealt with using such a rule, which broadly speaking reproduces the historical evolution responsible for the modern forms. But not all cases of liaison can be adequately analyzed in terms of truncation, and more concrete approaches assuming representations closer to the surface forms can be shown to provide a more complete account of the data. The analyses proposed in the HPSG literature naturally tend to follow this surface-oriented, non-transformational approach. See for example Bonami and Boyé (2003) for the morphophonology of prenominal adjectives and Bonami et al. (2004) for the interaction of syntactic and phonological constraints in liaison.

From a diachronic perspective, however, the abstract representations and operations considered in more recent work to be unnecessary and unmotivated for synchronic analysis become the principal objects of study, corresponding to historically attested or reconstructed forms and their evolution over time. Analyses of language change are thus surface-oriented and transformational at the same time.

The hypothesis adopted in this paper is that while the grammar of a language can change radically within the space of a few generations, this global change is

the sum of smaller, individual changes that can be modeled in terms of successive, overlapping alternative grammars corresponding to periods of variation (i.e. coexisting, competing analyses) eventually leading to reanalysis.[1]

2 Early developments

The sound changes that led to the development of French from Vulgar Latin have been extensively studied and are relatively well established, although authors often disagree on points of detail and chronology.[2] The loss of final consonants mentioned in the previous section as the source of consonant liaison began at the end of the Old French[3] period (from the 13th century onwards), but a number of changes from earlier periods are also relevant, and will be outlined here.

A major difference between Latin and French is the position of word stress. Polysyllabic words in Latin were stressed on the penultimate or antepenultimate syllable, while in French word stress falls on the final full syllable. This difference is not the result of massive stress shifts in French. In most words, the stress remained on the same syllable, but all following syllables at the end of the word were systematically reduced.

Already in Vulgar Latin, the antepenultimate stress pattern was largely eliminated by deletion of the post-tonic vowel. Later (but still in the pre-literary period of Gallo-Romance) final syllables were reduced: *a* was weakened to become the central vowel *ẹ* (the precusor of modern "mute *e*"), while most other vowels were deleted altogether.

(5) a. tábula > tábla > tábl̥e "table"
b. cólapu(m) > cólpo > colp "strike"

Final consonants (other than *m*) were preserved and did not stand in the way of the reduction/loss of final vowels:

(6) a. béllas > bél̥es "beautiful-*fpl*", béllos > bels "beautiful-*mpl*"
b. pórtat > pórt̥et "[he] carries", ténet > tient "[he] holds"

Vowel deletion created many new final consonants and consonant clusters. These underwent devoicing (in the case of the obstruents *d*, *θ*, *v*, *z* > *t*, *θ*, *f*, *s*), and most clusters of three consonants were simplified by deleting the second element.

(7) a. novu(m) > neuf "new", grande(m) > grand > grant "large"
b. cólapos > colps > cols "strikes", témpus > temps > tens "time"

[1] Cf. the approach to grammaticalization of Harris and Campbell 1995. For an earlier approach to formalizing reanalysis in HPSG to model syntactic change, see Bender and Flickinger (1999)).

[2] See e.g. Bourciez and Bourciez (1967); Fouché (1961); Zink (1986).

[3] The following abbreviations and approximate chronology are adopted in this paper: Old French "OFr" (10th–13th cent.), Middle French "MidFr" (14th–16th cent.), Modern French "ModFr" (17th cent. to present day).

These changes bring us to the period of the earliest surviving OFr literary texts (11th century). From this point on, we have textual evidence of the effects of sound changes in progress, keeping in mind that written forms are only an indirect representation of contemporary pronunciation.

The erosion of final consonant clusters continued, extending to sequences of two consonants. Various changes affected the first consonant in such clusters: vocalization of *l* to *u*, deletion of obstruents, but preservation of *r* and *n*. The second consonant was usually maintained. One effect of this change was that stem consonants were frequently deleted in favor of inflectional suffixes (*s* or *t*).

(8) a. vívere > vivre̥ "to live", vívo > vif "[I] live"
vs. vívit > vift > vit "[he] lives"

b. colp > coup "strike" *vs.* col(p)s > cous "strikes"
sáccu(m) > sac "sack" *vs.* sáccos > sacs > sas "sacks"

This had particularly significant consequences for nominal morphology, because the stem allomorphy in words like (8b) helped trigger a change in the status of the final stem consonant (see §4.2).

Single final consonants were maintained through the end of the OFr period, with one exception: *θ*. In most cases this consonant developed from an intervocalic *t* or *d* in Latin, which became word-final after the deletion of final vowels. The sound weakened and fell silent by the end of the 11th century:

(9) a. marítu(m) > mariθ > mari "husband"
nepóte(m) > neveuθ > neveu "nephew"

b. fíde(m) > feiθ > foi "faith"
mercéde(m) > merceiθ > merci "mercy"

Another important source of *θ* was the 3sg verb ending *-t*, which already showed signs of weakness in Vulgar Latin. Following the loss of final vowels in Gallo-Romance, this *t* was reinforced if it came into contact with another consonant. In such cases, *t* was maintained (10a), even if the reinforcing consonant was subsequently lost through cluster simplification. Following a vowel, on the other hand, *t* > *θ* was lost at the same time as the cases in (9).

(10) a. dórmit > dormt > dort "[he] sleeps",
présit > prist > prit "[he] took"

b. pórtat > pórte̥θ > pórte̥ "[he] carries"
dormí(vi)t > dormíθ > dormí "[he] slept"

The earliest OFr texts still contain written forms with final "t/d" (e.g. Paris and Pannier, 1872, pp. 97–99), but these letters rapidly disappeared from the orthography, except in exceptional cases like *et* "and". This consonant left no phonological traces in later stages of French. It should be mentioned, however, that orthographic "t" was later reintroduced analogically in some 3rd person verbs like *dormit* "[he]

slept" and *fut* "[he] was", which then rejoined forms like (10a) where *t* had always been preserved.[4]

3 Middle French

In the second half of the 12th century, a new wave of deletions began, affecting all remaining final consonants. The process was a very gradual one, however, continuing through MidFr and beyond. For various reasons, these changes in pronunciation did not generally lead to stable orthographic changes. The relatively phonetic spelling of the 12th century began to lag behind the evolution of the language, and silent letters became an increasingly pervasive feature of French orthography.

3.1 Texts and evidence

The texts of this period do offer occasional indications of consonant loss, including the simple omission of the relevant letters (*troi* instead of *trois* "three", *naturé* instead of *naturel* "natural") or the substitution of non-etymological — presumably also silent — consonants (*coureux* for *coureur* "runner", *sant* for *sang* "blood").[5] Poetry is a particularly rich source of evidence, because the loss of final consonants made available many new pairs of rhyming words: *vert*:*vers*, *rechief*:*bouclier*.[6] But given the conservative nature of poetic pronunciation, such rhymes only became accepted long after the loss of the consonants in popular speech. Furthermore, the ends of verses constitute a highly specific prosodic context where words were not necessarily pronounced as they would have been in connected speech.

Contemporary metalinguistic descriptions confirm, in fact, that the pronunciation of final consonants varied according to the immediately following context. The practice of pronouncing the same written word in distinct ways depending on what follows, which as we saw in §1 is so characteristic of ModFr, was already in place, in some form, by the 13th century. One of the rare linguistic texts from this period, the *Orthographia Gallica*, contains the following rule: "Whenever a word beginning with a consonant follows a word ending in a consonant, the consonant of the preceding word must not be pronounced, even though it is written, for example *apres manger* must be pronounced *apre manger*."[7]

The available evidence points to a weakening of word boundaries in late OFr, such that a -C#C- boundary came to be treated like a medial consonant cluster, and thus subject to various simplification processes that had already left their mark within words in OFr. In general, the first consonant in such sequences was deleted, but different combinations were presumably affected at different times, and to varying degrees. One would expect, for instance, for final obstruents to have survived

[4]For the history of the analogical epenthetic *t* in inversion constructions like *Porte-t-il ?* "Does he carry?", see Tseng (2008).

[5]Fouché (1961, p. 663, 783), Brunot (1966, p. 430)

[6]Fouché (1961, p. 664, 783)

[7]Translation of Rule VIII, Stürzinger (1884, p. 17–18).

longer before words starting with "r" or "l", cf. the hypothetical example *petit rost* "small roast" of Morin (1986), in which the [t] should have been temporarily protected from deletion as part of the resyllabified complex onset [tr]. Unfortunately, the texts of this period do not allow us to reconstruct the progression of the sound changes to this level of detail, and by the end of MidFr, all consonant initial words constituted triggers for deletion of a preceding final consonant. Here are some examples from the earliest recognized grammars of French, dating from the mid-16th century (Thurot, 1883):

(11) a. sans cause, soubz couleur, ung combat tel, faictz plaisans, suis sayn
san cause, sou couleur, un comba tel, fai plaisans, sui sayn
"without cause, under color, such a combat, pleasant facts, [I] am healthy" (Palsgrave, 1530)

b. Les femmes sont bonnes "The women are good"
Lé femme son bones (Sylvius, 1531)

Not all final consonants were affected uniformly by this process. According to Palsgrave, *m*, *n*, and *r* were not deleted in preconsonantal contexts; the same three exceptions were already mentioned in the *Orthographica Gallica*. Other grammarians of Palsgrave's time say that final *r* was in fact deleted, at least in some words, such as infinitives in *-er*. On the other hand, they recommend the pronunciation of many consonants that Palsgrave says are silent (in particular *f*, *l*, and *c/q*). Upon closer examination, the increasingly abundant phonetic descriptions of this period (16th–17th cent.) contain many contradictory details, reflecting the different authors' individual opinions about a system that contained areas of instability and variation, for reasons that will be discussed in the following sections.

Before a vowel-initial word, consonants were preserved, as the weakening of the word boundary -C#V- led to the resyllabification of the consonant from coda to onset position. The fricatives [s] (written "s/x/z") and [f], which after the final cluster simplifications described in §2 occurred only after vowels or the sonorants *r/n*, underwent voicing to [z] and [v], respectively, in words like *cors* "body" and *vif* "alive". Final stops were not affected in this way, so for example final "t/d" retained the unvoiced pronunciation [t] before a vowel in words like *tout* "all" and *quand* "when". (With only minor modifications, this is still how liaison consonants are pronounced in ModFr.)

The following examples from Saint-Lien (1580) illustrate the preservation of final consonants in pre-vocalic contexts, which is obviously the origin of consonant liaison in ModFr (Thurot, 1883):[8]

(12) a. tout ainsi que tu fais aux autres "just as you do unto others"
tou tin si ke tu fai zau zautres

b. vous estes un homme de bien "you are a good man"
vou zeste zun nome de bien

[8] See also Livet (1859, p. 508).

The early grammarians mention isolated exceptions to this rule concerning pre-vocalic contexts. For example, as mentioned at the end of §2, the final "t" of *et* "and" was purely orthographic, and was never pronounced, even before a vowel. Such cases rapidly multiplied in ModFr, as the status of final consonants evolved.

Finally, we need consider the pronunciation of final consonants with no immediately following word. Given the hypothesis that the changes described above resulted from the weakening of word boundaries at the end of the OFr period, final consonants should not have been affected in these "pre-pausal" contexts. One manuscript of the *Orthographia Gallica* seems to confirm this: "But at the ends of sentences or in the middle of a sentence at a pause, [consonants] can be pronounced".[9] The grammarians of the 16th century maintained this general rule, as we can see from the ends of the examples in (11–12), but with many exceptions. For Palsgrave, for example, final *m*, *n*, *r*, and *s/x/z* were distinctly pronounced, but *c*, *f*, *l*, *p*, and *t* were "but remissely sounded" (13a). On the other ahnd, final *t* and *p* following *a/e* retained their full sound (13b).

(13) a. auec, soyf, fil, beaucoup, mot
aue, soy, fi, beaucou, mo
"with, thirst, thread, much, word"

b. chat, debat, ducat, combat, hanap, duvet, regret, entremet "dessert"

Again, there was much disagreement from author to author concerning individual words or series of words. The overall tendency in the transition to ModFr was for more and more final consonants to fall silent in pre-pausal contexts.

3.2 Summary of sound changes

The rather jumbled picture that the early grammars present is the product of new forces that were partially dismantling the phonetic changes of the preceding period. To summarize the earlier changes, recall that in OFr period, the erosion of final unstressed syllables created a rich inventory of final consonants, and consonant-final words had the same pronunciation in all syntactic/prosodic contexts. The MidFr sound changes described in the previous section affected final consonants according to the immediately following phonological context:

(14) a. Final consonants were lost before a following consonant-initial word.

b. Final consonants were preserved before a following vowel-initial word, with voicing of [s] (and [f]).

c. Final consonants were preserved before a pause.

This purely phonological formulation is an idealization that ignores syntactic and lexical conditions that are likely to have existed, but for which we have insufficient evidence. The process eventually extended to all consonants, but some words were affected much later than others, in particular several series of words ending in *r*,

[9] Translation of H79, Stürzinger (1884, p. 18).

l, and *f* (Fouché, 1961, p. 669–70). The process lost steam and gave way to other developments towards the end of the MidFr period (that is, before the 16th century and the publication of the first grammars).

After the application of (refconx), some words still had a single, context-independent pronunciation, e.g. those ending in a full vowel. But consonant-final words developed two distinct pronunciations: a long form, corresponding to the original, historical pronunciation and used in pre-pausal and pre-V contexts, and a short form, derived from the long form by truncation and used only in pre-C contexts. Words originally ending in [s], and some ending in [f], developed a distinct pre-V long form in [z]/[v], so three contextually-determined forms in all.

4 Modern French

In this section we trace the development of the ModFr pronunciation of final consonants as the new changes already visible in the grammatical descriptions of the 16th century took hold. The effects of these changes, which were not purely phonological in nature and were highly unpredictable, led to major changes in the inventory and distribution of contextually alternating forms.

4.1 From Middle French to Modern French

While the roots of ModFr consonant liaison are already clearly visible in the idealized system described in §3.2, the pronunciation of this stage differed from the ModFr system in several respects.

First, many words no longer have distinct contextual forms in ModFr. For example, the noun *coup* "strike" now always has a silent consonant, while the preposition *avec* "with" always has a pronounced final [k]. Second, for words that do still have distinct forms, their distribution is no longer determined exclusively by the following phonological context. In particular, the short form, originally restricted to pre-C contexts, is now often found before vowels, for example in cases of unrealized optional liaison (*toujours ici* "still here" [tuʒuʁisi]).

Finally, the pre-pausal context in ModFr has realigned with the pre-C context. This means, significantly, that the short form has become the form of the word used in isolation, i.e. the citation form. While the citation form does not necessarily reveal the basic or "underlying" phonological form, it does represent the core phonological content of the word, perceived by speakers as sufficient for its identification. As an example, the phonological form [boku] is recognized as the word *beaucoup* in ModFr, while [bokup] is a contextually restricted form that cannot be uttered in isolation. The situation at the end of MidFr, after the application of the changes in (14), was the opposite: the short form [boku] would have been unacceptable out of context, because the citation form of the word was [bokup].

The usage described in 16th century grammars does not exactly reflect the results of the MidFr sound changes in (14); the effects of further developments can

already be observed at this time. Recall from (13), for example, that for Palsgrave, many final consonants were silent before a pause. The following transcription by H. Estienne (1582) gives an example of late MidFr pronunciation (Livet, 1859, p. 381–82):

(15) Vous me dites tousiours que vostre pays est plus grand de beaucoup et
Vou me dite touiours que votre pays est[?] plu gran de beaucoup e
plus abondant que le nostre, et que maintenant vous pourriez bien y viure
plus abondan que le notre, e que maintenan vou pourrie bien y viure
à meilleur marché que nous ne viuons depuis trois mois en ceste ville :
à meilleur marché que nou ne viuon depui troi mois en cete ville :
mais tous ceux qui en viennent parlent bien vn autre langage
mai tou ceux qui en viennet parlet bien vn autre langage
"You always tell me that your country is much larger and more abundant than ours, and that now you could live well there, more cheaply than we have been living for three months in this city: but all those who come from there speak another language"

Etienne's transcription is mostly consistent with the effects of the MidFr sound changes, keeping in mind that he does not indicate voicing alternations, and that it is not possible to distinguish pronounced and unpronounced nasals using his naive notation.

The final consonant is pronounced in *tousiours*, *ceux*, and *viennent*, although they are followed by consonants. These are not exceptions to truncation (14a), but instances of pre-pausal pronunciation (14c), reflecting the presence of prosodic boundaries before sentential complements and around relative clauses. Estienne explains that these consonants could be dropped in rapid speech. They must be dropped in ModFr.

The pronounced final consonants in *meilleur* and *parlent* do constitute exceptions to (14a). As mentioned above, words ending in *r* were among the last to be affected by truncation, and thus among the first to respond to normative and analogical influences working to revert the change. The [r] of *meilleur* was restored in pre-C contexts before the end of MidFr, and survived in ModFr. The pre-C pronunciation of *t* in *parlent* was also a normative reaction, to prevent the merger of singular and plural 3rd person verb forms. This pronunciation, unlike the previous one, was not adopted in ModFr. Note finally that if Etienne's transcription of *est* with two pronounced final consonants in pre-C context is accurate, it represents a completely artificial spelling pronunciation, recommended to my knowledge by no other grammarians, and totally abandoned in ModFr.

The transcribed passage contains no exceptions to the rule requiring the pronunciation of consonants in pre-V contexts (14b). We can see that liaison was more systematic at this stage, realized whenever the phonological context allowed it, for example in the sequences *pays est*, *beaucoup et*, and *mois en*. This pronunciation is no longer posible today, because ModFr imposes additional syntactic constraints

on liaison (e.g., no liaison between subject and verb, no liaison after a prepositional phrase).

4.2 Contextual alternations in Modern French

This section examines in more detail the various ways in which contextually alternating forms were reorganized and reanalyzed in ModFr.

We have seen that the pronunciation of words like *toujours* and *beaucoup* before a pause changed in early ModFr, from the long forms [tujuʁs] and [bokup] to the short forms [tujuʁ] and [boku]. This could be seen as an extension of the MidFr sound change, with final consonant truncation spreading from pre-C to pre-pausal contexts. This cannot be the only explanation, however, for a number of reasons. First, contemporary descriptions do not document a process of gradual phonetic loss. It is true that, immediately after providing the transcriptions in (13a), Palsgrave writes, "how be it, the consonant shall have some lyttell sounde" (ch. 27). Similar recommendations continue into the 17th century: "Il ne faut pas la prononser trop distinctemant" (Dobert, 1650). It is unclear, however, just what the phonetic interpretation of such remarks should be. Other authors explicitly recognize the co-existence of two competing pronunciations, one with and one without the final consonant: "cette lettre [*p*] est indifferente... quelques personnes font cette lettre muëtte, mais il vaut mieux la prononcer" (De la Touche, 1696).[10] The change evidently involved two overlapping usages, one of which eventually replaced the other, and not a progressive phonetic erosion (e.g. [p] > [ɸ] > ∅).

A second argument against treating pre-pausal "truncation" as a sound change is that it did not apply systematically. Although many words lost their final consonant pre-pausally, many others retained, or even regained theirs. As one illustration of this, three of Palsgrave's examples in (13a) now have pronounced final consonants: *avec*, *soif*, *fil*. And finally, it seems unlikely that pre-pausal truncation (when it occurred) could be an extension of pre-C truncation, since this last process was no longer productive at this stage; we observe no new deletions after the 16th century, and in fact, final consonants were reappearing for many words in pre-C contexts. An important factor here is the adoption of large numbers of Latinate borrowings in the learned usage of this period. These words reintroduced many consonantal sequences that had disappeared from the inherited lexicon, and undermined the phonotactic pressures that once motivated (14a).

We can conclude that the changes affecting the pronunciation of final consonants in ModFr were therefore not primarily phonological. They were instead guided by functional pressures (the tendency to neutralize unnecessary distinctions) and, to a surprising extent, normative influence. The contextual alternation of word forms introduced in MidFr was a costly complication in the grammar. It may have eased pronunciation, but it offered absolutely no other functional advantages. On the contrary, stem consonants and inflectional suffixes were deleted in a

[10] Cited by Thurot (1883).

significant proportion of word tokens.[11] The language compensated by developing other strategies, such as making determiners and subject pronouns obligatory, giving rise in the end to a system where for the most part speakers could simply do without the information so unreliably encoded by final consonants.

It would have made sense, given these circumstances, for contextual alternations to be eliminated altogether. This is in fact what happened for many words, in particular for the entire class of singular nouns (outside of fixed expressions). We have already seen, for example, that pre-C truncation came relatively late for many words ending in *r/l/f* (e.g. *trésor*, *calcul*, *relief*), and that normative forces were often successful in reversing its effects (Fouché, 1961, p. 669–70). The final consonant was also restored in many monosyllables, e.g. *duc*, *cap*, *chef*. This tendency is partly explained by functional considerations: a final consonant represents a major portion of the phonological content of a monosyllable, and without it, many words become homophonous and therefore ambiguous.

The question is, then, why final consonants were not restored more systematically, since there would always be some functional advantage to be gained. Moreover, since the final consonant was still pronounced in pre-V and pre-pausal contexts, its "restoration" was a simple matter of generalizing the form used in these contexts to pre-C contexts. (This process was obviously an analogical change, not a sound change.) The fact is, however, that most nouns did not follow this path: instead, contextual alternation was eliminated by deleting the final consonant across the board.

This was a process that had already started in OFr: recall from §2 that nouns regularly lost their final consonant in the plural, through cluster simplification (8). The presence of the plural marker [s] presumably served as a clue to the listener that a consonant might be missing, and moreover this consonant was still systematically pronounced in the singular. But this alternation meant that the final consonant was no longer absolutely necessary for recognizing the word. When the MidFr sound changes applied, the stem-final consonant disappeared even from the singular form, in pre-C contexts, and the status of this consonant as part of the phonological identity of the word was further weakened. It was still pronounced in pre-pausal and pre-V contexts in the singular, but for many nouns, this proved to be insufficient motivation for maintaining the original form of the noun.

Polysyllabic nouns generally had a rich enough phonological content to do without one consonant: *appétit*, *estomac*. And though monosyllabic nouns showed more resistance, as explained above, in many cases they too lost their final consonant. For example, for nouns like *drap* "sheet" or *clef* "key", which appeared more frequently in the plural, or *coup*, which occurred frequently in phrases of the form *coup de*, usage favored forms with a silent final stem consonant (Fouché, 1961, p. 676–77). In such cases, the consonant disappeared completely, eliminating contextual alternation in favor of a single, truncated form. Again, this was a case of form

[11] To take one example, at least one out of three occurrences of the nominal case and number marker *s* became silent, according to Zink (1989, p. 36).

replacement, not a phonological process of truncation: the pattern for these nouns was for the pre-C form to generalize to pre-pausal contexts, and then later to pre-V liaison contexts.

The phonological identity of singular common nouns thus changed in one of two ways, depending on whether the historical final consonant was lost everywhere, including pre-V and pre-pausal contexts, as in the case of *clef* (now also written "*clé*") or restored everywhere, including pre-C contexts, as in *chef*. Recall from (14b) that final *s/f* were originally pronounced [z]/[v] in pre-V contexts. Nouns where final *s/f* were restored as non-alternating final consonants eventually stopped undergoing voicing, and presented a single phonological form in all contexts: e.g. *bœuf* "bull" is now pronounced invariably with an [f], but in early ModFr we find transcriptions like *le beuv et la vache* "the bull and the cow" (Raillet, 1664) and *du beu và la mode* "dish of braised beef" (De la Touche, 1696).

For other classes of words, contextual distinctions were not completely neutralized; these are the words that participate in consonant liaison in ModFr. The majority of these words are inflected forms (e.g. plural nouns and adjectives, conjugated verbs), which means that the final consonant corresponds to a grammatical ending (or part of it) and is not part of the stem. This explains why the pronunciation of these words developed more or less uniformly, without the haphazard lexical variation that we just observed for singular nouns. Furthermore, the only consonants involved here are [z] and [t].

The fact that inflectional suffixes encode morphosyntactic information may explain why these consonants were not lost altogether, and the fact that this information is often redundantly encoded in more than one place in the sentence may explain why they were not restored across the board. Instead, ModFr has simply retained a version of the MidFr system, with a prononced final consonant in certain contexts, and a silent consonant elsewhere. But compared to MidFr, the contexts where the final consonant is pronounced have been reduced severely: it now only occurs in some pre-V contexts, and not at all before a pause.

Before exploring the reasons for this development, let us mention the other classes of words that have maintained contextual forms in ModFr. These include closed-class items (pronouns, determiners, conjunctions), but also many content words (prepositions, adjectives, adverbs). In these cases, the final consonant can be part of the root or a derivational suffix, like *-eux* or *-ment*. It is not surprising to find, within these same word classes, examples of words where the final consonant was fully restored in all contexts, e.g. *il* "he", *leur* "their", *bref* "brief" (often involving the final consonants *r/l/f*, as we see here). There are extremely few cases of across-the-board generalization of the truncated form (possible examples include *hors* "outside", *bientôt* "soon"), because the proclitic nature of most of the members of these classes ensured the survival of liaison in pre-V contexts. In the case of adjectives, the liaison consonant was also preserved by analogy with the feminine forms: e.g. *petit/petite* "small", *premier/première* "first".

Just as for the inflected forms in [t] and [z], the final consonants of these other alternating words are no longer pronounced in ModFr before a pause (or in isola-

tion). As explained above for singular nouns (which have basically followed the same evolution, taken one step further), the prevalence of truncated forms in MidFr diminished the role of final consonants, and the core phonological identity of these words was eventually "updated" to reflect this. Another way to view this shift is to say that in MidFr, the unmarked form of a word was its long form, and the truncated form had to be licensed by a special context (pre-C). Once the language adapted to rely less on the presence of the final consonant, the the truncated form was able to take over as the unmarked form, and gradually spread analogically to pre-pausal contexts. For many words, both forms existed as stylistic variants in this context until the end of the 17th century (recall the quotations at the beginning of this section). The short form eventually won out, and the realization of the final consonant became restricted to an ever smaller set of pre-V liaison contexts. In current French, competition between long and short forms can be observed in many pre-V contexts (the phenomenon of optional liaison).

It should be mentioned, finally, that a few words in ModFr seem to preserve the MidFr distribution of contextual forms, with a truncated form in pre-C contexts but not in pre-pausal contexts:

(16) a. *huit femmes* [ɥifam] '8 women', *huit hommes* [ɥitɔm] '8 men', *il y en a huit* [ɥit] 'there are 8'

b. *dix femmes* [difam] '10 women', *dix hommes* [dizɔm] '10 men', *il y en a dix* [dis] 'there are 10'

These words (which will not be included in the formal analysis of the following section) can be considered to be remnants of the MidFr system. Because of their frequency, and the types of constrcuctions in which they appear, they have managed to avoid the more dominant paths of development described above. These words exhibit a good deal of instability, in part as a result of pressure from the more prevalent pattern, but we cannot conclude that they consitute a completely non-productive class.

5 HPSG formalization

The foregoing discussion described two transitions in the evolution of French final consonants: the sound change introducing contextual forms in MidFr, and different paths of simplification and reanalysis of the contextual alternation in ModFr.

5.1 Phonological context

The changes in question involve the phonological content of word forms, but they are conditioned by the properties of the surrounding context. One way of handling this kind of phono-syntactic interaction is to enrich lexical representations with information about the phonology of adjacent elements. I adopt a variant of the PHON-CONTEXT model of Asudeh and Klein (2002), which defines the following constraint on phrasal constructions:

(17) *construction* →

$$\left[\text{DTRS} \left\langle \left[\text{PHON} \mid \text{P-CTXT} \quad \boxed{1}\right], \boxed{1}\left[\text{PHON} \mid \text{P-CTXT} \quad \boxed{2}\right], \ldots, \boxed{n}\left[\text{PHON} \mid \text{P-CTXT} \quad \textit{p-ctxt}\right] \right\rangle\right]$$

Each daughter in the construction is given full access to the *sign* of the immediately following daughter. It is clear that this formulation is too unconstrained; exactly how much contextual information should be made visible in this way is an open empirical question. In the following analysis, alternating words only need to refer to the first segment of the phonology of the immediately following word (and to one more abstract feature, to be introduced below). Also note that, unlike Asudeh and Klein, I do not a *nil* context for the last daughter in (17). This value needs to be left underspecified, in case the construction is embedded with a larger construction,[12] or instantiated as *nil* by a root utterance constraint.

5.2 Introduction of contextual forms

We being by sketching an analysis of the OFr system, the starting point for the transition summarized in §3.2. At this stage, consonant-final words showed no contextual alternation at syntactic word boundaries. In other words, an OFr word can be assigned a lexical entry with a simple PHON value, encoding the unitary pronunciation of the word in all contexts, and making no use of the P-CTXT apparatus just introduced. Phonological processes active at this time (final devoicing, final cluster simplification) did give rise to alternations between forms of the same lexeme (masculine vs. feminine, singular vs. plural), which later became grammaticalized as instances of paradigmatic stem allopmorphy, for example *vif*/*vive* "alive", *coup*/*cous* "strike(s)", cf. the examples in (8). The significance of this development was discussed in §4.2, but its formal analysis is not directly relevant for our purposes, since it involves relations between the lexical entries of distinct inflected word forms.

The sound changes in (14) introduce contextual alternations in the pronunciation of a single word. This development can be modeled by assigning consonant-final words lexical entries with complex PHON specifications, with disjunctive clauses corresponding to the phonological contexts giving rise to form alternation.

(18)
$$\left[\text{PHON} \begin{array}{l} \left[\begin{array}{ll}\text{SEGS} & \boxed{1}\\ \text{P-CTXT} & \textit{nil}\end{array}\right] \vee \left[\begin{array}{ll}\text{SEGS} & \textsf{s-z}(\boxed{1})\\ \text{P-CTXT} & \left[\text{SEGS} \quad \left\langle \textit{vow}, \ldots \right\rangle\right]\end{array}\right] \\ \qquad \vee \left[\begin{array}{ll}\text{SEGS} & \textsf{trunc}(\boxed{1})\\ \text{P-CTXT} & \left[\text{SEGS} \quad \left\langle \textit{cons}, \ldots \right\rangle\right]\end{array}\right] \end{array}\right]$$

[12] In fact the rightmost daughter should structure-share its P-CTXT with the mother construction, so that contextual information can be passed down through levels of syntactic embedding to the relevant lexical element.

In this analysis, the pre-pausal form (encoded by the first disjunct, specifying a null P-CTXT) is taken as the basic form, corresponding to the historically original form, inherited from OFr. The pre-V form is identical except that final [s] and [f] undergo voicing; this is indicated by the phonological function s-z applied to the basic form $\boxed{1}$. The pre-C form is derived by truncation of the final consonant of the basic form.

The adverb *toujours*, for instance, has the PHON value shown in (19a), with three distinct pronunciations, while *beaucoup* has just two (19b), because [p] is not affected by s-z. (I assume modern phonetic values for vowels and consonants elsewhere in the word, for expository purposes.)

(19) a.
$$\begin{bmatrix} \text{SEGS} & \boxed{1}\langle \text{t,u,ʒ,u,ʁ,s} \rangle \\ \text{P-CTXT} & \textit{nil} \end{bmatrix} \vee \begin{bmatrix} \text{SEGS} & \textsf{s-z}(\boxed{1}) = \langle \text{t,u,ʒ,u,ʁ,z} \rangle \\ \text{P-CTXT} & \begin{bmatrix} \text{SEGS} & \langle \textit{vow},\ldots \rangle \end{bmatrix} \end{bmatrix}$$
$$\vee \begin{bmatrix} \text{SEGS} & \textsf{trunc}(\boxed{1}) = \langle \text{t,u,ʒ,u,ʁ} \rangle \\ \text{P-CTXT} & \begin{bmatrix} \text{SEGS} & \langle \textit{cons},\ldots \rangle \end{bmatrix} \end{bmatrix}$$

b.
$$\begin{bmatrix} \text{SEGS} & \boxed{1}\langle \text{b,o,k,u,p} \rangle \\ \text{P-CTXT} & \textit{nil} \end{bmatrix} \vee \begin{bmatrix} \text{SEGS} & \textsf{s-z}(\boxed{1}) = \boxed{1} \\ \text{P-CTXT} & \begin{bmatrix} \text{SEGS} & \langle \textit{vow},\ldots \rangle \end{bmatrix} \end{bmatrix}$$
$$\vee \begin{bmatrix} \text{SEGS} & \textsf{trunc}(\boxed{1}) = \langle \text{b,o,k,u} \rangle \\ \text{P-CTXT} & \begin{bmatrix} \text{SEGS} & \langle \textit{cons},\ldots \rangle \end{bmatrix} \end{bmatrix}$$

As discussed in §4.2, the role of the final consonant was weakened by the frequent occurrence of the truncated form. This triggered various developments in the next stage of the language.

5.3 Transitions to ModFr pronunciations

For the majority of words, the major change in ModFr was the introduction of variation in pre-pausal contexts. The original long form and the truncated form co-existed for a time (20a), before the eventual triumph of the truncated form (20b).

(20) a.
$$\begin{bmatrix} \text{PHON} & \begin{bmatrix} \text{SEGS} & \boxed{1} \vee \boxed{2} \\ \text{P-CTXT} & \textit{nil} \end{bmatrix} \vee \begin{bmatrix} \text{SEGS} & \textsf{s-z}(\boxed{1}) \\ \text{P-CTXT} & \begin{bmatrix} \text{SEGS} & \langle \textit{vow},\ldots \rangle \end{bmatrix} \end{bmatrix} \\ & \vee \begin{bmatrix} \text{SEGS} & \boxed{2}\,\textsf{trunc}(\boxed{1}) \\ \text{P-CTXT} & \begin{bmatrix} \text{SEGS} & \langle \textit{cons},\ldots \rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

b.

$$\rightsquigarrow \left[\text{PHON} \begin{bmatrix}\text{SEGS} & \boxed{2} \\ \text{P-CTXT} & \textit{nil} \vee \left[\text{SEGS} \quad \left\langle \textit{cons}, \ldots \right\rangle\right]\end{bmatrix} \vee \begin{bmatrix}\text{SEGS} & \textsf{liaison}(\boxed{2}) \\ \text{P-CTXT} & \left[\text{SEGS} \quad \left\langle \textit{vow}, \ldots \right\rangle\right]\end{bmatrix}\right]$$

A number of important shifts are involved in the transition to (20b). The form [2] is now the more frequent form, and the citation form. The historical long form loses its status of basic form. In fact, for words like *toujours*, the original form with final [s] no longer appears in any contexts; we are left with only the two "derived" pronunciations [tuʒuʁ] and [tuʒuʁz]. The relationship between these forms is consequently reinterpreted as shown in (20b): [2] is now the basic form, and the pre-V form is derived from it by a new process, labeled liaison.

The function liaison cannot represent a simple phonological process. The relation between liaison forms and non-liaison forms is grammaticalized in the form of a two-slot paradigm, which is used in the analysis of all manifestations of liaison in ModFr, including those that have historical origins other than the final consonant deletion described throughout this paper. The slots of the paradigm can be filled in in several different ways. In all of the examples considered up to now, the liaison form is derived from the non-liaison form by the addition of an extra final consonant. This "latent" consonant can correspond to an unpredictable (historical) root consonant (21a), or it can be systematically associated with the grammatical features of the word (b). In such cases the identity of the latent consonant must be encoded somewhere in the lexical representation of the word, but not as part of its core phonological content.[13] The liaison form can be suppletive (21c,d), or it can be defective (e).

(21)

	non-liaison	liaison form	
a.	boku	bokup	*beaucoup* 'a lot'
b.	pəti	pətiz	*petits* 'small.*pl*'
c.	sə	sɛt	*ce* / *cet* 'this'
d.	nuvo	nuvɛl	*nouveau* / *nouvel* 'new' (prenominal)
e.	fʁɑ̃	*	*franc* 'frank' (prenominal)
f.	ku	ku	*coup* 'blow' / *cou* 'neck' / *coût* 'cost'

And finally, words that show no liaison alternation in ModFr, such as singular nouns, simply have identical forms in both slots of their paradigm (f).

The lexical schema in (20b) thus underwent a further step of reinterpretation: the morphologization of the relationship between the two forms.

[13] Bonami et al. (2004) introduce the idea of a phonological "appendix" for encoding latent consonants for liaison and morphological derivation.

(22)
$$\begin{bmatrix} \text{PHON} & \begin{bmatrix} \text{SEGS} & \boxed{a} \\ \text{P-CTXT} & \textit{nil} \vee \begin{bmatrix} \text{SEGS} & \langle \textit{cons}, \ldots \rangle \end{bmatrix} \end{bmatrix} \\ & \vee \begin{bmatrix} \text{SEGS} & \boxed{b} \\ \text{P-CTXT} & \begin{bmatrix} \text{SEGS} & \langle \textit{vow}, \ldots \rangle \end{bmatrix} \end{bmatrix} \\ \text{MORPH} & \begin{bmatrix} \textit{liaison-paradigm} \\ \text{NON-LIAIS-FORM} & \boxed{a} \\ \text{LIAIS-FORM} & \boxed{b} \end{bmatrix} \end{bmatrix}$$

This informal representation is meant to show that neither form is derived from the other in the phonology. Instead, the forms are organized in a paradigm in the morphological component of the lexical entry, where the various possible relationships, or the lack of relationship, between the two forms can be modeled.

ModFr has also seen an evolution in the nature of the contextual conditions. While these were closely correlated with the phonological content of the following word in earlier stages, there are situations where this no longer the case in ModFr. We assume that consonant-initial words in MidFr became associated with an abstract feature [−LIAISON-TRIGGER], encoding the fact that they could not license the appearance of a liaison form. The switch to a non-phonological feature is crucial for the class of "aspirated *h*" words, which lost their initial consonant in early ModFr period (e.g. *hache* 'axe': MidFr [haʃœ] $\rightsquigarrow$ ModFr [aʃ]). They still fail to trigger liaison today, despite being vowel-initial phonologically.

(23)
$$\begin{bmatrix} \text{PHON} & \begin{bmatrix} \text{SEGS} & \langle \text{h}, \ldots \rangle \end{bmatrix} \\ \text{LTRIG} & - \end{bmatrix} \rightsquigarrow \begin{bmatrix} \text{PHON} & \begin{bmatrix} \text{SEGS} & \langle \textit{vow}, \ldots \rangle \end{bmatrix} \\ \text{LTRIG} & - \end{bmatrix}$$

The constraints on liaison in ModFr refer to the value of the lexically-specified feature [±LTRIG], instead of directly inspecting the SEGMENTS list of the licensing word. We can represent this move by modifying the P-CTXT connstraints inas follows:

(24)
$$\begin{bmatrix} \text{PHON} & \begin{bmatrix} \text{SEGS} & \boxed{a} \\ \text{P-CTXT} & \begin{bmatrix} \text{LTRIG} & - \end{bmatrix} \end{bmatrix} \vee \begin{bmatrix} \text{SEGS} & \boxed{b} \\ \text{P-CTXT} & \begin{bmatrix} \text{LTRIG} & + \end{bmatrix} \end{bmatrix} \\ \text{MORPH} & \begin{bmatrix} \textit{liaison-paradigm} \\ \text{NON-LIAIS-FORM} & \boxed{a} \\ \text{LIAIS-FORM} & \boxed{b} \end{bmatrix} \end{bmatrix}$$

There are other clear signs of the grammaticalization of liaison in ModFr and its shift away from a purely phonological phenomenon. The strict association between liaison forms and liaison contexts expressed in all of the preceding lexical schemas must be relaxed, because in many syntactic environments in ModFr, liai-

son is optional. The only general constraint is that a liaison form must be immediately followed by a [+LTRIG] word:

(25) a. *beaucoup aimer* [bokueme] / [bokupeme] 'like a lot'
b. *beaucoup manger* [bokumɑ̃ʒe] / *[bokupmɑ̃ʒe] 'eat a lot'

(26)
$$\left[\begin{array}{ll} \text{PHON} & \left[\text{SEGS} \quad \boxed{a}\right] \vee \left[\begin{array}{ll} \text{SEGS} & \boxed{b} \\ \text{P-CTXT} & \left[\text{LTRIG} \quad +\right] \end{array}\right] \\ \text{MORPH} & \left[\begin{array}{ll} \textit{liaison-paradigm} & \\ \text{NON-LIAIS-FORM} & \boxed{a} \\ \text{LIAIS-FORM} & \boxed{b} \end{array}\right] \end{array}\right]$$

It follows that liaison forms cannot appear in isolation or before a pause. Non-liaison forms are subject to no contextual constraints in this generic lexical entry schema, but particular syntactic combinations (head-specifier phrases, head-subject phrases) can impose additional conditions.

The lexical schema in (26) is the last stage of the analysis that will be presented here, but it should be mentioned that the grammaticalization of liaison in ModFr calls into question the reliance on P-CTXT constraints. The P-CTXT approach is appropriate for sandhi phenomena that are primarily phonologically conditioned, because it gives a word direct access to the PHON values of its neighbors. While it is technically possible to refer to non-phonological information via P-CTXT, given the powerful formulation of the constraint in (17), such proposals must be carefully motivated.[14] As we can see in (26), only one contextual constraints is still in force at the lexical level in ModFr, it does not refer directly to phonological information, but to the abstract feature LTRIG.

See Bonami et al. (2004) and Bonami et al. (2005) for a treatment of ModFr liaison in terms of constraints on syntactic combinations, where the grammaticalized remnants of phonological context constraints are modeled using the interaction of two interface features (LTRIG, also introduced here, and LFORM, encoding the liaison status of the alternating word). Those proposals can be considered to be a further reanalysis step, following on from the succession of analyses presented here. The current paper serves to situate synchronic HPSG analyses of French liaison in their historical context.

References

Asudeh, Ash and Klein, Ewan. 2002. Shape Conditions and Phonological Context. In Frank van Eynde, Lars Hellan and Dorothee Beermann (eds.), *Proceedings of the 8th International HPSG Conference*, pages 20–30, Stanford, CA: CSLI Publications.

[14] See Tseng (2005) for the issue of locality in phonological selection.

Bender, Emily and Flickinger, Dan. 1999. Diachronic Evidence for Extended Argument Structure. In Gosse Bouma, Erhard Hinrichs, Geert-Jan M. Kruijff and Richard T. Oehrle (eds.), *A Collection of Papers on Formal Grammar, Head-Driven Phrase Structure Grammar, and Categorial Grammar*, pages 3–19, Stanford, CA: CSLI Publications.

Bonami, Olivier and Boyé, Gilles. 2003. La nature morphologique des allomorphies conditionnées. Les formes de liaison des adjectifs en français. In Bernard Fradin, Georgette Dal, Françoise Kerleroux, Nabil Hathout, Marc Plénat and Michel Roché (eds.), *Les Unités morphologiques / Morphological Units*, Villeneuve d'Ascq: Silex.

Bonami, Olivier, Boyé, Gilles and Tseng, Jesse. 2004. An integrated approach to French liaison. In Gerhard Jäger, Paola Monachesi, Gerald Penn and Shuly Wintner (eds.), *Proceedings of Formal Grammar 2004*, pages 29–45, Nancy: Loria.

Bonami, Olivier, Boyé, Gilles and Tseng, Jesse. 2005. Sur la grammaire des consonnes latentes. *Langages* 158, 89–100.

Bourciez, Édouard and Bourciez, Jean. 1967. *Phonétique française. Étude historique*. Paris: Klincksieck.

Brunot, Ferdinand. 1966. *Histoire de la langue française des origines à nos jours. Tome I. De l'époque latine à la Renaissance*. Paris: Armand Colin.

Fouché, Pierre. 1961. *Phonétique historique du français. Volume III: Les consonnes et index général*. Paris: Klincksieck.

Harris, Alice C. and Campbell, Lyle. 1995. *Historical syntax in cross-linguistic perspective*. Cambridge: Cambridge University Press.

Livet, Charles-Louis. 1859. *La Grammaire française et les Grammairiens du XVIe siècle*. Paris: Didier.

Morin, Yves-Charles. 1986. On the morphologization of word-final consonant deletion in French. In Henning Andersen (ed.), *Sandhi Phenomena in the Languages of Europe*, pages 167–210, Berlin: Mouton de Gruyter.

Paris, Gaston and Pannier, Léopold. 1872. *La vie de saint Alexis: poème du XIe siècle et renouvellements des XIIe, XIIIe, et XIVe siècles*. Bibliothèque de l'École des hautes études, No. 7, Paris: A. Franck.

Schane, Sanford. 1968. *French phonology and morphology*. Cambridge, MA: MIT Press.

Stürzinger, Johann Jakob (ed.). 1884. *Orthographia Gallica : Ältester Traktat, über französische Aussprache und Orthographie*. Altfranzösische Bibliothek, No. 8, Heilbronn: Gebr. Henninger.

Thurot, Charles. 1883. *De la prononciation française depuis le commencement du XVIe siècle d'après les témoignages des grammairiens. Tome second*. Paris: Imprimerie nationale.

Tseng, Jesse. 2005. Prepositions and complement selection. In Aline Villavicencio and Valia Kordoni (eds.), *Second ACL-SIGSEM Workshop on the Linguistic Dimensions of Prepositions and their Use in Computational Linguistics Formalisms and Applications*, pages 11–19, University of Essex.

Tseng, Jesse. 2008. L'inversion pronominale: histoire et analyse. In *Actes du 1er Congrès mondial de linguistique française*, Paris.

Zink, Gaston. 1986. *Phonétique historique du français*. Paris: Presses Universitaires de France, 6. edition.

Zink, Gaston. 1989. *Morphologie du français médiéval*. Paris: Presses Universitaires de France, fourth edition.