

Liaison and syllable structure in French

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0. Introduction¹

Sequences of an adjective and a noun in French are privileged locations for the study of liaison and enchainement. Liaison is the pronunciation of a ‘latent’ consonant in a prevocalic context, and enchainement is the subsequent resyllabification following liaison. It is thus not surprising that phonologists working on liaison have very often focused on this precise environment. The present paper continues this tradition and proposes some theoretical improvements as compared to past proposals. The improved treatment can account for the following phonological aspects of the phenomenon.

- the triple allomorphy between adjectives like *vilaine/vilain* ‘ugly’, as compared to the double allomorphy of adjectives like *petite/petit* ‘small’.
- the puzzle why *bon* ‘good, masc.’ can be pronounced [bɔ̃n] in the liaison context, but the possessive *mon* ‘my, masc.’ is [mɔ̃n] in the same environment and never [mɔ̃].²
- the difference between the realization of the feminine and the masculine allomorphs in the plural. *Petites* in *petites hirondelles* ‘little swallows’ is pronounced as [pətitɥ] but *petits* in *petits albatros* ‘little albatrosses’ is pronounced either as [pətitɥ] or, marginally, as [pətit], but never as [pətitɥ].

The theoretical claims made in this paper can be summed up as follows.

The syllable structure is used as a trigger for phonological alternations. First, in the feminine form of the adjective, the closing consonant is in the coda, whereas in the masculine liaison context, the latent consonant is an onset or a coda. This difference explains all three properties listed above, a proposal, which, to our knowledge, has not been made before.

As few prespecification as possible is assumed, as far as the phonological form of the adjective is concerned. Instead the alternation in the phonological form of the adjective is a consequence of the following generalizations:

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² Only standard French (General French) is considered in this paper, as spoken in Paris and on television.

- the feminine gender marking is more marked than the masculine one, and the systematic presence of a closing consonant in the feminine, as opposed to the sporadic one in the masculine, is a consequence of this markedness effect.
- tense vowels are found predominantly in open syllables, whereas lax vowels are mostly found in closed syllables. The triple alternation in adjectives like *vilaine/vilain* reflects the variable syllable structure.

The paper is organized in 7 sections. The first one introduces some facts and earlier OT analyses. In the second section, the present proposal is introduced. The following section reviews the data. Adjectives are classified into different categories, according to their behavior in the liaison context. It is also shown that demonstratives behave like adjectives, but that a simple morphosyntactic explanation is difficult to maintain in view of the possessives, where the feminine liaison is homophonous with the masculine, and of adjectives ending with *–une/-un*, where the quality of the vowel presents less variation than in other nasal vowels. Section 4 scrutinizes the syllabification structure of the sequence adjective plus noun and the fifth section develops an optimality-theoretic analysis for the core group of adjectives. Section 6 critically discusses older OT approaches.

Section 8 is an appendix and presents experimental results confirming the variation in the realization of adjectives in the liaison context.

1. Liaison and enchaînement

The phenomena of liaison and enchaînement in French has often been discussed in the generative framework, both in derivational approaches and in OT framework. In some syntactic environments, like in sequences of an article + a noun, or an adjective + a noun, a word final consonant emerges phonetically before a vowel initial word, as shown in (3a,b).³ In a similar, but consonant initial environment, this consonant is mute (3c). Very often, the emerging consonant is realized as the onset of the following syllable, in which case, one speaks of liaison with enchaînement, as in (3a). The emergent consonant can also be realized as the last syllable's coda of the word to which it morphologically belongs, and then, one speaks of liaison without enchaînement (3b). This latter form of liaison is much rarer, and is found nearly exclusively in public speech styles from politicians or news speakers (see Encrevé 1986 for an empirical study). For both liaisons, with and without enchaînement, their triggering factor is the onsetless following word, thus the phonological structure of the following noun. In (3a-b), the words *hirondelles* 'swallows' and *envolé* 'flown away, part.' are vowel initial, and the prototypical liaison words *les* 'the, pl.', with final [z], and *sont* 'are', with final [t], are phonetically realized with their liaison consonant. In (3c), *grues* 'cranes' and *dansé* 'danced' are consonant initial and the preceding words *les* and *ont* lack the final consonant. The liaison segment [z] is often related to the plural, as in the articles *les* and *des*, the adjectives, or the possessives *mes* 'my', *tes* 'your', *ses* 'her, his', *nos* 'our', *vos* 'your', *leurs* 'their', and [t] is often associated with the third person, singular or plural, though these relationships are nothing more than tendencies.

³ There have been intensive discussions in the older literature on liaison, most notably in the early days of transformational phonology, to define the syntactic or prosodic environments in which it applies (see for instance Selkirk 1972 and Rotenberg 1978). The present paper does not bear on this issue, but focuses on a context in which liaison is obligatory (see for instance Encrevé 1986 and Fouché 1959).

(3) Liaison in French

- a. with enchaînement: les hirondelles [le.zi. Rõ.dɛl] ‘the swallows’
se sont envolées [sə.sõ.tã.vɔ.le] ‘have flown away’
- b. without enchaînement: les hirondelles [lez.i. Rõ.dɛl]
se sont envolées [sə.sõt.ã.vɔ.le]
- c. no liaison: les grues [le.gʁy] ‘the cranes’
ont dansé [õ.dã.se] ‘have danced’

The selection of the allomorphs of *les* and *sont* in (3) depends on the consonant vs. vowel initial context, and therefore, cannot be said to involve a conflict between phonology and morphology. In some instances of liaison, however, phonology and morphology do seem to conflict, like in the sequences of adjective plus noun examined in this paper. Compare the examples in (4): In isolation, the adjective *petit* is realized without a final [t] in the masculine, and with a final [t] in the feminine and in the liaison context.

(4) Liaison in prenominal adjectives in French

- a. consonant initial masculine noun: *petit canard* ‘little duck’ [pəti^hkanar]
- b. feminine noun: *petite bête* ‘little beast’ [pətit^hbɛt]
- c. vowel initial masculine noun: *petit oie* ‘little goose’ [pətit^hɔi]

The conclusion that several authors have drawn from the distributional pattern sketched above is that the pre-vocalic masculine form of adjectives, which is called the masculine liaison in this paper, is in fact the feminine allomorph. Intermingling of morphosyntax in the phonology (Prunet 1987, Perlmutter 1999), analysis invoking suppletion with gender (Tranel 1990, 1996, 1999) and lexical conservatism (Steriade 1999) have been proposed as different instantiations of this idea.

In Tranel (1996), the first OT approach of liaison, the focus of the analysis lies on the faithfulness or unfaithfulness of the phonological form to the corresponding feminine or masculine morphosyntactic feature. It is assumed that the feminine and the masculine liaison allomorph are a single form. This idea has also predominated in the older generative literature, where it was necessary to posit just one underlying form and derive the others by rules (see Gaatone 1978 for an early criticism of this conception).

Tranel assumes that morphosyntactic features are overridden by phonological considerations like the need to have an onset. Crucially, floating consonants in adjectives like *petite/petit*, with two allomorphs, are not subject to high ranking faithfulness constraints. The final and floating [t] of *petit*, whether realized or not in a sequence like *petit abbé* ‘little priest’, does not violate the faithfulness constraints. This segment is subject to a low ranking constraint AIF, which says ‘Avoid integrating floaters’. By contrast, candidates like [petabbé] and [petibbé] in (6c,d), in which a non-floating vowel has been deleted, and which are thus perfect for ONSET, violate faithfulness, and are immediately dismissed. The constraint GENDER AGREEMENT, which requires agreement between noun and adjective, is violated by the optimal candidate (6b).

(5) Tranel's hierarchy

FAITHFULNESS >> ONSET >> GENDER AGREEMENT >> AIF (Avoid integrating floaters)

(6) Tranel (1996)

pəti(t) abbé	FAITH	ONSET	GENDER AGREEMENT	AIF
a. pəti abbé		*!		
b. pətɪt abbé			*	*
c. pət abbé	*!			
d. pəti bbé	*!			

Perlmutter's (1999) assumes that inputs consist of the set of relevant allomorphs, an approach dubbed 'Lexical Sourcing Principle'. Like Tranel (1999), he also assumes that allomorphs are prespecified for gender and accordingly needs a constraint CONCORD requiring faithfulness to inputs with the right gender, as formulated in (7a). Thus, both Perlmutter (1999) and Tranel (1996 and 1999) need prespecification for gender, as well as listed allomorphs.

(8) Perlmutter's analysis

- a. CONCORD: No two members of a concord set (a head noun and its adjectival modifiers) can have distinct gender or number feature values.
- b. ONSET >> CONCORD >> NoCODA

All approaches specifying gender in input allomorphs have the same shortcoming: they are unable to account for phonological variation other than the presence of an onset. It looks like an accident that the feminine and the masculine forms of the adjectives always present the same pattern of alternation. Nothing prevents allomorphs to have the reverse distribution, namely one in which the masculine has a final consonant and the feminine ends with a vowel, as long as the liaison form has a final consonant. There is also no principled difference between truly suppletive forms and adjectives presenting a regular alternation. Since they are all listed, the fact that regular phonological changes of French are involved in *vilaine* and *sotte* is lost for the analysis. A final drawback is the impossibility to account for the threefold allophony in these adjectives.

Since this paper looks at adjective + noun sequences in French, let us dwell a moment on the different classes of adjectives: those with one allomorphs in 1.1, those with two allomorphs in 1.2 and finally those with three allomorphs in 1.3.

1.1. Adjectives with one allomorphs

Non-alternating adjectives are listed in (6). Some are closed by two, some by just one consonant, and still others end with a vowel. They all have the same phonological structure in the feminine and in the masculine.

- (6) Nonalternating singular adjectives (one allomorph)
- | | |
|-------------------------------|---------------------------|
| honnête [ɔnɛt] ‘honest’ | oblique [ɔblik] ‘oblique’ |
| humide [ymid] ‘humid’ | rouge [ʁuʒ] ‘red’ |
| correct(e) [kɔʁɛkt] ‘correct’ | alerte [alɛʁt] ‘alert’ |
| calme [kalm] ‘quiet’ | pauvre [povʁ] ‘poor’ |
| jaune [ʒon] ‘yellow’ | noir(e) [nwaʁ] ‘black’ |
| fatigué(e) [fatige] ‘tired’ | poli(e) [pɔli] ‘polite’ |

1.2. Adjectives with two allomorphs

Adjectives with two allomorphs like *petit*, are numerous in French. They all have an alternating phonological structure implemented in the final consonant only, as illustrated in (7). These are the adjectives which have often been described as containing a “latent” consonant (Clements & Keyser 1983, Encrevé 1986 and Zoll 1996 among others). These adjectives are characterized by the presence of a final consonant in the feminine, and no final consonant in the preconsonantal masculine. In the prevocalic masculine context, the same consonant as in the feminine form is realized. This consonant is often [z] or [t], as in *petite* or *grise*, but can also be another one, as for instance in *longue*, with a final [g].⁴ An example of sequences of a prenominal adjective plus different nouns is given in (8). The noun in (8a) is feminine beginning with a consonant, in (8b) it is feminine beginning with a vowel, in (8c) a consonant-initial masculine and in (8d) a vowel-initial masculine. The same order will be used in the whole paper, often with the same nouns, but with different adjectives. The property of particular interest for this paper is the liaison masculine context in (8d).

In the default case, the adjectives will be cited in their complete feminine form first, since the masculine is generally truncated, and thus incomplete.

- (7) Alternating adjectives (2 allomorphs):
- | | |
|------------------------------------|-------------------------------------|
| petite/petit [pətit/pəti] ‘little’ | heureuse/heureux [øʁøz/øʁø] ‘happy’ |
| grise/gris [ɡʁiz/ɡʁi] ‘grey’ | longue/long [lɔ̃g/lɔ̃] ‘long’ |
- (8) a. Preconsonantal feminine: petite fauvette, f. [pətitfovɛt] ‘little warbler’
b. Prevocalic feminine: petite alouette, f. [pətitaluɛt] ‘little lark’
c. Preconsonantal masculine: petit merle, m. [pətimɛʁl] ‘little blackbird’

⁴ Tranel (1981) mentions 13 consonants which can be present in the feminine and absent in the preconsonantal masculine: [t] in *petite* ‘little’, [z] in *heureuse* ‘happy’, [n] in *fine* ‘fine’, [r] in *première* ‘first’, [d] in *chaude* ‘warm’, [g] in *longue* ‘long’, [s] in *rousse* ‘red-haired’, [ʃ] in *blanche* ‘white’, [v] in *louve* ‘wolflike’, [ɲ] in *benigne* ‘not serious’, [l] in *soûle* ‘drunk’, [j] in *gentille* ‘nice’. The readiness of these consonants to be pronounced as a liaison segment varies considerably from consonant to consonant, from more to less in their order of appearance.

d. Prevocalic masculine: petit aigle, m. [pətitegl] ‘little eagle’

Some few adjectives with different forms in the masculine and in the feminine do nonetheless use the masculine form with a final vowel in the liaison context. These are adjectives ending on a non-liaison consonant, like *franche*, *blanche* and *fraîche* [ʃ] or *gentille* [j]. Examples are given in (9) and (10).

(9) Adjectives with no liaison form: the consonant is not a possible liaison one

franche/franc [frãʃ/frã] ‘frank’ blanche/blanc [blãʃ/blã] ‘white’

fraîche/frais [frɛʃ/frɛ] ‘fresh’ gentille/gentil [ʒãtiʃ/ʒãti] ‘nice’

(10) a. gentille fauvette, f. [ʒãtiʃfovɛt]

b. gentille alouette, f. [ʒãtiʃaluet]

c. gentil merle, m. [ʒãtimɛrl]

d. gentil aigle, m. [ʒãtiɛgl]

Morin (1992) reports the result of an informal study that he conducted in different regions of France to find out what speakers do when confronted with sequences such as *franc entretien* ‘open conversation’ or *un blanc amas d’étoiles parfumées* ‘a white heap of perfumed stars’ and found that speakers avoid the realization of a liaison consonant altogether in *franc* and *blanc*. They prefer to realize the preconsonantal (or free) form of the masculine. He claims that this is due to the absence of a learnt allomorph with liaison (by contrast to *long été* [lõgete] ‘long summer’ or *sang impur* [sãgẽpyr ‘impure blood’ which may be learned). His conclusion is that the liaison and the preconsonantal form are partly independent of each other, and are only related by analogy rather than by rules of derivation or by morphophonological relation. We will see below that OT allows us to express the relationship between allomorphs in a more precise way than analogy, but that it also allows us to get rid of derivations and morphophonological relations in the derivational sense.

A further alternation pattern involving only the final consonant, is illustrated in (11) and (12), and concerns adjectives ending with two consonants, always [ʀ] followed by [t], [d] or [s]. Only the final stop is truncated in the masculine form, both in the preconsonantal position and, crucially, in the masculine liaison context. [ʀ] is always realized. In the feminine, a schwa can be pronounced at the word boundary, in our example between [d] and [f], which introduces a syllable boundary in a sequence like (12a), involving [ʀdf].⁵ The problem of schwa deletion or epenthesis in French is completely ignored in the present paper (but see Charette 1991, Noske 1984, van Oostendorp 1999 and Rialland 1986 for illuminating insights).

(11) Alternating adjectives: last consonant in VCC is latent

courte/court [kʉrt(ə)/kʉʀ] ‘short’

forte/fort [fɔʀt(ə)/fɔʀ] ‘strong’

lourde/lourd [luʀd(ə)/luʀ] ‘heavy’

⁵ Alternatively, [d] or [t] can be elided also in the feminine (see Dell 1995)

bavarde/bavard [bavard(ə)/bavar] ‘talkative’
 perverse/pervers [pɛrvɛrs/pɛrvɛr] ‘perverse’

- (12) a. lourde fauvette, f. [lurd(ə)fɔvɛt]
 b. lourde alouette, f. [lurdaluɛt]
 c. lourd merle, m. [lurmɛrl]
 d. lourd aigle, m. [lurɛgl]

The last pattern of alternation involving just the final consonant is shown in (13) and (14). The final labial fricative is voiced in the feminine and voiceless in the masculine, regardless of the first segment of the following noun.⁶

- (13) Voicing alternates in [v/f]
 active/actif [aktiv/aktif] ‘active’ vive/vif [viv/vif] ‘vivid’
 brève/bref [brɛv/bɛɾɛf] ‘brief’ neuve/neuf [nœv/nœf] ‘new’

- (14) a. vive mésange, f. [vivmesãʒ]
 b. vive alouette, f. [vivaluɛt]
 c. vif merle, m. [vifmɛrl]
 d. vif aigle, m. [vifɛgl]

1.3 Adjectives with three allomorphs

The third group of adjectives alternate not only in their final consonant, but also in the final vowel. This vowel changes its quality depending partly on the presence vs. absence of the final consonant, and this interdependency delivers three allomorphs. Several patterns of alternations exist in this group, which are illustrated in (15). In *sotte/sot*, the feminine form is always [sɔt], with a final consonant and a lax vowel. In comparison, the masculine form presents a more complex alternation pattern. In preconsonantal position, as in the example (16c), there is no final consonant, and the vowel has a tense quality. In a prevocalic context, as in (16d) the final consonant is generally pronounced, but the quality of the vowel is not as stable as in the other contexts. It can be lax, as in the feminine form, or tense, as in the preconsonantal masculine. If the consonant is not pronounced, the vowel is always tense. This option is not listed in the following examples. *Dernière/dernier* is a further example of the same kind, in which the quality of the vowel is tense or lax. *Vilaine/vilain* in (17) illustrates a different alternation, involving nasality. Again, the feminine form is straightforward: it is always realized by a lax oral vowel followed by a nasal consonant (17a-b). The preconsonantal masculine is just a nasal vowel (19c), and the prevocalic masculine is either homophonous with the feminine or it is a sequence of a nasal vowel and a nasal consonant (19d).

⁶ A few adjectives, like *sèche/sec* [sɛʃ/sɛk] ‘dry’, have two different and apparently unrelated final consonants in the feminine and the masculine, and the liaison masculine always choose the masculine.

(15) Adjectives with three allomorphs: mid or nasal vowels. Vowel quality and consonant are affected

- a. sotte/sot [sɔt/sot/so] ‘silly’
- b. dernière/dernier [dɛʁnjɛʁ/dɛʁnjɛʁ/dɛʁnje] ‘last’
- c. vilaine/vilain [vilɛn/vilɛ̃n/vilɛ̃] ‘ugly’

- (16)
- a. sotte fauvette, f. [sɔtfovɛt]
 - b. sotte alouette, f. [sɔtaluɛt]
 - c. sot merle, m. [somɛʁl]
 - d. sot aigle, m. [sɔtɛgl/ sɔtɛgl]

- (17)
- a. vilaine fauvette, f. [vilɛnfovɛt]
 - b. vilaine alouette, f. [vilɛnaluɛt]
 - c. vilain merle, m. [vilɛ̃mɛʁl]
 - d. vilain aigle, m. [vilɛ̃nɛgl/vilɛnɛgl]

In some words, the combination of a nasal vowel plus a nasal consonant is the only possible realization for a liaison masculine, as in *une/un* ‘a, ind.article’ and adjectives ending with this sequence. This is illustrated in (18) and (19). In these words, [yn] is not a possible masculine liaison rime, and the vowel has to be nasal, thus [ɛ̃n], compare (19d).

(18) Words like *une/un* [yn/ɛ̃n/ɛ̃]

- a. aucune/aucun [okyn/okɛ̃n] ‘no’
- b. commune/commun [komyn/komɛ̃n/komɛ̃], masc. ‘common, shared’

- (19)
- a. aucune fauvette, f. [okynfovɛt]
 - b. aucune alouette, f. [okynaluɛt]
 - c. aucun merle, m. [okɛ̃mɛʁl]
 - d. aucun aigle, m. [okɛ̃nɛgl] *[okynɛgl]

1.4 Unpredictable allomorphy

A different type of adjectives with three allomorphs are shown in the examples listed in (20). In these words, the consonant voicing changes in the liaison allomorph: [s] is changed into [z] and [d] into [t].

(20) Adjectives with three allomorphs:

- a. basse/bas [bas/baz/ba] ‘low’
- b. grasse/gras [ɡʁas/ ɡʁaz/ɡʁa] ‘fat’
- c. grande/grand [ɡʁɑ̃d/ɡʁɑ̃t/ɡʁɑ̃] ‘tall’
- d. seconde/second [sɛɡɔ̃d/ sɛɡɔ̃t/sɛɡɔ̃] ‘second’

Grande/grand and *grosse/gros* are the prototypical cases. The feminine is invariable. It is always [ɡʁɑ̃d] and [ɡʁos]. The preconsonantal masculine is also invariable and

ends with the corresponding vowel [ã] and [o]. Finally, the liaison consonant, also invariable, has a different consonant voicing. It is [t] (instead of [d]) in the case of *grand*, and [z] (and not [s]), in the case of *gros*. But, except for this peculiarity, there is no alternation in the phonological composition of these adjectives. It is to be observed here, that, as mentioned above, [s] and [t] are the liaison consonants *par excellence* and that the alternation between voiced and voiceless coronal fricative is observed in other parts of the grammar, as well. Intervocally, [s] is regularly pronounced [z], as in *dix* [di/dis/diz] ‘ten’ and *six* [si/sis/siz] ‘six’. As for the coronal stop [t], it is also realized in a large number of contexts, as for instance between a verb in the 3rd person and a following pronoun or participle. Some examples of liaison with [z] and [t] are given in (21).

(21) Typical liaisons with [z] and with [t]

les [z] aigles ‘the eagles’	sont [t] allés ‘went’
deux [z] amis, ‘two friends’	vont [t] entrer ‘are going to come in’
dix [z] oies ‘ten geese’	quand [t] on mange ‘when we eat’
vas [z]-y ‘go ahead’	fait -[t] il ‘does it’

The alternation found in *grande* and *grosse* is restricted to a small group of very frequent prenominal adjectives. Section 6 discusses these adjectives in more details. The last group of adjectives are the suppletive ones which consist in a small number of frequently occurring prenominal adjectives for which feminine and masculine forms differ in a phonologically unpredictable way. The liaison masculine adjective is homophonous with the feminine. Three different patterns can be identified: *elle-eau* [ɛl/o], *eille/eu* [ɛj/ø] and *olle-ou* [ɔl/u], as exemplified by the nearly exhaustive list in (22).

(22) Suppletion: Unpredictable allophony

- a. belle/bel/beau [bɛl/bo] ‘handsome’, nouvelle/nouvel/nouveau [nuvɛl/nuvo] ‘new’ (but *naturelle/naturel* ‘natural’)
- b. vieille/vieil/vieux [vjɛj/vjø] ‘old’ (but *pareille/pareil* ‘same’, heureuse/heureux ‘happy’)
- c. folle/fol/fou [fɔl/fu] ‘mad’, molle/mol/mou [mɔl/mu] ‘soft’

- (23) a. belle fauvette, f. [bɛlfovɛt]
- b. belle alouette, f. [bɛlaluvɛt]
- c. beau merle, m. [bomɛrl]
- d. bel aigle, m. [bɛlɛgl]

Tranel (1996) accounts for suppletive forms with prespecification and Tranel (1999) extends the set of prespecified allomorphs to adjectives like *grande/grand*, *petite/petit*, *grosse/gros*, *franche/franc* etc. which are treated like *belle/beau* as well as *mon/ma* in consisting of sets of allomorphs specified for gender. The feminine form has only one allomorph, but the variability of the masculine adjective is part of its input, as shown in (24). Specifically, the change of voicing in *grande/grand* or the absence of the final consonant in the liaison allomorph of an adjective like *franche/franc* is expressed by idiosyncratic listing. There is no need to refer to gender

in the form of a violable constraint anymore, as was illustrated in (), but the role of faithfulness has been greatly increased.

- (24) a. *peti(t)* [masc.] vs. *petit* [fem.]
 b. *gră(t)* [masc.] vs. *grăd* [fem.]
 c. *fră* [masc.] vs. *fră* [fem.]

Steriade (1999) considers not only the adjectives with two allomorphs, but also those with three. Her proposal, called ‘lexical conservatism’, posits that adjectives in the liaison context tend to be faithful to listed allomorphs specified for gender. But, since the constraint against hiatus is high ranking and forces the latent final consonant to be pronounced in the context of liaison, in an adjective like *petite*, the final consonant is present, rendering the masculine homophonous with the feminine. It is important to note that, as in Tranel (1999), the liaison adjective has the same gender as the noun. Adjectives with three allomorphs like *sotte*, *dernière* and *vilaine* have only two listed allomorphs each, as shown in (25a) and the other allomorphs (26a) emerge through the effects of the faithfulness constraints. In the liaison context, the emergence of the final consonant triggers either faithfulness to the listed feminine allomorphs, as in (25b), or, alternatively, faithfulness to the quality of the vowel of the listed masculine allomorph, as in (26b). In both cases, the result is a masculine adjective, whose phonological surface form is different from the listed masculine allomorph. The first pronunciation is called “normative” and the second “innovative”. The two different faithfulness constraints can be ordered differently in order to deliver the pronunciations of the liaison adjectives.

(25) Conservatism (listedness)

- a. Listed allomorphs: [sɔt, so], *vaine/vain* ‘vain’ [vɛn vɛ̃], [dɛʁnjɛʁ dɛʁnje]
 b. Conservative or normative (faithful) realization: [sɔt] *ami*, [dɛʁnjɛʁ] *homme*, [vɛn] *espoir*

(26) Innovatism

- a. Not listed allomorphs: [sɔt], [vɛ̃n], [dɛʁnjɛʁ]
 b. Innovative realization: [sɔt] *ami*, [dɛʁnjɛʁ] *homme*, [vɛ̃n] *espoir*

The innovative allomorphy is regulated by the interplay of the constraint against hiatus and faithfulness to listed allomorphs. Liaison consonants have to belong to the set [t, z, n, r, l] (though no example with [l] is given). Steriade says explicitly that phonotactics play no role in the choice of the allomorph.

The faithfulness to listed allomorphs presupposes first the existence of listed allomorphs, which serve as inputs, and second a set of conditions, which encode semantic and morphosyntactic similarity via phonological similarity. Even though Steriade mentions in her paper that the allophony she accounts for is regular in the French phonology, she nevertheless prefers to give an account in terms of faithfulness to listed allomorphs. The existence of such constraints, however, predicts the possibility to obtain as optimal candidates allomorphs which are phonologically ill-formed or dispreferred, like [sɔ] or [dɛʁnje], just because there happens to be a

faithfulness constraint requiring homophony to the feminine vowel in a context where a coda consonant is not necessary.

To sum up this short review, all former OT proposals assume faithfulness to prespecified gender allomorphy, the only difference being the amount of prespecification required in terms of suppletive forms or listed allomorphs and the role of the faithfulness constraints. The only active phonological constraints, NOHIATUS and ONSET, regulate the emergence of the liaison consonant. In the purely phonological approach developed in the next sections, by contrast, no prespecification is needed, except for the clearly lexicalized suppletive forms *belle/beau* and the like, in which the phonology is irregular.

2. OT analysis

We now turn to the constraint-based optimality-theoretic analysis of the alternations just introduced. Knowledge of the basic tenets and architecture of this theory, as originally proposed by Prince & Smolensky (1993), and developed by a variety of researchers (see for instance McCarthy & Prince 1993a, b, 1994, 1995) is presupposed.

2.1 One allomorph

Let us start with the non-alternating adjectives in (4). Their input consists of just one allomorph, and the output can be assumed to be the exact replicate of the input, consisting of the same set of features, as guaranteed by the principle known as Lexicon Optimization (Prince & Smolensky 1993), which requires similarity between output and input. When evaluation comes into play, faithfulness constraints take care of the identity between input and output. These constraints form a family of constraints, such as DEP-IO, MAX-IO, IDENT-IO, etc., each of which is responsible for one specific, well-defined correspondence relationship between input and output. In the following, no attempt is made at defining them more exactly (see McCarthy & Prince 1995). Just one constraint (FAITH-IO), as formulated in (40), is a placeholder for all relevant faithfulness constraints. Crucially, no deletion and no epenthesis are tolerated, and identity of featural content between input and output is also observed. FAITH-IO is high-ranking and, in fact, never violated in the adjectives considered here, and, as we will see, also in the adjectives presenting allomorphy.

The first markedness constraints introduced here, NOCODA and NOHIATUS in (41), play no role for the selection of the optimal candidate in the invariable forms because they are crucially dominated by FAITH which requires perfect identity between input and output, regardless of the violations incurred by the optimal candidate. NOCODA is a standard constraint which militates against closed syllables in requiring that syllables have no coda, and NOHIATUS is the constraint which penalizes a sequence of two nuclear vowels.

(40) Faithfulness constraint

FAITH: An output corresponds to its input (no deletion, no epenthesis, ...)

(41) Markedness constraints

- a. NOCODA: Syllables have no codas.
- b. NOHIATUS: *V.V

In the input, the noun is specified for gender, but the adjective is not. One constraint, unviolable in French, and called AGREE (Tranel 1996) or CONCORD (Perlmutter 1999), is responsible for agreement between noun and adjective. It will not be shown in the tableaux below. Regardless of the phonological form it endorses, it is assumed that its morphosyntactic specification is always the one of the noun.

The tableaux (42) and (43) illustrate the sequences *honnête milan* ‘honest red kite’ and *jolie outarde* ‘pretty bustard’, two invariable adjectives followed by a noun. *Honnête milan* violates the constraint NOCODA and the sequence *jolie outarde* violates NOHIATUS, but still, the faithful candidates are optimal. The rankings FAITH >> NOCODA and FAITH >> NOHIATUS are thus established by these tableaux.

(42) Invariant adjectives

honnête /ɔnɛt/ + milan, m. ‘honest red kite’	FAITH	NOCODA
☞ [ɔnɛt] milan		*
[ɔnɛ] milan	*!	

(43) Invariant adjectives

jolie /ʒɔli/ + outarde, f. ‘pretty bustard’	FAITH	NOHIATUS
☞ [ʒɔli] outarde		*
[ʒɔlit] outarde	*!	

2.2 Two allomorphs

The second group of adjectives to be accounted for are those with two allomorphs, like *petite* or *grise*. It is proposed that the allomorphy between presence and absence of the final consonant is part of the input. In this respect, the present proposal follows the post transformational analysts, like Morin (1992), Steriade (1999) and Tranel (1996, 1999), but it also differs from them in the prespecification for gender. The present approach differs also from older generative approaches which have concentrated on the formulation of truncation rules (like in Milner 1967, Schane 1965, 1970, Dell 1973, Selkirk 1972, Kaye & Lowenstamm 1984), or on rules of epenthesis (Klausenburger 1974, Tranel 1974, Kaye & Morin 1977). In all these derivational approaches, one of the allomorphs is the underlying form, and the other one must be derived by rules (see Encrevé 1986, Gaatone 1978 and Tranel 1981 for detailed reviews of these approaches).

The optimality-theoretic constraint ranking needs to take care of the fact that the feminine form always ends with a consonant whereas the masculine ends with a vowel or with a consonant depending on the following segment. In other words, the masculine allomorphy is entirely regulated by the context, but the feminine is not.

It has been observed in the literature, as for instance by Aikhenvald (2000), Greenberg (1966), Corbett (1991), Wechsler (2002) and many others, that in two-

gender languages, like French,⁷ masculine gender is universally less marked than feminine, and that the difference in markedness is reflected in the phonology. In French, the phonological unmarkedness of the masculine is particularly obvious, and has been discussed by a number of linguists (see Lamarche 1996, Martinet 1956, Roché 1990, Schane 1970, Spence 1983, among others). Both Roché (1990) and Lamarche (1996) observe, though in different terms, that it is possible for a feminine person to be referred to by a masculine word, as in *Le docteur, Madame Dupont, est arrivé* ‘The doctor, masc., Ms Dupont, has arrived’, but the reverse is not possible *L’infirmière, Monsieur Durand, est déjà là*. ‘The nurse, M. Durand, is already there’. In the phonology, since the feminine is often expressed by an additional segment or morpheme, it seems to be formed by derivation from the masculine, an analysis which has been offered a number of times in the literature.⁸ The feminine adjective usually serves as the basis for further derivations, like in *fraîche-frais* ‘fresh’ and the complex words *fraîcheur*, noun, *fraîchement*, adv. and *fraîchir*, verb, see Roché (1990). From a phonological point of view, and in line with the analysis proposed in this paper, the allomorph [frɛ̃] serves as the basis for further word formations when the suffix is vowel initial. Other deadjectival derivations, in which the suffix is consonant initial are formed on the basis of the masculine allomorph, as in *bonté* ‘goodness and *beauté* ‘beauty’.

It is proposed to account for the markedness of the feminine with the help of an OT constraint expressing that, everything else being equal, feminine inflections are more marked than masculine ones. Fulfilment of MARKED(F), formulated in (44), is understood as the selection of the maximally marked input. In French, this universal constraint is often instantiated in such a way that the featural material which can be absent in the masculine is associated with a final consonant, often in the form of an additional final coda, in the feminine.

(44) MARKED(F): Feminine inflections are phonologically complex.

In the preconsonantal context, only FAITH, NOCODA and MARKED(F) are needed in order to obtain that the feminine adjective ends with a consonant and the masculine with a vowel. In the feminine, the effect of MARKED(F), ranked higher than NOCODA but lower than FAITH, can be felt, and the longer form, with a coda, is optimal. If there is only one phonological form available for both the feminine and the masculine, as in the case of *honnête* and *jolie* in tableaux (42) and (43), MARKED(F) is trivially fulfilled since FAITH is unviolated, and the unique input leaves no choice other than perfect faithfulness, if it is assumed that no segment not specified in the input can be inserted. In *petite*, by contrast, two allomorphs can be constructed from the input. The parentheses around [t] in the tableaux (45) to (47), indicate optionality of this segment. MARKED(F) requires the longer allomorph to be picked up for the feminine, regardless of the violation of NOCODA it

⁷ In languages with more than two genders, such a simple markedness relation does not seem to hold, as shown by Corbett (1991: 291).

⁸ Martinet expresses the unmarkedness in the following terms: “...un morphème marqué du fait de son contenu s’exprimera en général en ajoutant quelque formant à base masculine: *frais* - *fraîche*, *franc* - *franche*, *le maître* - *la maîtresse*, *der Lehrer* - *die Lehrerin*. Marque sémantique et marque formelle vont normalement de pair, et la chose est bien naturelle: là où l’on veut en dire plus, on ajoute un signe complémentaire.” It appears from this citation that Martinet associates semantic unmarkedness and morphological unmarkedness with each other.

causes. As a result, the ranking of the three constraints is now FAITH >> MARKED(F) >> NoCODA. The question of how the allomorphy has to be noted in the input is an important one, which will be discussed below. At this point, it does not matter whether the optional final consonant is a floating segment or if the two allomorphs are listed in their entirety.

(45) Adjectives with two allomorphs: preconsonantal feminine (one segment alternates)

/pəti(t)/ fauvette, f. ‘warbler’	FAITH	MARKED(F)	NoCODA
☞ a. [pətit.] fauvette			*
b. [pəti.] fauvette		*!	

In the preconsonantal masculine, MARKED(F) is inactive, and NoCODA is responsible for the absence of the final consonant. The preconsonantal masculine is a case of Emergence of the Unmarked. It is the only form which is free to fulfill the purely phonological constraint NoCODA.

(46) Adjectives with two allomorphs: preconsonantal masculine

/pəti(t)/ pinson, m. ‘brambling’	FAITH	MARKED(F)	NoCODA
a. [pətit.] pinson			*!
☞ b. [pəti.] pinson			

Also in the masculine liaison, the longer allomorph is optimal, but this time because of NOHIATUS which forces the realization of the optional consonant. In order to make sure that [t] is syllabified as the onset of the following noun’s first syllable, NOHIATUS must dominate NoCODA, as shown in tableau (47).

(47) Adjectives with two allomorphs: liaison masculine

/pətit(t)/ aigle, m. ‘eagle’	FAITH	NOHIATUS	NoCODA
☞ a. [pəti.tɛgl]			**
b. [pətit.ɛgl]			***!
c. [pətiɛgl]		*!	**

To sum up so far, adjectives with two allomorphs can select the longer allomorph as optimal in two different ways. First, because of MARKED(F), which takes care of the markedness of the feminine, and second, because of NOHIATUS which prefers the candidate with a consonant. In the case of the adjectives with two allomorphs, there is also no variation. Feminine and liaison allomorphs are always realized with a final consonant, and preconsonantal masculine always without.

2.3 Three allomorphs

We now come to the adjectives with three allomorphs. Beginning with *sotte/sot*, several additional facts must be accounted for. First, the allomorphy concerns not only the final consonant, but also the vowel quality. A mid vowel is tense or lax depending on the syllable structure.⁹ In an open syllable, the vowel is tense, and in a closed syllable, it is lax. Though this is just a tendency in French in general, it is a stable correlation in the adjectives under consideration.

The complementary distribution between tense and lax vowels can be expressed by markedness constraints in (48). $*LAXV]_{\sigma}$ posits the absence of lax mid vowels in open syllables, and $*TENSEV C]_{\sigma}$ the absence of tense mid vowels in closed syllables. Since FAITH is never violated, a prespecified vowel quality may override these tendencies, as in the case of invariable tense vowel in *haute/haut* ‘high’ [ot/o] or *heureuse/heureux* ‘happy’ [øz/ø] ‘happy’, which have a tense vowel even when close by a coda. Things are different for lax vowels. Laxness can be prespecified as well, but the feature [lax] changes to [tense] in open syllables. At least the back round mid vowel [ɔ] is always in a closed syllable, and is changed into its tense correspondent as soon as it is in an open syllable. In terms of repair, thus, a prespecified tense vowel forces a following consonant to be in the following syllable whereas a prespecified lax vowel in an open syllable has no other choice than to change its quality. As a consequence, $*LAXV]_{\sigma}$ is higher ranked than $*TENSEV C]_{\sigma}$.

- (48) a. $*LAXV]_{\sigma}$: No lax mid vowels in open syllables.
 b. $*TENSEV C]_{\sigma}$: No tense mid vowels in closed syllables.

The alternation between laxness and tenseness of the vowel in dependence of the syllable structure is readily expressed with the constraints seen until now. The tight relationship between syllable structure and vowel quality calls for underspecification in the input, noted in the tableaux (49) to (51) with a capital O. From now on, FAITH is not indicated in the tableaux any longer, since it is always fulfilled, and MARKED(F) is only noted in tableaux for feminine forms. Similarly, NOHIATUS is taken up in the tableaux only in case the input consists of a vowel final adjective and a vowel initial noun, and thus a hiatus can arise.

Tableaux (49) and (50) show preconsonantal feminine and masculine respectively. The feminine ends with a coda, as required by MARKED(F), whereas the masculine ends with a vowel, as before. Since the input contains an optional final consonant, both allomorphs are faithful. In this respect, *sotte* behaves like *petite* in tableaux (49) and (50). The vowel quality in *sotte* and *sot* is regulated by the constraints in (48).

(49) Adjectives with three allomorphs: preconsonantal feminine

/sO(t)/ mésange, f. ‘great tit’	MARK(F)	$*LaxV]_{\sigma}$	$*TenseV C]_{\sigma}$	NoCODA
☞ a. [sɔt. mezãʒ]				*
b. [so. mezãʒ]	*!			
c. [sɔ. mezãʒ]	*!	*		
d. [sot. mezãʒ]			*!	*

⁹ Recall that only mid vowels can be lax or tense. High vowels are always tense, and low vowels seem to be neutralized for this feature.

(50) Adjectives with three allomorphs: preconsonantal masculine

/sO(t)/ troglodyte, m. ‘northern wren’	*LaxV] _σ	*TenseV C] _σ	NoCODA
a. [sɔt. troglɔdit]			*
☞ b. [so.troglɔdit]			
c. [sɔ. troglɔdit]	*!		
d. [sɔt. troglɔdit]		*!	*

Consider now the liaison masculine form. There is agreement in the literature that it alternates between two realizations, as in [sɔtɛɡl] and [sɔtɛɡl] (Steriade 1999, ...). It is assumed here that the reason for this alternation is to be found in the tight correlation between vowel quality and syllable structure, and the role played by the phonotactic constraints. The realization of a final [t] as an onset of the following noun or as coda of the adjective *sotte* has an influence on the vowel quality (and vice-versa). Since both vowel qualities are options in the input, and given that both syllabifications are possible, both realizations emerge. In *petite*, by contrast, [i] is always tense, a fact that which has to be accounted for by prespecification of tenseness for this vowel, or alternatively, by a constraint prohibiting high lax vowels. Even if syllabification of final [t] is ambiguous, it is not reflected in the vowel quality.

There is some evidence that onsets and codas are acoustically and perceptively different.

See also Spinelli et al. (2002) who conducted lexical activation experiments with sequences of words like *dernier oignon* ‘last onion’ and *dernier rognon* ‘last kidney’, in which underlined [r] is a liaison consonant or an onset. They found that vowel initial words are activated by hearers when these words have been intended by the speaker (hearers recognize *oignon* in *dernier oignon*, but they do not hear *oignon* in *dernier rognon*). Speakers of French are thus sensitive to subphonemic cues, like duration of the last vowel of *dernier* and of the crucial consonant, which could be interpreted as a difference in syllable structure, a possibility which Spinelli et al. do not consider. For them [r] is always an onset.

In order to express the variation in syllabification of [t], a constraint of the Alignment family, and more exactly ALIGN(Morpheme, Syllable, R), as formulated in (51) is needed. This constraint requires aligning the right edge of a morpheme with the end of a syllable. The optionality of the two syllabifications – one with [t] in the onset, and the other with [t] in the coda - can be expressed by a tie, or an overlapping of ALIGN and NoCODA.

Since the quality of the vowel of *sot* depends on the presence or absence of the closing consonant, it is unspecified in the input. The lack of specification for laxness of a vowel is rendered by a capital in the following tableaux.

(51) ALIGN(Morpheme, Syllable, R): Every morpheme ends with a syllable.

(52) Adjectives with three allomorphs: liaison masculine

/sO(t)/ aigle, m.	NoHIATUS	*LAXV] _σ	*TENSEV C] _σ	ALIGN	NoCODA
☞ a. [sɔt.ɛɡl]					*
b. [sɔ.ɛɡl]	*!				

☞ c. [so.tɛgl]				*	
d. [sot.ɛgl]			*!		*
e. [sɔ.tɛgl]		*!		*	
f. [so.ɛgl]	*!				

In adjectives like *vilaine/vilain* or *bonne/bon*, nasality can be realized on the vowel, on the consonant or on both segments but the latter constellation arises only when the vowel and the following consonant are in two different syllables. If the vowel is oral, the nasal consonant is obligatory, because the feature [nasal] has to be anchored.

The input must contain the information that nasality is obligatory in at least one of the last two segments of the adjective. In tableau (54), the input is represented as a disjunction. The second part of the disjunction, when the vowel is nasal, accounts for the optionality of the nasal consonant. The vowel is only oral in case the nasal consonant is tautosyllabic. In all other contexts, the vowel is nasal. MARKED(F) requires the maximal allomorph in the feminine. Between the two options, [ɛn] or [ɛ̃n], the first sequence is optimal, as shown in tableau (54), because of the prohibition of a tautosyllabic nasal vowel plus nasal consonant.

(53) *NASV+n]_σ: No tautosyllabic nasal vowel plus a nasal consonant.

(54) Adjectives with three allomorphs: feminine

/vilɛn~ɛ̃(n)/ fauvette, f.	MA(F)	NOHIATUS	*NASV+n] _σ	ALIGN	NOCODA
☞ a. [vilɛn.] fauvette					*
b. [vilɛ̃n.] fauvette			*!		*
c. [vilɛ̃.] fauvette	*!				

The masculine allomorph has no choice but be an open syllable with a nasal vowel, since NOCODA is active and [ɛ] alone is not an option, because it does not realize the feature [nasal].

(55) Adjectives with three allomorphs: masculine

/vilɛn~ɛ̃(n)/ merle, m.	MA(F)	NOHIATUS	*NASV+n] _σ	ALIGN	NOCODA
a. [vilɛn.] merle					*!
b. [vilɛ̃n.] merle			*!		*
☞ c. [vilɛ̃.] merle					

Finally, the masculine liaison again can be realized and syllabified in two different ways. NOHIATUS guarantees the presence of a consonant, [n] in the present case. The vowel can be nasal, but then, because of *NASV+n]_σ, the consonant is relegated to the onset of the next word, or it can be [ɛ], in which case [n] is obligatorily part of the coda, as guaranteed by *LAXV]_σ. These options are illustrated in candidates a. and b. in Tableau (56).

(56) Adjectives with three allomorphs: liaison masculine

/vilɛn~ɛ̃(n)/ aigle, m.	MA(F)	NOHIATUS	*NASV+ n] _σ	*LAXV] _σ	ALIGN	NoCODA
☞a. [vilɛn.ɛgl]						*
☞b. [vilɛ̃.nɛgl]					*	
c. [vilɛ̃.ɛgl]		*!				
c. [vilɛ̃n.ɛgl]			*!			
d. [vilɛ.nɛgl]				*!	*	

3. Syllabification

4.1 Syllabification and dislocated syntactic construction

Tranel (1990, 1996, 1999) proposes to explain the variability of the vowel quality in adjectives like *vilaine* and *sotte* by gender and feature prespecification, and Steriade (1999) accounts for this puzzling fact with faithfulness to listed allomorphs specified for gender. The approach taken here denies a direct correspondence between morphosyntactic and phonological features, and instead proposes an indirect way to explain the variation: the feminine and the liaison masculine allomorphs have a different syllable structure, and it is the variation in the syllable structure that determines the quality of the vowel (see also Charette 1991, Féry 2003a, van Oostendorp 1999, Plénat 1987 and Rialland 1999, among others). The feminine adjective ends with a coda and thus has a final closed syllable, whereas the masculine form prefers to end in a vowel, an open syllable. In the context of liaison, there is a conflict as far as syllabification is concerned, since the liaison consonant belongs morphologically to the adjective, but is triggered phonologically by the following noun. In most speech styles, the syllabification of the liaison consonant is ambiguous, and cannot be decided on auditory or acoustic grounds. This is because adjective plus following noun form a tight prosodic entity together, in which word boundaries are not realized phonetically. A kind of phonetic ambisyllabicity (see below) is the consequence. Fortunately, contexts can be identified that reveal the syllabic affinity of the consonant. Tranel (1990) discusses such a construction in detail, that he calls ‘dislocated syntactic construction’ in which the adjective and the following noun are in different prosodic domains, but liaison still happens, and the final consonant is pronounced. Crucially, enchaînement, the property of the liaison consonant to be syllabified with the following noun, happens in some cases and not in others. The presence or absence of enchaînement gives us indications as to whether the consonant is in the coda (no enchaînement, closed syllable) or in the following onset (enchaînement, open syllable).

Following Morin & Kaye (1982), the first to mention this construction, Tranel notes that the dislocated syntactic construction is not fully accepted by all French speakers, but I agree with him when he says that, even if the construction can be judged as marginal or bad, it still triggers clear intuitions about syllabification. The particular interest of the dislocation lies in the fact that the adjective and the following noun are not entirely part of the same DP, or of the same Phonological Phrase. Syntactically, the noun in (30a) seems to be extraposed and the main clause contains the clitic *en*, a placeholder for the noun. In order for this construction to be well-

formed at all, it is important that the last word of the main clause can stand alone as a DP. A similar construction with a quantifier like *quelques* ‘some’ in (30b) or the articles *le*, *les* or *des* in (30c) is not well-formed because these words cannot stand as independent DPs. This restriction is surprising in view of the fact that a noun needs an article in French, and, as a result, the dislocated noun is a non-standard DP. It thus looks as if the noun is dependent on the preceding material (article plus optional adjective or quantifier), but this material is not dependent on the noun.

- (30) a. J’ en ai vu un, martinet
 I of it have seen one, swift, m.
 ‘I have seen a swift’
 b. *J’ en ai vu quelques, martinets
 I of it have seen some, swifts
 ‘I have seen some swift’
 c. *J’ en ai vu le, martinet
 I of it have seen the, swift
 ‘I have seen the swift’

But even if article and noun (or adjective and noun) are separated by a prosodic break of the size of a Phonological Phrase (PhP), liaison may take place in the domain of the Intonation Phrase (IP) (Féry 2003b), and this explains why it applies in the dislocated construction, across a clear prosodic break.¹⁰ The main clause and the following extraposed word form together an Intonation Phrase, but each of them is in a separate Phonological Phrase, expressed by special temporal and tonal structures. Because of the very possibility of making a pause between the two words, it is an ideal context to control the behavior of the final consonant, and thus its syllable affiliation.

- (31) Prosodic phrasing
 [[J’ en ai vu un]_{PhP} [martinet]_{PhP}]_{IP}
 [[J’ en ai vu un petit]_{PhP} [martinet]_{PhP}]_{IP}

The examples in (32) illustrate the dislocated syntactic construction and the corresponding syllabification for *petite/petit*. In the a. cases, *fauvette* ‘warbler’ is a consonant-initial feminine noun and the last [t] of *petite*, is always a coda. In the b. cases, with *alouette*, a feminine noun beginning with a vowel, the final consonant of *petite* is also syllabified with the adjective. A syllable structure with a coda in the final syllable of the adjective is the result. As indicated in the example, syllabification of [t] as the onset of *alouette* is not possible. Case c. is unproblematic. Since the adjective ends in a vowel, and the following noun begins with a consonant, syllabification is straightforward. Case d is the interesting one. In this situation, the liaison consonant can appear or not, but only the former situation is discussed here. In principle, the liaison consonant could be syllabified as in a., in which case it would be the coda of the adjective’s final syllable, or it could be the onset of the following noun’s first syllable. Tranel is definite about the fact that, in (32d) it is syllabified as an onset, an

¹⁰ Liaison is often thought to apply only at the level of the phonological phrase (see Nespor & Vogel 1986, Post 1993 and many others)

intuition that I only partly share. The alternative syllabification is not completely impossible, but just highly marked, a situation rendered with the question mark.¹¹

(32) *petite/petit*

- a. J'en ai vu une petite, fauvette [pətit.fovɛt]
I of it have seen a small, warbler
'I have seen a small one, warbler'
- b. J'en ai vu une petite, alouette [pətit.a.luɛt] *[pəti.ta.luɛt]
- c. J'en ai vu un petit, merle [pəti.mɛʁl]
- d. J'en ai vu un petit, étourneau [pəti.te.tuʁno] ?[pətit.e.tuʁno]

The case is different with the suppletive forms *nouvel*, *bel*, *vieil*, *fol* and so on. Syllabification of the final consonant is straightforward: it is always the coda of the adjective. The explanation is that the vowel of these words is lax and must be in a closed syllable. These forms are lexicalized and, as a result, are not subject to change. In particular, there is no allomorph with a tense vowel and a final consonant, and, as will be shown below, the syllable structure alone is not able to create new allomorphs. In *belle/beau*, the pairing between laxness and close syllables, on the one hand, and tenseness and open syllables, on the other hand, is obligatory.

(33) Suppletive forms *nouvel*, *bel*, *vieil* in dislocation

- a. J'en ai vu une belle, fauvette [bɛl.fovɛt]
- b. J'en ai vu une belle, alouette [bɛl.a.luɛt] *[bɛ.la.luɛt]
- c. J'en ai vu un beau, merle [bo.mɛʁl]
- d. J'en ai vu un bel, étourneau [bɛl.e.tuʁno] *[bɛ.le.tuʁno]

In (34) to (36), adjectives with three allomorphs of the type *vilaine/vilain*, *sotte/sot* and *dernière/dernier* are shown. The syllabification of the consonant presents an interesting variation between being a coda or an onset, which illustrates that there is a tight connection between the syllable structure and the vowel quality. If the final consonant is a coda, it is syllabified with the adjective, and the vowel is consequently lax. Alternatively, in the preferred realization, the consonant is syllabified with the noun, and the vowel is nasal (in *vilain*) or tense (in *sot* and *dernier*). A mixed solution, in which the consonant is syllabified with the noun, but the vowel is lax, or in which the consonant is syllabified with the adjective, but the vowel is tense, is not grammatical. This example illustrates unambiguously that syllable structure and vowel quality depend on each other.

- (34) a. J'en ai vu une vilaine, fauvette [vilɛn.fovɛt]
b. J'en ai vu une vilaine, alouette [vilɛn.a.luɛt] *[vilɛ.na.luɛt]

¹¹ Tranel finds motivation for this claim in Encrevé's survey of cases of liaison without enchaînement which seem to be much more frequent in cases of non-obligatory liaison, as in (i) than in cases of obligatory liaison as in (ii) or (iii). However, it is not rare to hear clear cases of liaison without enchaînement in obligatory contexts, especially in the speech of news speakers on television.

(i) des soldats anglais, je vais essayer, j'avais entendu dire, très intéressant

(ii) vos enfants, un ancien ami, ils ont compris

(iii) tout à coup, comment allez-vous

- c. J'en ai vu un vilain, merle [vilẽ.mɛʀl]
 d. J'en ai vu un vilain, étourneau [vilẽ.ne.tuʀno] [vilɛn.e.tuʀno] *[vilɛ.ne.tuʀno]
- (35) a. J'en ai vu une sotte, fauvette [sɔt.fovɛt]
 b. J'en ai vu une sotte, alouette [sɔt.a.luɛt] *[sɔ.ta.luɛt]
 c. J'en ai vu un sot, merle [so.mɛʀl]
 d. J'en ai vu un sot, étourneau [sɔt.e.tuʀno /so.te.tuʀno] *[sɔ.te.tuʀno]
- (36) J'en ai vu un dernier, étourneau
 [dɛʀnjɛʀ.e.tuʀno/dɛʀnje.re.tuʀno] *[dɛʀnjɛ.re.tuʀno]

The adjectives of the type of *grande* or *grosse*, with a variation in the voicing of their final consonant, allow only coda position for [d] or [s] and only onset position for [t] and [z].

- (37) *grosse/gros* (The final C syllabifies with the adjective in the feminine as [s], but with the noun in the liaison masculine, as [z])
 a. J'en ai vu une grosse, fauvette [ɡʀos.fovɛt]
 b. J'en ai vu une grosse, alouette [ɡʀos.a.luɛt] *[ɡʀo.sa.luɛt]
 c. J'en ai vu un gros, merle [ɡʀo.mɛʀl]
 d. J'en ai vu un gros, étourneau [ɡʀo.ze.tuʀno] *[ɡʀoz.e.tuʀno],
 *[ɡʀos.e.tuʀno]

Given the pattern of possible and impossible syllabifications illustrated in (32) to (37), an obvious conclusion is that the boundary of the first Phonological Phrase falls together with the boundary of a possible variant of the adjective (see also Steriade 1999 for the same observation): [vilɛ], [sɔ] and [dɛʀnjɛ] are not possible allomorphs, as well as [vilẽ], [sɔt] and [dɛʀnjɛʀ] (with the final consonant syllabified as a coda). It is also not possible to break up the suppletive forms after their nucleus. This observation confirms the prosodic boundary illustrated in (31). The end of a prosodic phrase is aligned with morphological material, in this case the adjective.

According to Tranel (1990), the existence of two syllabification in adjectives like *vilaine* and *sotte* motivates a suppletion analysis. He does not discuss adjectives like *grosse* or *grande*, but these should fall under the same pattern. Adjectives like *petite*, on the other hand, have no suppletive form, but their syllabification, illustrated in (32), is the result of a single underlying form. He discusses his suppletion analysis with the difference between *mon* and *bon*, shown in (38).¹² Adjectives or possessives with nasal vowels are specified as such in the lexicon, together with their gender specification. In the default case, they do not alternate, but if they do, it is the result of a special case of suppletion also anchored in the lexicon. As a result, *mon* is a default case and has a unique syllabification, shown in (38a), but *bon* has two, as the consequence of the dual status of its vowel.

In the analysis proposed in this paper and developed in section 7, by contrast, the absence of an allomorph [mɔn] for *mon* is explained by the absence of an

¹² His analysis of *bon* can be extended to adjectives like *vilaine* and *sotte*.

allomorph with a coda, as shown in (38b,d). A final consonant is always triggered by the need to realize an onset, and, if one excepts ambisyllabicity, which is always phonetic in French, [n] is never just a coda.

(38) *bonne/bon* and *ma/mon*

- | | | | |
|----|----------------|-----------------------------|-----------------------|
| a. | bon elephant | [bɔ̃.nelefã] [bɔ̃n.elefãt] | ‘good elephant, m.’ |
| b. | mon elephant | [mɔ̃.nelefã] *[mɔ̃n.elefã] | ‘my elephant’ |
| c. | bonne éléphant | [bɔ̃n.elefãt] | ‘good elephant, fem.’ |
| d. | mon éléphant | [mɔ̃.nelefãt] *[mɔ̃n.elefã] | ‘my elephant, fem.’ |
| e. | ma grenouille | [ma.grənuij] | ‘my frog, f.’ |

To sum up this section, the dislocated structure introduced in this section reveals the syllabification of the prenominal adjectives. They show that the final consonant syllabifies with the adjective in the feminine, but with the noun in the liaison masculine, and reveal the tight connection between syllable structure and quality of the final vowel.

4.2 Narrow focus

A second construction which shows the syllabic affiliation of the liaison consonant is a narrow focus on the noun. In such a context, the prosodic unit constituted by the sequence adjective plus following noun is given up in favor of two prosodic domains, one on the adjective and one on the noun. Some phonological alternations are more sensitive to this pattern than liaison, since, as mentioned above, liaison applies in the domain of the IP, and focusing creates a new Phonological Phrase (see Féry 2003b for experimental evidence). Obstruent nasalization (as in *vingt-deux* /vɛ̃tdø/ → [vɛ̃ndø] ‘twenty-two’) and obstruent voicing assimilation (as in *pas de pain* /padpɛ̃ / → [patpɛ̃] ‘no bread’) apply much less often in the context of a narrow focus than in a broad focus. However, even if liaison and enchaînement still applies, the syllable structure is realized more clearly than in a broad focus context.

(39) Narrow focus

- A: C’est un petit merle?
 B. [Non, c’est un gros]_{PHP} [ÉTOURNEAU]_{PHP} [gro.ze.tur.no]

So far, no experimental study has been conducted to examine the behavior of the liaison consonant in this environment.

One further case remains to be discussed to close the review of the core cases. In the OT model developed here, suppletion is understood as faithfulness to an allomorphy present in the input. The suppletive adjective *belle/beau* has two allomorphs, one with a final consonant and one with a final vowel and in case NOHIATUS is active, the consonant-final allomorph is optimal. Again the feminine is realized by the longer allomorph, with a coda, whereas the preconsonantal masculine must fulfill the markedness constraint NOCODA.

(40) Suppletion: masculine liaison

/bɛl~bo/ aigle, m.	FAITH	NOHIATUS	ALIGN	NoCODA	*[LAXV] _σ
a. [bɛl.ɛgl]				*	
b. [bo.ɛgl]		*!			
c. [bɛ.lɛgl]			*		*!

This section has shown that the allomorphy observed in adjectives in French, especially in the liaison context, is a consequence of very general principles of morphology and phonology, like markedness of the feminine as compared to the masculine, syllable structure and associated vowel quality. The reason why *petite* has two allomorphs while *vilaine* and *sotte* have three is to be found in the vowel height. High vowels in French have just one quality, whereas mid vowels have two: they are lax or tense depending on the syllable structure. Nasal vowels alternate between oral and nasal quality depending on the syllable structure as well. At no place it has been necessary to invoke faithfulness to gender or to listed allomorphs, as has been proposed by several authors in the recent past.

An alternative model is the stochastic one proposed by Boersma (1997) and Boersma & Hayes (2001), which predicts that constraints overlap and that the degree to which they do so correspond to the amount of variation found in the phonological realization of optional forms. A problem arising with using this approach in our case is that, depending on the adjective considered, the variation differs. In section 3, it was shown that *sot* is realized more often with a tense vowel than *parfait* for instance, or that *léger* and *dernier* differs as to the laxness of their final vowel. However, it could well be the case that this last kind of variation can be explained away if more constraints are introduced which account for the fact that *parfait* is found more often than *sot* in a prenominal position, or that *dernier* is more propentious to be realized with a lax vowel because there is another lax vowel in the initial syllable, and so on. For the following, the tied constraints will be used, though in a detailed analysis, a stochastic model can certainly renders the facts more accurately.

5. Additional facts

This section examines a series of contexts showing that the predictions made by lexical conservatism - and gender prespecification in general - are less accurate than the phonological approach. First, adjectives with a different allomorph in the liaison masculine than in the feminine are examined. Second, it will be shown that the syllabification approach accounts in a straightforward way for the fact that *bon* and *mon* have different allomorphs in the liaison context, and finally, it is also shown that in the plural, the liaison masculine is always the same as the preconsonantal one because of the presence of an additional consonantal onset [z].

5.1. The masculine liaison allomorph is not the feminine

Several classes of adjectives do not take the feminine as their liaison allomorph, a fact which speaks against an analysis in terms of ‘wrong’ morphosyntactic features. These adjectives have been discussed in various papers, like Tranel (1999) and Steriade (1999) for instance, but have been ignored by others, like Tranel (1996) and

Perlmutter (1999). They are important to assess the value of a model working with faithfulness to entire allomorphs, or of such in which the avoidance of hiatus necessarily triggers the choice of a feminine allomorph, as in Perlmutter's model.

7.1.1 Adjectives like *courte/court*, *sourde/sourd*

Adjectives ending in the sequence [Rt/R], [Rd/R] or [Rs/R] show that if the pre-consonantal masculine allomorph suffices for the syllabification's needs, this form is chosen rather than the longer feminine form. The data, in (64) are repeated from (11), and examples are added in (65). In *courte/court* [kurt/kur], [t] is only part of a feminine, never of a masculine. As shown in tableau (66), the constraints used until now derive this result straightforwardly. The masculine does not need to select a longer allomorph, but only wants to avoid a hiatus and be as unmarked as possible. The fact that [R] is always realized, and the coronal stop is optional, must be part of the input. The syllabification of [R] is probably variable. If this segment is final, it is rather a semi-syllable (see Féry 2003a for a detailed discussion, as well as the syntactic dislocation facts, which favor the coda syllabification). As soon as another consonant follows, however, it is in the coda. This is the case when [t] of *courte* or [z] of the plural follows (see below). In the tableau (66), the syllabification is left open.

- (64) *courte/court* [kurt(ə)/kur] 'short'
forte/fort [fɔrt(ə)/fɔR] 'strong'
lourde/lourd [lurd(ə)/luR] 'heavy'
bavarde/bavard [bavard(ə)/bavar] 'talkative'
perverse/pervers [pɛrvɛrs/pɛrvɛR] 'perverse'

- (65) *courte* [kurt(ə)] *visite*, f. 'short visit' *court* [kur] *instant*, m. *[kurt] 'short moment'
forte [fɔrt(ə)] *poule*, f. 'strong chicken' *fort* [fɔR] *hibou*, m. *[fɔrt] 'strong owl'

(66) Adjectives with two allomorphs: masculine liaison

/kur(t)/ instant, m.	FAITH	MA(F)	NOHIATUS	NOCODA
a. [kur] instant				
b. [kurt] instant				*!

7.1.2 Adjectives like *active/actif* [aktiv/aktif]

In the masculine, the final labial fricative is voiceless, whereas it is voiced in the feminine. W.r.t. the markedness relation introduced above, this is what is expected, since voiced fricatives are more marked than unvoiced ones. A constraint against voiced fricative is thus part of the universal set of constraints against marked structures, which can be formulated as *VOICEDFRICATIVE (or even just *VOICED) and which chooses the voiceless variant of the fricative in the default case.

- (67) *actif* [aktiv/aktif] 'active' *actif* [aktif] *étourneau*, m. *[aktiv]
vif [viv/vif] 'vivid' *vif* [vif] *autour*, m. 'goshawk' *[viv]

(68) Adjectives with two allomorphs: masculine liaison

/viv/f/ aigle, m.	FAITH	MA(F)	NOHIATUS	NOCODA	*VoIFRIC
a. [vifɛgl]					
b. [vivɛgl]					*!

The masculine and feminine variants of this adjective differ also in their syllable structure. Féry (2003a) proposes an analysis in which a voiced fricative is preferably an onset, sometimes of a semi-syllable, and the lengthening of a vowel preceding a voiced fricative is explained by the tendency to realize a bimoraic syllable word-finally. The masculine variant, with a final voiceless fricative has a shorter vowel, which shows that the consonant is a coda. Markedness of feminine can alternatively be expressed by the number of syllables *vive* and *vif* consist of.

7.1.3 Adjectives in which the consonant quality (always [d-t] and [s-z]) varies.

As mentioned in section 2, a few adjectives have a different voicing of the final obstruent in the feminine and in the liaison masculine. In the latter case, the consonant adopts the voicing of the canonical liaison consonants, [z] and [t]. This cannot be interpreted as the result of a greater markedness in the case of the feminine, since even though voiced stops are more marked than voiceless stops, voiceless fricatives are not more marked than voiced ones. Instead, the typical liaison consonant seems to be the triggering factor of the voicing alternation here (see Steriade 1999 for an explanation along the same line).

(69) Two adjectives with alternation of the final coronal stop [d/t]

- a. grand [grãd/grât/grã] ‘tall’
- b. second [səgõd/ səgõt/səgõ] ‘second’

- (70) a. grande [grãd] oie, f. ‘big goose’
- b. seconde [səgõd] aigrette, f. ‘second egret’

- c. grand [grât] étourneau, m. ‘big starling’
- d. second [səgõt] huître, m. ‘second oyster bird’
- (but marginally: froid [d] ‘cold’ étourneau, chaud [d] ‘warm’ huître)

(71) A few adjectives with alternation of the final coronal fricative [s/z]

- a. basse/bas [bas/baz/ba] ‘low’
- b. grasse/gras [gras/ graz/gra] ‘fat’
- c. grosse/gros [gros/ groz/gro] ‘big, fat’

- (72) a. grosse [gros] oie, f. ‘fat goose’
- b. gros [groz] ibis, m. ‘fat ibis’

(but *lisse* [s] ‘smooth’ *ibis*. This adjective has only one allomorph)

This alternation cannot be made part of the regular phonology of French, since, as already mentioned in section 2, it is restricted to a group of frequent adjectives. Less common, postnominal and invariable adjectives like *tiède* ‘lukewarm’ [tjɛd] and *lisse*

‘smooth’ [lis], keep the voicing of their last obstruent constant. The same is true of adjectives like *froide/froid* ‘cold’ [frwad/frwa] with two allomorphs and a final [d], which do not change [d] to [t] in the liaison context, and of adjectives like *rousse/roux* ‘red-haired’ [rus/ru], with [s] both in the feminine and in the liaison masculine. This speaks for a lexicalized alternation in *grande/grand* and *grosse/gros*. Steriade (1999) proposes a constraint for restricting the set of liaison consonants to some segments, and she makes this constraint dominate IDENT(voice). A major drawback of such a proposal is that it cannot avoid adjectives like *froide* or *rousse* to behave like that, too. Instead, postulating three allomorphs in *grande* and *grosse* and just two in *froide* and *rousse* will guarantee that only *grande* and *grosse* change their voicing in the liaison context. In order to trigger the emergence of [t] in *gran[t] ami*, and of [z] in *gros elephant*, we do need a markedness scale on liaison consonants, like the one in (73). These are markedness constraints, and they select the most harmonious liaison consonant from a set of allomorph for each input.

(73) Scales of well-formed liaison consonants

- a. t > d
- b. z > s
- c. n > m, ŋ
- d. r > l

7.1.4 Adjectives with no canonical liaison consonant

In a paper on prenominal liaison contexts, Morin (1992) claims that some adjectives chose as their liaison allomorph the form without final consonant in spite of the fact that they have an allomorph with a final consonant. Prototypical cases seem to be adjectives with final [ʃ], such as those listed in (74a). Morin also cites *gentille/gentil* in (74b) but the presence of a glide after [i] is certainly not as bad as the insertion of an alveopalatal fricative.

(74) a. <i>franche</i> [frãʃ/frã]	<i>franc entretien</i> , m. [frã] *[frãʃ]	‘frank conversation’
<i>blanche</i> [blãʃ/blã]	<i>blanc aigle</i> , m. [blã] *[blãʃ]	‘white eagle’
<i>fraîche</i> [frɛʃ/frɛ]	<i>frais oeuf</i> , m [frɛ] *[frɛʃ]	‘fresh egg’
b. <i>gentil</i> [ʒãtij/ʒãti]	<i>gentil étourneau</i> , m. [ʒãti] ?[ʒãtij]	‘nice starling’

Given the necessity of scales like the ones in (73), it is a natural development to assume that some consonants are so low on the liaison scale that they are disallowed entirely. This could be the case for [ʃ] (and maybe also for [j]), and is certainly also for other consonants which are never in a liaison position, like [w, m, f, v, k, ʒ] for instance. The upshot of such a prohibition is that the allomorph without final consonant is preferred to the one with a forbidden liaison consonant. A hiatus is the result.

For these cases, too, a framework in which feminine allomorphs are selected when a hiatus must be avoided does not make the right prediction. It has been shown once more that the choice of the right allomorph in the liaison context depends on different factors, most of all related to phonological markedness.

7.2 Nasality: *Mon/bon, aucun*

7.2.1 *Ma/mon*

The possessive *ma/mon* has no allomorph [mɔ̃n] in the standard dialect (though it has in other dialects, most prominently in Southern French varieties) and thus differs from *bonne/bon* which is realized as [bɔ̃n] both in the feminine and nearly always in the liaison masculine. This difference has been the subject of many papers, and has been discussed in all kinds of frameworks, but it has been nearly always assumed that it is a consequence of some kind of prespecification, either of the invariable nasal vowel in *mon*, or of the oral vowel in *bonne*. A different explanation is offered here.

To see the problem, consider first some possible syllabifications of *ma/mon* and *bonne/bon* in (75) and (76). The crucial difference is found in the preconsonantal feminine. In this context, *ma* is preferred over *mon*, in contradiction to the predictions of MARKED(F), since *ma* is clearly less marked than *mon*. The vowel [a] is however a regular ending of feminine determiners in French (as well as in other Romance languages), as testified by the feminine definite article *la* as well as possessives ending in [a], like *ma*, *ta*, *sa*. It must be assumed that the association between [a] and feminine in these words overrides MARKED(F). In the case of the adjective, *bonne* is chosen, with [n] in the coda. In both *mon* and *bon*, the preconsonantal masculine forms end with a nasal vowel. There is no difference here. Finally, in the liaison contexts, an important difference can be observed. Whereas in the case of *bonne/bon*, the liaison allomorph is always [bɔ̃n] in the feminine and varies between [bɔ̃n] and [bõ̃n] in the masculine (recall *vilaine/vilain*), it always presents the nasal vowel in *mon*, thus [mõ̃n]. In other words [mɔ̃n] is never an option.

- (75) a. *ma perruche*, f. [ma.pɛryʃ] ‘my parakeet’
 b. *mon autruche*, f. [mõ̃.otryʃ/mõ̃_{amb}otryʃ] ‘my ostrich’
 c. *mon perroquet*, m. [mõ̃.pɛrɔkɛ] ‘my parrot’
 d. *mon engoulevent*, m. [mõ̃.nãgylvã/mõ̃_{amb}ãgylvã] ‘my nightjar’
- (76) a. *bonne perruche*, f. [bɔ̃n.pɛryʃ] ‘good parakeet’
 b. *bonne autruche*, f. [bɔ̃n.otryʃ/bɔ̃n_{amb}otryʃ] ‘good ostrich’
 c. *bon perroquet*, m. [bõ̃.pɛrɔkɛ] ‘good parrot’
 d. *bon engoulevent*, m. [bõ̃.nãgylvã/bõ̃_{amb}ãgylvã] ‘good nightjar’

As can be seen from (75) and (76), ambisyllabicity is also an option, as it has been in numerous other cases discussed above. However, to the difference of German and English which have ambisyllabic consonants as primary syllabification options, ambisyllabicity in French is only found as a phonetic variant of other, more clear cut syllabifications. Crucially, ambisyllabicity in French does not have the power to create new allomorphs, but is just a pronunciation variant. As a consequence, in (75d),

[n] can be interpreted as a phonetic coda at the same time as it is an onset, but this coda is not phonological, and cannot change the quality of the vowel.

The approach proposed here does not assume any prespecification for nasality. Instead, the syllabification facts responsible for the allomorphy of *vilaine*, described in section 3, also explain the different behavior of *mon* and *bon*. More exactly, the absence of an allomorph with [n] in the coda of *mon* is crucial to explain the absence of an allomorph with [ɔ] altogether. In this word, the presence of [n] always correlates with liaison, and emerges only as a consequence of the need for an onset. As a result, the preceding vowel is in an open syllable and preserves its nasality, in the same way as was explained in some details for *vilaine/vilain*. *Bonne/bon*, on the other hand, has an allomorph with a coda [n], and as a consequence, has no problem in selecting this allomorph in case a liaison consonant is needed.

The following tableaux illustrate the syllabification of *mon* and *bon* in the masculine liaison context.

(77) Possessive: masculine liaison

/ma/mõ(n)/ aigle	FAITH	NOHIATUS	*ɔ] _σ	NoCODA
☞ a. [mõ.nɛgl]				
b. [mõɛgl]		*!		
c. [ma.ɛgl]		*!		
c. [mɔ.nɛgl]			*!	

(78) *Bonne/bon*: masculine liaison

/bɔn/bõ(n)/ aigle	FAITH	NOHIATUS	*ɔ] _σ	NoCODA
a. [bɔn.ɛgl]				*
a. [bɔ.nɛgl]			*!	
b. [bõ.ɛgl]		*!		
☞ c. [bõ.nɛgl]				

The choice of the input does not play as an important role in the analysis as it may appear at first sight. Even if an allomorph with [ɔ] is allowed for the possessive, it would have no chance to emerge as long as no coda is needed. As already mentioned, the set of inputs is driven by Lexicon Optimization (Prince & Smolensky 1993) reducing the allomorphy to the observed ones. But the observed ones are themselves conditioned by the existing allomorphy.

7.2.2 *une/un* [yn/œn] and similar cases

A similar distribution is observable with the indefinite article where the absence of [yn] as a possible liaison allomorph (in the standard dialect at least) is also explained by the fact that no coda is needed in this environment. In the masculine, [n] is always an onset, since it is always a liaison consonant. The explanation offered in the literature is that when the quality of the vowel in the masculine is too different from the one in the feminine, the vowel is the masculine one (see e.g. Steriade 1999), and the regular phonology cannot apply. This would also explain why the masculine

liaison allomorph preserves the quality of the masculine. By analogy, *commune/commun* [komyn/komœn], *aucune/aucun* [okyn/okœn] and also *fine/fin* [fin/fœn] behave like *une/un*.

- (79) *Aucune/aucun* [okyn/okœn],
 a. aucune fauvette [okyn.fovɛt]
 b. aucune alouette [okyn.aluɛt]
 c. aucun merle [okœ.mɛrl]
 b. aucun aigle [okœ.nɛgl/ okœn_{amb}ɛgl] *[okyn]
- (80) a. fine fauvette [fin.fovɛt]
 b. fine alouette [fin.aluɛt]
 b. fin merle [fœ.mɛrl]
 c. fin aigle [fœ.nɛgl/fœn_{amb}ɛgl] [*fin]

In any case, it must be observed that the liaison allomorph is once again not the feminine, but resembles the masculine, and that an approach based on faithfulness to allomorphs specified for gender makes the wrong predictions. Steriade's conservatism is also problematic since, in order to work, it has to recur to many different idiosyncratic constraints (see Steriade 1995).

7.3 Plural

It has been shown in (5), repeated in (81), that the plural forms behave differently from the singular in the masculine liaison context. The liaison consonant in the plural is the plural marker [z], both in the feminine and in the masculine, but in the masculine, it is the only final consonant realized. Compare the sequences in (82).

- (81) a. les petites pâquerettes, fem. pl. [pətitpakɔʁɛt] 'little daisies'
 b. les petites anémones, fem. pl. [pətitzanemɔn] 'little anemones'
 c. les petits mugets, masc. pl. [pətimygɛ] 'little lilies of the valley'
 d. les petits iris, masc. pl. [pətiziris] 'little iris'

One puzzle is why [z] is realized at all in *petites anémones*. After all, [t] should be enough to avoid a hiatus. The answer is that [t], being the coda of the adjective, does not fill the onset position of the following noun, but the plural [z] can. For the OT analysis proposed here, it means that the constraint ONSET, which says that syllables have onsets is needed also, beside *HIATUS. It certainly has to be lower ranking than MARKED(F), so that feminine allomorphs have a coda, and ONSET cannot replace *HIATUS because otherwise the allomorph which is homophonous to the feminine variant in *sotte* and *vilaine* in (52) and (56) would have no chance to emerge. /z/ must be analyzed as a special plural morpheme.

- (82) Plural adjectives
 a. petits [pətiz] oiseaux 'birds'

- b. sots [soz] oiseaux (*sɔs)
- c. derniers [dɛʁnjez] oiseaux
- d. vilains [vilɛ̃z] oiseaux
- e. courts [kurz] oiseaux
- f. vifs [vifz] oiseaux
- g. grands [grɑ̃z] oiseaux
- h. beaux [boz] oiseaux

The allomorph is the same one as the preconsonantal masculine plus [z], which is the plural marker, both from its segmental content (a voiced fricative) as from its prefix-like behavior (Dell 1995). The vowel preceding it is thus in an open syllable and presents no remarkable variation.

The correlation between syllable structure and tenseness/laxness of the vowels has been investigated in details elsewhere (Plénat, Steriade, Féry) and, even if there are counterexamples to the loi de position, the regularity between vowel quality and presence of a coda is regular enough. In adjectives, it is illustrated by ().

This paper offers new solutions to old problems of French phonology related to liaison and concomitant allophonic changes of segments involved in the affected syllables. It is proposed that liaison in prenominal adjectives or possessives plus noun is to be primarily explained by the syllable structure of the morphological material involved. The allophony observed in the preconsonantal and prevocalic feminines and masculines is the consequence of surface constraints guiding the segmental alternations as a consequence of the syllabification. The emergence of a final coda consonant in the feminine adjective is explained by a surface constraint to the effect that feminine is more marked than masculine (at least in French and other two-gender systems), but a liaison consonant, by contrast, is an onset called for by the following vowel initial noun. An important difference between the present proposal and previous OT analyses is that no prespecification of allomorphs wrt gender is necessary.

Considered under this angle, some puzzles of the French phonology find a simple explanation. For instance, the contrast between *mon ami* [mɔ̃nami] ‘my friend’, with a nasal vowel, and *bon ami* [bɔnami] ‘good friend’, with an oral vowel, is explained in terms of syllable structure, and not, as has been proposed in the past, because of some intrinsic contrast between the nasality of the vowels of these two words. Since [n] in *mon* is always triggered by the need to have an onset for the following word, the preceding vowel is in an open syllable, and is realized as a nasal vowel. In *bonne*, on the other hand, [n] is a coda, and as a consequence, the vowel [ɔ] is in a closed syllable and is lax and oral. The existence of such an allomorph justifies the liaison realization found in [bɔnami]. Also the behavior of the final consonants in the plural liaison is accounted for by the model proposed here. In *petits oléandres* ‘little oleanders’ the alternation between a realized [z] and a realized [t] in the plural of *petits*, but never of both, is explained with the necessity of realizing a single onset. In the feminine plural *petites anémones* ‘little anemones’, by contrast, [t] is a coda,

and [z] an onset, which explains why, in this case, both consonants may be pronounced.

The proposal is couched in an optimality-theoretic model (OT) which claims that the variety of surface forms of individual languages results from different rankings of a unique set of universal markedness and faithfulness constraints. For the liaison facts reviewed in this paper, it is crucial that markedness constraints actively determine the allophonic variation observed in correlation with syllable structure. Inputs present some amount of allophony, but are otherwise unspecified for syllable structure, emergence of a coda, vowel quality and gender specification. In general, the masculine preconsonantal allomorph is relatively unmarked as compared to the feminine or the liaison variant, and this is accounted for with ranking the constraints for the marked cases higher than those responsible for the unmarked pattern. “Elsewhere” effects (Kiparsky 1973) in OT are thus no longer the result of extra-rules, but arise from the interplay of ordinary constraints.

8. Appendix: Empirical evidence for variation

Two related experiments, one on perception and one on production, were conducted in order to test the reality of the variation exposed in the preceding sections, especially for the adjectives with three allomorphs. The production part of the experiment can be understood as a reproduction of Morin’s (1992) inquiry, mentioned in the preceding section, the difference being that stricter controlled conditions were used in the present case. The hypothesis, based on introspection and on Morin’s results, was that there would be variability in the tolerance of speakers, as well as in their pronunciation of the adjectives, depending on their frequency and on their suppletive status.

Stimuli, subjects, experimental set-up and results are discussed in turn.

8.1 Stimuli

For the perception experiment, twelve adjectives were inserted in one sentence each. They were always used prenominal, and the noun phrase they were part of was always sentence-final, so that they were maximally stressed. A few examples are given in (26). A trained phonetician read the sentences with the adjectives realized in three different ways, which are reproduced in IPA at the end of each sentence. In other words, three sentences for each adjective were included in the experimental material. There were two adjectives with a nasal vowel which are common in the prenominal position (*vilain* and *ancien*), two with a final tense or lax [e/ɛ] followed by *r* (*dernier* and *léger*) two with a tense/lax vowel followed by another consonant (*sot* and *parfait*), two ending with [s] or [z] in the liaison context, one very frequent (*gros*) and the other one, less frequent (*épais*), one ending with [t] or [d] (*grand*), one adjective with suppletive forms (*vieux*), and finally two adjectives with a nasal vowel which are usually postnominal (*mignon* and *fin*). No effort was made to produce a clear syllabification, and the adjective and the following noun were always realized in one phonological phrase with no break or tonal boundary between them.

(26) Experimental material

- a. vilain: Un marchand m'a proposé un vilain abricot a, b, c [vilẽ/vilẽn/vilen]
'A shopkeeper has offered me an ugly apricot.'
- b. dernier: Ce fut son dernier été[dẽrnjẽR/dẽrnjẽR/dẽrnjẽ]
'It was his last summer.'
- c. grand: On accédait au deuxième étage par un grand escalier [grãd/grãt/grã]
'One came to the second floor by means of a large staircase.'
- d. vieux: Il soigne un vieil ours [vjẽj, vjõz, vjõ]
'He takes care of an old bear.'
- e. fin: Mon collègue est un fin amateur d'oeuvres d'art [fin/fẽn/fẽ]
'My colleague is a fine art lover.'

In the production experiment, the same sentences were inserted in short dialogues which elicited three different information structural contexts: first, the whole sentence was new and wide focus was induced, second, only the adjective was focused, and third, only the following noun. The contexts are illustrated for one sentence only. Due to the experimental set-up, twice as much sentences with wide focus were elicited.

(27) Wide and narrow focus

a. First dialogue (wide focus, narrow focus on the noun)

A: Ce matin, je suis allée au marché. Je voulais acheter des fruits, et un marchand m'a proposé un vilain abricot. Il n'avait vraiment l'air de rien, mais il était délicieux. 'This morning, I went to the market. I wanted to buy fruit and a shopkeeper has offered me an ugly apricot. It didn't look great, but it was delicious.'

B: Il t'a proposé un vilain melon? 'He offered you an ugly melon?'

Non, un vilain ABRICOT.

b. Second dialogue (wide focus, narrow focus on the adjective)

A: Ce matin, je suis allée au marché. Je voulais acheter des fruits, et un marchand m'a proposé un vilain abricot. Il n'avait vraiment l'air de rien, mais il était délicieux.

B: Il t'a proposé un bel abricot? 'He offered you a beautiful apricot?'

C: Non, un VILAIN abricot.

8.2 Subjects

The subjects who participated in the experiments were students involved in an exchange program between Paris Nanterre and the University of Potsdam. They were native speakers of Standard French, aged between 20 and 24 years and had no known hearing or speech deficit. They had been students in law in Potsdam for less than four months at the time of the second experiment, and even less at the time of the first experiment. All were paid for their participation. One session lasted about 30 minutes.

8.3 Experimental set-up

Nine speakers took part to the perception experiment, and seven to the production experiment. Five of them participated in both. One month separated the two experiments, the perception experiment came first.

For the perception experiment, a set-up was conceived in which the subjects were alone in a quiet room with a DAT recorder and headphones. In a first step, the subjects had the opportunity to familiarize themselves with the speaker's voice and with the rhythm of the experiment. The subjects were instructed that they had to evaluate the phonetic realization of the adjective, and not the meaning or the syntax of the sentences. The experimenter gave short instructions and then left. The subjects had a sheet of paper and a pen and their task consisted in listen carefully to the adjectives and to write down a judgement on the acceptability of the realization of the adjective on a scale from 1 to 10, (the French school grading system), 1 being the worst and 10 the best. Every sentence was presented just once, but the sentences came in three different versions, with a different realization of the adjective in each version. The sentences were separated by fillers.

In the production experiments, two subjects were tested together, and the experimenter stayed in the room where the recording took place. The first informant (speaker A) read the first context sentence, then the second informant (speaker B) asked a question and speaker A answered it. The question elicited a narrow focus on either the adjective or the noun, as illustrated in (27). For every informant, her or his first contact with the sentences was in the role of speaker A. In the next session, which took place immediately afterwards, the same person took on the role of speaker B. The subjects were instructed to read the sentences as naturally as possible, in a normal conversational pace. In this experiment, too, they had the opportunity to familiarize themselves with the material, before the recordings could take place.

The recordings were analyzed auditorily by three trained phonologists who transcribed the realization. This was an easy task, and no conflict arose during the evaluation.

8.4 Results

The results of both experiments showed a variation along the expected line. The following table gives the end results for both perception, counted as average of the nine speakers for each realization, and production, represented as the sum of times each realization has been produced. The results in the production columns give all 28 realizations of every adjective together, wide focus and both kinds of narrow focus.

(28) Table 1: Experimental results

	produc	tion		percep	tion	
	Fem	Masc+C	Masc	Fem	Masc+C	Masc
Vilain abricot	ɛn 18	ẽn 5	ẽ 5	ɛn 6	ẽn 6	ẽ 6
Ancien ami	ɛn 24	ẽn 4	ẽ 0	ɛn 8	ẽn 6	ẽ 3,5
Dernier été	ɛR 19	eR 9	e 0	ɛR 10	eR 9	e 3,5
Léger espoir	ɛR 6	eR 20 (ez 2)	2 0	ɛR 8	eR 8	e 3
Sot enfant	sɔt 6	sɔt 20	so 2	sɔt 6	sɔt 7	so 4
Parfait amour	fɛt 26	fɛt 2	fe 3	fɛt 10	fɛt 6	fe 3
Gros	gROS	groZ	gro	gROS	groZ 8	gro

éléphant	1	22 (grot 3)	2	2		4
Épais amas	eɛs 0	epez 5	epe/ epe 23	eɛs 1	epez 5	epe 8
Grand escalier	grād 3	grāt 25	grā 0	grād 2	grāt 10	grā 2
Vieil ours	vjej 27	viøz 0	viø 1	vjej 8	viøz 2	viø 6
Mignon ange	ɲɔn 13	ɲõn 10	ɲõ 5	ɲɔn 5	ɲõn 3	ɲõ 3
Fin amateur	fɪn 6	fɛn 11 (fɛt 3)	fɛ 8	fɪn 2	fɛn 3,5	fɛ 9

As far as perception is concerned, an interesting pattern of variation can be observed. In some cases, as in *léger* and *dernier*, two realizations obtained the same, or nearly the same score. For *vilain*, all three realizations were exactly at the same level, since the average score was 6 in all cases. In other adjectives, like in *gros*, *épais*, *grand* and *fin*, one realization stood up high above the other two. In the case of *mignon*, by contrast, no realization got more than 5 points in average. This bad score may be due to the fact that, whatever the reason, the sequence *mignon ange* is definitely marked. For all adjectives, except for *épais* and *fin*, the preconsonantal masculine variant, the one without consonant, got the worst results. It can be said that, in general, liaison is expected and its absence is felt as unacceptable. As for the choice between the two remaining allomorphs, several cases must be distinguished. In *grand*, *gros* and *vieux*, which have special liaison forms, it is clear that it is exactly this form which did best. In the adjectives of special interest for the present paper, those with no suppletive liaison allomorphs, like *vilain*, *ancien*, *dernier*, *léger*, *sot* and *parfait*, both forms were judged to be nearly equivalent. In other words, speakers do not judge a liaison allomorph realized with a tense or a nasal vowel followed by a consonant as less acceptable than an allomorph with a lax vowel followed by a consonant.

It is interesting to see what the speakers did with the same adjectives in the production experiment. In most cases, the adjectives *vilain*, *ancien*, *dernier*, *léger*, *sot* and *parfait*, were realized with a final consonant. *Sot* and *léger* generally had a tense vowel, but the four other adjectives were realized most often with a lax vowel, though the proportion varied depending on the adjective considered. *Ancien* and *parfait* were nearly always realized with a lax vowel, but *vilain* and *dernier* much less so. Also *fin* was realized most often with a nasal vowel, though in the case of *mignon*, the realization with a lax vowel or with a nasal vowel were balanced. All in all, these data allow us to maintain the variation accounted for in the preceding section. Speakers do realize the masculine vowel followed by the closing consonant, and that in a large extent, as this limited experiment reveals.

As for the other adjectives, there were only few surprises. In the suppletive forms, it was expected that the lexicalized form would predominate, and this was unambiguously and straightforwardly confirmed. Interesting was the avoidance of the choice of a liaison consonant for *épais*. In the feminine, this adjective ends with [s], like *grosse*, but it has no suppletive liaison form with [z]. However, since there is no

usual prenominal adjective whose liaison consonant is [s], neither [s] nor [z] are felt as good solutions. If the speakers realized the consonant at all, it was as a voiced fricative, but they clearly preferred to left the consonant unrealized.

A second interesting observation is the relatively large number of so-called *pataquès*, the use of the wrong liaison consonant. *Léger* was realized twice with final [z], *gros* and *fin* each three times with [t]. One speaker realized three of the 8 *pataquès*, but the other realizations were distributed over the speakers. Some of the speakers corrected themselves spontaneously, though only after completing the sentence, and this was ignored for the results, since this corrected realization was not spontaneous enough.

The third remark concerns the difference between *dernier* which was most often realized with a lax vowel and *léger*, which had a tense vowel. Vowel harmony is clearly at play here, and the results obtained should thus be interpreted with caution. In *dernier*, the first syllable has a lax [ɛ], and in *léger*, we find a tense [e].

For the sake of completeness, the following table gives the result of the realizations distributed in the three environment. Interestingly no significant difference was found when comparing the realizations in the wide and in the narrow focus contexts. When comparing the numerical results, it should be kept in mind that there were twice as much realizations of the wide focus sentences.

(29) Table 2: Results of the production experiment

	Wide focus				[N] _F			
	Fem	Masc+C	Masc	Pataq	Fem	Masc+C	Masc.	Pataq
Vilain abricot	10 ɛn	2 ɛ̃n	2 ɛ̃		2 ɛn	3 ɛ̃n	2 ɛ̃	
Ancien ami	12 ɛn	2 ɛ̃n			5 ɛn	2 ɛ̃n		
Dernier été	10 ɛR	4 eR			6 ɛR	1 eR		
Léger espoir	2 ɛR	11 eR		1 ez	2 ɛR	4 eR		1 ez
Sot enfant	3 sɔt	10 sɔt	1 so		1 sɔt	6 sɔt		
Parfait amour	13 fɛt	1 fet			6 fet	1 fet		
Gros éléphant	1 gros	10 groz	1 gro	2 grot		6 groz		1 □□□□
Épais amas		2 epez 1 epez	3 epe 8 epe			2 epez	5 epe	
Grand escalier	1 grād	13 grāt			2 grād	5 grāt		
Vieil ours		14 vjej				7 vjej		
Mignon ange	7 ɲɔn	5 ɲɔ̃n	2 ɲɔ̃		2 ɲɔ̃n	3 ɲɔ̃n	2 ɲɔ̃	

Fin amateur	3 fɪn	5 fɛ̃n	3 fɛ̃	3 fɛ̃t	1 fɪn	3 fɛ̃n	3 fɛ̃	
Sum	62	80	20	6	27	41	14	2

To sum up, it is evident that a lot of variation is found in the way the way the liaison allomorphs are realized.

8.4 Conclusion

This section has examined in detail the allomorphy found in the prenominal adjectives in the liaison contexts in French from an empirical perspective. The different kinds of allomorphy found in the production experiments, and confirmed by the tolerance of speakers for the various realizations in the perception experiment have been given a new explanation. It has been shown that the phonology, especially when motivated by syllabification considerations, plays a much more important role than has been assumed so far. The syllabification approach to liaison facts proposed in the present paper is more restrictive and explains more facts than the earlier approaches, which have been entirely or partially based on prespecification of the allomorphs for gender. It is also based on general properties of the French phonology which are independently needed. The main properties of the proposed analysis can be summed up as follows.

(83) Properties of the adjective allomorphy in French

- (1) A feminine adjective is preferably closed by a coda.
- (2) Otherwise, due to markedness considerations, the preferred realization of an adjective is the one in which the final syllable is open.
- (3) A following vowel initial noun wants to have an onset, and this triggers the realization of the final consonant.
- (4) Allomorphs do not need to be prespecified for gender. They are generated and evaluated by OT surface constraints determining the syllable structure, the tenseness/laxness of the mid vowels and the markedness of feminine gender.
- (5) The quality of a mid vowel is lax in a closed syllable, and tense (or nasal) in an open syllable.
- (6) Gradiency and variation in the liaison allomorphs can be accounted for by a stochastic model of the grammar.

References

- Aikhenvald, Alexandra Y. (2000). *Classifiers: A Typology of Noun Categorization Devices*. Oxford: Oxford University Press.
- Boersma, Paul (1997). How we learn variation, optionality, and probability. *Proceedings of the Institute of Phonetic Sciences of the University of Amsterdam* **21**: 43–58.
- Boersma, Paul & Bruce Hayes (2001). Empirical tests of the Gradual Learning Algorithm. *Linguistic Inquiry* **32**:1. 45-86.
- Charette, Monik (1991). *Conditions on phonological government*. Cambridge: Cambridge University Press.
- Clements, G.N. & Keyser, S.J. (1983) CV phonology. *A generative theory of the syllable*. Cambridge, Massachusetts. MIT Press.
- Corbett, Greville (1991). *Gender*. Cambridge: Cambridge University Press.
- Dell, François (1973). *Les Règles et les Sons*. Paris: Hermann.
- Dell, François (1995). Consonant Clusters and Phonological Syllables in French. *Lingua* **95**. 5-26.
- Encrevé, Pierre (1986). *La Liaison avec et sans Enchaînement: Phonologie Tridimensionnelle*. Paris: Seuil.
- Féry, Caroline (2003a). Markedness, Faithfulness, Vowel Quality and Syllable Structure in French. *Journal of French Language Studies* **13**.1-33.
- Féry, Caroline (2003b). Gradedness in the segmental correlates of focus and prosodic phrasing in French. In: Trudel Meisenburg & Maria Selig (eds.) *Nouveaux départs en phonologie*. Tübingen: Narr.
- Fouché, P. (1959). *Traité de prononciation française*. 2nd ed. Paris: Klincksieck.
- Gaetone, David (1978). Forme sous-jacente unique ou liste d'allomorphes? *Linguistics* **214**. 33-54.
- Greenberg, Joseph (1966). *Language Universals: with Special Reference to Feature Hierarchies*. The Hague: Mouton.
- Grevisse, M. (1986). *Le bon usage. Grammaire française*. 12ième édition refondue par André Goosse. Paris.
- Judge, A. & Healey, F.G. (1983). *A Reference Grammar of Modern French*. London.
- Kaye, Jonathan & Yves-Charles Morin (1978). Il n'y a pas de règles de troncation, voyons!. In Dresser, Wolfgang & W. Meid (Eds.). *Proceedings of the Twelfth International Congress of Linguists*, Innsbruck. 788-792.
- Kiparsky, Paul (1973) Abstractness, Opacity, and Global Rules. In: *A Festschrift for Morris Halle*. New York: Holt, Rinehart, and Winston. 93-106.
- Klausenburger, J. (1974). Rule inversion, opacity, conspiracies: French liaison and elision. *Lingua* **34**. 167-179.
- Lamarque, Jacques (1996). Gender Agreement and suppletion in French. In Karen Zagana (ed.) *Grammatical Theory and Romance Languages*. Amsterdam: John Benjamins. 145-157.
- Langer, Ingrid (1998). Lexikalisch-funktionale Analyse des französischen Adjektivs. Konstanz. Arbeitspapier Nr. 90 des Fachbereichs Sprachwissenschaft.
- Martinet, André (1956). *Linguistique structurale et grammaire comparée. Travaux de l'Institut de Linguistique I*. Paris.
- McCarthy, John & Alan Price (1993a). *Prosodic Morphology I: constraint interaction and satisfaction*. Ms, University of Massachusetts, Amherst & Rutgers University. To appear, Cambridge, Mass.: MIT Press.
- McCarthy, John & Alan Prince (1993b). Generalized alignment. *Yearbook of Morphology 1993*. 79-153.
- McCarthy, John & Alan Prince (1994). Emergence of the unmarked : optimality in prosodic morphology. *NELS* **24**. 333-379.

- McCarthy, John & Alan Prince (1995). Faithfulness and reduplicative identity. In Jill Beckman, Laura Walsh Dickey & Suzanne Urbanczyk (eds.) *Papers in Optimality Theory*. Amherst: GLSA.
- Milner, Jean-Claude (1967). French Truncation Rule. *Quarterly Progress Report of the Research Laboratory of Electronics* **86**. MIT. 273-283.
- Morin, Yves-Charles (1992). Un cas méconnu de la déclinaison de l'adjectif français: Les formes de liaison de l'adjectif antéposé. In A. Clas (ed.) *Le mot, les mots, les bons mots*. Montréal: Presses de l'Université de Montréal. 112-128.
- Morin, Yves-Charles & Kaye Jonathan D. (1982). The syntactic bases for French Liaison. *Journal of Linguistics* **18**. 291-330.
- Nespor, Marina & Irene Vogel (1986). *Prosodic phonology*. Dordrecht: Foris.
- Noske, Roland (1984). Syllabification and Syllable Changing Rules in French. In H. van der Hulst & N. Smith (eds.) *The structure of phonological representation. Part II*. Dordrecht: Foris. 257-310.
- Oostendorp, Marc van (1999). *Phonological Projection: A Theory of Feature Content and Prosodic Structure*. Berlin: Mouton de Gruyter.
- Perlmutter, David. (1999). Interfaces: Explanation of Allomorphy and the Architecture of Grammars. In Steven Lapointe, Diane Brentari & Patrick Farrell (eds.) *Morphology and its Relation to Phonology and Syntax* Stanford: CSLI Publications. 307-338.
- Plénat, Marc (1987). On the structure of rime in Standard French. *Linguistics* **25**. 867-887.
- Prince, Alan & Paul Smolensky (1993). *Optimality Theory: Constraint interaction in generative grammar*. Ms, Rutgers University & University of Colorado, Boulder. To appear, Cambridge, Mass.: University Press.
- Post, Brechtje (1993). A Phonological Analysis of French Intonation. Master Thesis. Ms, Katholieke Universiteit Nijmegen.
- Prunet, Jean-François (1987). Liaison and nasalization in French. In Carol Neidle & Rafael Nuñez Cedeño (eds.) *Studies in Romance Languages*. Dordrecht: Foris. 225-235.
- Rialland, Annie (1986). Schwa et syllables en français. In Leo Wetzels & Engin Sezer (eds.) *Studies in Compensatory Lengthening*. Dordrecht: Foris. 187-226.
- Rialland, Annie (1994). The phonology and phonetics of extrasyllabicity in French. In P. A. Keating (ed.) *Phonological Structure and Phonetic Form. Papers in Laboratory Phonology 3*. Cambridge: Cambridge University Press. 136-159.
- Roché, Michel (1990). "Neutre" et pseudo-neutre en français. *Cahiers de Grammaire* **15**. 125-155.
- Rotenberg, J. (1978). The syntax of phonology. PhD Dissertation. MIT.
- Schane, Sanford A. (1965). *The Phonological and Morphological Structure of French*. PhD dissertation, MIT.
- Schane, Sanford A. (1970). Phonological and morphological markedness. In Manfred Bierwisch & Karl Erich Heidolph (eds.) *Progress in Linguistics*. The Hague: Mouton. 286-294.
- Selkirk, Elisabeth O. (1972). *The Phrase Phonology of English and French*. PhD dissertation, MIT.
- Spence, N.C.W. (1983). Some Reflections on Gender in French. *Zeitschrift für romanische Philologie* **99**. 16-28.
- Steriade, D. (1995). Positional neutralization. Ms, University of California, Los Angeles
- Steriade, D. (1999). Lexical Conservatism in French Adjectival Liaison. In J.-M. Authier, B.E. Bullock & L.A. Reed (eds.) *Formal perspectives on Romance linguistics*. Amsterdam/Philadelphia: John Benjamins Publishing Company. 243-270.
- Tranel, Bernard (1974). The phonology of nasal vowels in Modern French. PhD Dissertation. MIT.
- Tranel, Bernard (1981). *Concreteness in Generative Phonology: Evidence from French*. Berkeley: University of California Press.
- Tranel, Bernard (1990). On Suppletion and French Liaison. *Probus* **2**. 169-208.

- Tranel, Bernard (1996). French Liaison and Elision Revisited: A Unified Account within Optimality Theory. In Claudia Parodi, Carlos Quicoli, Mario Saltarelli & María Luisa Zubizarreta (eds.) *Aspects of Romance Linguistics*. Washington, D.C.: Georgetown University Press. 433-455.
- Tranel, Bernard (1999). Suppletion and OT: On the issue of the syntax/phonology interaction. In Emily Curtis, James Lyle & Gabriel Webster (eds.) *Proceedings of the Sixteenth West Coast Conference on Formal Linguistics*. Stanford: CSLI. 415-429.
- Wechsler, Stephen (2002). 'Elsewhere' in Gender Resolution'. In Kristin Hanson & Sharon Inkelas (eds.) *The Nature of the Word— Essays in Honor of Paul Kiparsky*. Cambridge, Mass.: MIT Press.
- Zoll, Cheryl (1996). *Parsing below the segment in a constraint-based framework*. Stanford: CSLI Publications.