Constraining exceptionality as prosody-morphology mismatch: a study of French nasal vowels

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1 Introduction

Instances of morpheme-specific phonology, where individual words or morphemes are associated with unique phonological patterns, have been a longstanding problem in generative phonology (Pater 2000; Mascaró 2007; Anttila 2002). The proposals of the paper are two-fold. First, I present a theory of prosodically-indexed markedness constraints as a means of deriving the sensitivity of phonotactic restrictions to prosodic structure. Second, I propose that exceptional allomorphy may arise through prosody-morphology mismatches which reduce prosodic boundary sizes. The workings of the theory are illustrated by an analysis of nasal vowels in French, accounting for variability in both prefix allomorphy and liaison, cases that have not previously received a uniform treatment (Côté, 2011; Tranel, 1981, and references therein).

This paper is organized as follows. The remainder of section 1 summarizes the basic distribution of nasal vowels in Standard French, and presents an account using prosodically-indexed constraints. Exceptions to the general pattern are proposed to be derived through a prosodic structure mismatch. The analysis is developed in greater depth in sections 2 and 3. Section 2 presents a description and analysis of the morpheme-internal distribution of nasal vowels. Section 3 discusses regular patterns of prefix allomorphy as compared with the exceptional prefix in-. Section 4 extends the proposals to account for liaison, analyzed as an exceptional pattern. Section 5 concludes the paper.

1.1 French nasal vowels and prosodic constraint indexation

There are three basic distributions of nasal vowels and nasal consonants in French. The observed pattern is largely determined by morphological constituency, such that looser restrictions apply in the presence of larger morphological junctures. Generally, nasal vowels are increasingly marked before more sonorous segments; the degree to which this preference is enforced depends on juncture strength.

Morpheme-internally, nasal vowels are admitted only before obstruents, with highly rare exceptions. However, the restriction is loosened for prefix nasal vowels; if the sequence $VX$ is broken up by a prefix boundary, nasal vowels are tolerated before obstruent and sonorant-initial stems, but not those beginning with glides or vowels. Across word boundaries, nasal vowels are unrestricted before all segment types. In essence, contextual restrictions on nasal vowels become increasingly weak before larger junctures. Furthermore, patterns triggered by exceptional morphemes nonetheless conform to one of the three types.
I propose that this sort of pattern is captured in parallel Optimality Theory (McCarthy & Prince, 1995; Prince & Smolensky, 1993) by the indexing of markedness constraints to prosodic constituents, a process referred to as *prosodic constraint indexation*. The basic claim is that markedness constraints have multiple instantiations, each indexed to a different constituent of the prosodic hierarchy. Each constraint is defined such that it is only violated if its targeted structure is fully contained within the indexed domain (cf. Pater, 2010). A general constraint schema is given in (1).

\[(1)\ M^{PCat}
\]

Given a marked structure \(M\) and a prosodic domain \(PCat\), assign a violation mark for any instance of \(M\) that is fully contained within \(PCat\).

Prosodic constraint indexation is an OT implementation of one of Prosodic Phonology’s core generalizations, that prosodic constituents serve as domains for the application of phonological rules and phonotactic restrictions (Nespor and Vogel 1986; Selkirk 1980). A similar proposal is made by Flack (2009) to account for restrictions on onsets and codas at various prosodic domain edges.

I account for the distribution of French nasal vowels using indexed instantiations of two markedness constraints: \(*\hat{V}[+\text{SON}]\) penalizes nasal vowels before sonorant segments, and \(*\hat{V}[-\text{CONS}]\) penalizes them before glides and vowels. To account for the morpheme-internal distribution, I propose that root morphemes are isomorphic to the minimal prosodic word (PWdMin). Since nasal vowels are prohibited before sonorant segments, the prosodically-indexed constraint \(*\hat{V}[+\text{SON}]^{PWdMIN}\) outranks relevant faithfulness constraints (\(*\hat{V}[+\text{SON}]^{PWdMIN} >> \text{IDENT}\)). Prefixes, however, are not subject to the same restriction since their nasal vowels surface faithfully before sonorant-initial stems (e.g. [g-nobliʃ] ‘to ennoble’). Thus, I propose that they are not contained in their stem’s PWdMin, and are directly adjoined to the maximal prosodic word (PWdMax) in an affixal clitic structure. At this level, the indexed constraint \(*\hat{V}[+\text{SON}]^{PWdMAX}\) is ranked below faithfulness, allowing nasal vowels to surface before sonorants. Since these nasal vowel-sonorant sequences are not completely contained within PWdMin, they incur no violation of \(*\hat{V}[+\text{SON}]^{PWdMIN}\). This prosodic structure allows boundary-sensitivity to be generated within a single constraint ranking, \(*\hat{V}[+\text{SON}]^{PWdMIN} >> \text{IDENT} >> *\hat{V}[+\text{SON}]^{PWdMAX}\).

\[
\text{PWdMax} \quad [\text{IDENT} >> *\hat{V}[+\text{SON}]^{PWdMAX}]
\]

\[
\text{PWdMin} \quad [*\hat{V}[+\text{SON}]^{PWdMIN} >> \text{IDENT}]
\]

\[
[n\tilde{a}-\tilde{r}a\tilde{k}yn]
\]

*Figure 1*: Affixal clitic structure for prefixed form [nə̃-ʁə̃kyn] ‘non-grudge’
Regardless of morphological complexity, nasal vowels do not precede glides or vowels word-internally. Thus, the more stringent constraint \( *\tilde{v}[-\text{CONS}]^{\text{PwMAX}} \) must outrank faithfulness. Since nasal vowels may appear before any segment crossing a word boundary, \( *\tilde{v}[-\text{CONS}]^{\text{PPH}} \), indexed to the next higher prosodic constituent (the prosodic phrase), is ranked below faithfulness.

The greater tolerance of marked sequences across prosodic junctures follows from a particular interaction among faithfulness and indexed markedness constraints. Specifically, consider markedness constraints \( \text{M}^{\text{PCat-Lg}} \) and \( \text{M}^{\text{PCat-Sm}} \), where the former is indexed to a hierarchically greater prosodic constituent. A markedness constraint enforced within the small domain will fail to apply to sequences spanning two such constituents given the constraint ranking in (2).

\[
(2) \quad \text{M}^{\text{PCat-Sm}} >> \text{F} >> \text{M}^{\text{PCat-Lg}}
\]

This pattern of constraint interaction generates a form of derived environment blocking, where a phonological process that applies within a domain fails to do so across a juncture. Whereas such effects are a subset of the rich variety of morphology-phonology interactions (for a recent overview see Inkelas, 2011), they are the focus of the present paper.

### 1.2 The emergence of exceptionality

There are several systematic exceptions to the general distributions described above. For each exceptional case, the observed distribution of nasal vowels corresponds to a pattern associated with a smaller prosodic boundary. For instance, while prefix nasal vowels may generally surface before sonorant-initial stems, prefix in- only surfaces with a nasal vowel before obstruent-initial stems, mirroring the morpheme-internal pattern.

I propose that these exceptional items are prosodified into a more reduced structure where prosodic boundaries are consolidated, a process referred to as exceptionality through prosodification. The elimination of boundaries consequently induces a stricter pattern of constraint interaction where markedness is higher-ranked. This is illustrated in figure 2 for the minimal pair *mignon objet* ‘cute object’ and *commun objet* ‘common object.’ Following (Sampson 2001), I propose that the no liaison pattern exemplified by *mignon objet* is the default across word boundaries, while the insertion of a linking consonant is the result of a lexical exception.

The regular no-liaison pattern corresponds with the structure on the left of the figure: \( *\tilde{v}[-\text{CONS}]^{\text{PwMAX}} \) is not violated since the output [ɔ̃o] sequence is separated a prosodic word boundary. Although the sequence incurs one violation of \( *\tilde{v}[-\text{CONS}]^{\text{PPH}} \), no linking consonant is inserted due to the ranking \( \text{DEP}>>*\tilde{v}[-\text{CONS}]^{\text{PPH}} \). The liaison-triggering adjective *commun* is exceptionally prosodified as an affixal clitic. Since it is contained within the same PwdMax as its following
noun, a linking consonant is inserted to avoid an output with \[\tilde{\varepsilon}o\], which would violate the higher-ranked \(*\tilde{V}[-\text{CONS}]^{\text{PWdMAX}}\).

\[
\begin{align*}
\text{PPhr} & \quad \text{vs.} \quad \text{PWdMax}^\text{Min} \\
\text{PWdMax} & \quad \text{PWdMax}^\text{Min} \\
\text{Input:} & \quad /\text{mijn}\tilde{\varepsilon}/ /\text{ob}\tilde{z}e/ /\text{kôm}\tilde{e}/ /\text{ob}\tilde{z}e/ \\
\text{Output:} & \quad [\text{mijn}\tilde{e} \quad \text{ob}\tilde{z}e] \quad [\text{kôm}\tilde{e} \quad \text{n ob}\tilde{z}e]
\end{align*}
\]

**Figure 2:** Different prosodifications of identical sequences create different outputs

To summarize the paper’s claims, three distributions of nasal vowels are derived by the indexation of markedness constraints to three prosodic constituents. Three sub-rankings correspond with regular patterns at some boundary or lack thereof. Exceptional items each reflect a regular pattern observed across a smaller juncture, which follows from their reduced prosodic constituency.

\[
\begin{align*}
\text{PPh Ranking:} & \quad \text{DEP}>>*\tilde{V}[-\text{CONS}]^{\text{PPH}}, *\tilde{V}[-\text{SON}]^{\text{PPH}} \\
\text{Regular pattern:} & \quad \text{regular blocking of liaison, no restrictions on } \tilde{V}X \\
\text{PWdMax Ranking:} & \quad *\tilde{V}[-\text{CONS}]^{\text{PWdMAX}} >> \text{DEP, IDENT(NAS)}>>*\tilde{V}[-\text{SON}]^{\text{PWdMAX}} \\
\text{Regular pattern:} & \quad \text{regular prefix allomorphy} \\
\text{Exceptional patterns:} & \quad \text{liaison with nasalization} \\
\text{PWdMin Ranking:} & \quad *\tilde{V}[-\text{SON}]^{\text{PWdMIN}} >> \text{MAX, IDENT(NAS), UNIFORMITY} \\
\text{Regular pattern:} & \quad \text{morpheme-internal phonotactics} \\
\text{Exceptional patterns:} & \quad \text{liaison with denasalization, in- allomorphy}
\end{align*}
\]

**Figure 3:** Summary of nasal vowel patterns and associated constraint rankings

The notion that exceptionality can be correlated with reduced prosodic structure is consistent with several independent claims. For instance, the unique phonological patterning of functional elements has been attributed to similar prosodic structure mismatches (Selkirk 1996). Furthermore, frequent and exceptional items display a tendency to have shortened duration relative to more infrequent ones, a generalization true of words, word pairs, and even syntactic structures (Gahl & Garnsey, 2004 and references therein). A different line of research has further indicated a correlation between duration and prosodic boundary size, where shorter syllable durations are observed before smaller boundaries (Varis, 2012).
The patterning of French nasal vowels and the exceptions to their basic distributions are analyzed in greater detail in the sections that follow.

2 Morpheme-internal nasal vowels in French

One of the earliest problems studied in the generative phonology of French is the distribution of nasal vowels (Ṽ) in relation to sequences of oral vowels followed by nasal consonants (VN) (Schane 1968; Dell 1985; Tranel 1981). Both are restricted in the types of segments that they precede; in non word-final contexts VN precedes only vowels (3), whereas Ṽ precedes only consonants (4).

(3) inɔ̃de 'to inundate'  (4) ɛ̃po 'tax'
anɔnim 'anonymous'  ābisjɔ 'ambition'
ənœʁ 'honor'  ād 'wave'
aliziz 'analysis'  kɛz 'fifteen'
enɔm 'enormous'  āvibɔ 'roughly'

I propose that the dispreference of VN sequences before consonants is due to a restriction against nasal consonants followed by other consonants, a constraint formulated as *NC. This appears closely related to the well-attested markedness of nasals before voiceless segments (Pater 1999), and it likely follows from the fact that nasals generally have reduced acoustic place cues in pre-consonantal positions (Jun 2004). As will be shown in section 3, such a constraint also becomes crucial for a proper analysis of French prefix allomorphy1.

(5) *NC
Assign a violation for any nasal consonant preceding another consonant.

A closer examination of the distribution of nasal vowels shows that their acceptability is further dependent on the sonority of the following segment. Two observations are critical: word-internal nasal vowels never precede glides or other vowels (oral or nasal), and they are statistically underattested before sonorants.

Regarding the first claim, there are no instances of nasal vowels preceding another vowel within the same word, (*ṼṼ or *ṼṼ). This is a stronger restriction than the dispreference of vowel hiatus, since hiatus is attested when the first vowel is oral (eg. [kɔʁyɛl] 'cruel,' [nɛif] 'naïve'). Similarly, nasal vowels are never attested before glide consonants /w, ɥ, j/. This follows to some extent from the restricted distribution of glides more generally (Tranel 1987). For instance, the absence of nasal vowels before /w/ and /ɥ/ is due to the fact that neither glide can be a singleton onset in non word-initial syllables. However, /j/ is a permissible

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1 NC sequences in French are restricted to a highly limited number of native words (eg. [bins] 'disorder,' [klamse] 'to croak') and a somewhat larger class of loanwords (eg. [amnezi] 'amnesia,' [wikɛnd] 'weekend'). Instances of surface NC may also result from the complex process of schwa-deletion (eg. /samɔdi/ → [samdi] 'Saturday') (Schane 1968; Dell 1985).
onset following oral vowels, as in [kaju] 'pebble' and [lwajal] 'loyal.' Since glides are the consonants closest in sonority to vowels, the absence of nasal vowels before both types of segments is not surprising.

Furthermore, it is not the case that nasal vowels occur freely before all other consonant segments. While they generally occur freely before each of the language’s 12 obstruent phonemes (/p, b, f, v, t, d, s, z, ñ, ñ, k, g/), nasal vowels are significantly underattested before non-glide sonorants /m, n, l, ř/. I quantified this by comparing observed co-occurrence probabilities of nasal vowels before various consonants to their expected values given an equal distribution of consonant types. This was examined using a version of the Corpaix corpus of spoken French, restricted to items with a minimum of 10 transcribed tokens (Véronis 2000).

The corpus consists of a list of 4601 orthographically transcribed words which are not otherwise morphologically segmented. Token frequencies of individual items were not included in the present analysis. Items containing nasal vowels followed by consonants (VC) were isolated by searching for orthographic sequences VNCX, where V is any vowel, N is a nasal consonant n or m, C is any consonant, and X is any segment. A small number of non-target forms were manually removed, notably sequences of form VNNV which contain no nasal vowel (e.g. femme [fam] ‘woman’), and sequences VNCS where orthographic s does not trigger the pronunciation of the previous consonant (e.g. temps [tã] ‘time’).

Following this procedure, 876 types containing VC are obtained, roughly 20% of the total corpus. Table 1 compares the observed (O) number of items containing VC before both obstruent and sonorant consonants and the expected (E) number of such forms that would be found if each segment surfaced with equal frequency after nasal vowels.

<table>
<thead>
<tr>
<th>Sonorants</th>
<th>O/E</th>
<th>Obstruents</th>
<th>O/E</th>
</tr>
</thead>
<tbody>
<tr>
<td>[m, n, l, ř]</td>
<td>16</td>
<td>[p, b, f, v, t, d, s, z, ñ, ñ, k, g]</td>
<td>860</td>
</tr>
</tbody>
</table>

Table 1: Observed and expected frequencies of V before sonorants and obstruents

The low observed over expected (O/E) ratio for VC+[SON], 0.073, confirms that there is a strong dispreference for nasal vowels preceding sonorant consonants. On the other hand, there is no such restriction against nasal vowels before obstruents, which are somewhat overattested (O/E=1.3). The above values were calculated over types independent of token frequency, and included both mono-morphemic and morphologically complex items. Given that morphologically complex forms are more tolerant of VC+[SON] across morpheme boundaries (further discussed in section 3), the rarity of such structures would likely be more pronounced in a mono-morphemic corpus.
Given that nasal vowels are underattested before sonorants generally, and fully absent before vowels and glides, the emergent generalization is that nasal vowels become more marked as the sonority of the following segment increases. I propose that the pattern is enforced by two markedness constraints penalizing nasal vowels before sonorous segments, *Ṽ[+SON] and *Ṽ[-CONS]. As will be shown in section 3, both constraints are necessary to account for the general pattern of prefix allomorphy.

(6) *Ṽ[+SON]
Assign a violation for any nasal vowel immediately followed by a [+SON] segment.

(7) *Ṽ[-CONS]
Assign a violation for any nasal vowel immediately followed by a [-CONS] segment.

2.1 Optimality Theoretic analysis of the morpheme-internal pattern
As laid out in section 1, instantiations of each markedness constraint are indexed to prosodic constituents. In the analysis of morpheme-internal phonotactics, we will be concerned with versions indexed to the minimal prosodic word.

The constraint ranking is briefly illustrated below using hypothetical inputs containing marked forms. We first consider a hypothetical input with a VNC sequence, where C is an obstruent. This may be repaired by either fusion (VN→Ṽ) or deletion of the nasal consonant. Thus, *NC[PwDMIN] outranks MAX and UNIFORMITY.

(8) Ranking arguments: *NC[PwDMIN] >> MAX, UNIFORMITY

<table>
<thead>
<tr>
<th>/ənd/</th>
<th>*NC[PwDMIN]</th>
<th>MAX</th>
<th>UNIFORMITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>ənd</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*əɾ əd</td>
<td>*!</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>*əɾ 5d</td>
<td>*!</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

Where an input VNC sequence ends in a sonorant consonant, deletion of the nasal consonant is preferred over fusion, since fusion results in an ill-formed Ṽ[+SON] sequence. Either *Ṽ[+SON][PwDMIN] or UNIFORMITY must outrank MAX.

(9) Ranking arguments: *Ṽ[+SON][PwDMIN] >> MAX or UNIFORMITY >> MAX

<table>
<thead>
<tr>
<th>/ənliv/</th>
<th>*NC[PwDMIN]</th>
<th>*Ṽ[+SON][PwDMIN]</th>
<th>MAX</th>
<th>UNIFORMITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>ənliv</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*əɾ əliv</td>
<td>*!</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>*əɾ əliv</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lastly, since nasal vowels do not surface before sonorant consonants, 
\[ *{\mathcal{V}}^{+[\text{SON}]}^{\text{PWdMIN}} \text{ outranks } \text{IDENT(\text{NASAL})}. \]

(10) Ranking arguments: 
\[ *{\mathcal{V}}^{+[\text{SON}]}^{\text{PWdMIN}} \gg \text{IDENT(\text{NASAL})} \]

| \( \text{\textipa{\v{n}ncek}} \) | \( *\! \) | \( \text{IDENT(\text{NASAL})} \) |
| \( \text{\textipa{\v{n}ncek}} \) | \( *! \) | \( \text{IDENT(\text{NASAL})} \) |

The necessary constraint rankings associated with the morpheme-internal pattern are summarized below. In this and all subsequent Hasse diagrams, prosodically-indexed markedness constraints are boxed.

(11) Morpheme-internal phonotactics
Pattern: \( \mathcal{V} \) precedes only obstruents

\[ *{\mathcal{V}}^{+[\text{SON}]}^{\text{PWdMIN}} \gg *\! \text{NC}^{\text{PWdMIN}} \]

\[ \text{IDENT(\text{NASAL})} \quad \text{MAX} \quad \text{UNIFORMITY} \]

3 Prefix allomorphy and variability
This section considers two patterns of phonologically conditioned allomorphy which emerge on prefixes with allomorphs ending in a nasal vowel. Specifically, we contrast a dominant pattern exemplified by prefixes bien-, en-, and non- with the alternations of the negational prefix in-.

3.1 Regular prefix allomorphy: en-, non-, and bien-
Most prefixes in French exhibit a pattern of allomorphy which is inconsistent with the stem-internal pattern. The relevant difference is that nasal vowels are permitted before sonorant consonants, whereas root-internally they appear only before obstruents. Before vowel-initial stems, such prefixes emerge with a nasal vowel and a coronal nasal consonant.

(12) \( \text{\textipa{\v{n}-ivkə}} \) 'to intoxicate’  \( \text{nõn-ëskkə} \) ‘unregistered’
\( \text{\textipa{\v{n}-amukə}} \) 'to enamor’  \( \text{nõn-äplwa} \) ‘unemployment’
\( \text{\textipa{\v{n}-ōkæjikə}} \) ‘to make proud’  \( \text{nõn-inisje} \) ‘uninitiated’

The same prefixes end with a nasal vowel when affixed to a consonant-initial stem, regardless of the following consonant’s sonority.

(13) \( \text{\textipa{ā-kəsə}} \) 'to cash'  \( \text{nõ-fōksjɔ̃mə} \) ‘non-function’
\( \text{\textipa{ā-noblis}} \) 'to ennable'  \( \text{nõ-põmə} \) ‘non-payment’
\( \text{\textipa{ā-kiʃjikə}} \) 'to enrich'  \( \text{nõ-nœspə} \) ‘non-respect’
\( \text{\textipa{ā-lase}} \) 'to enlace'  \( \text{nõ-ljo} \) ‘dismissal’
The morpheme-internal rankings presented in section 2 are incapable of generating this pattern, principally since prefix nasal vowels surface faithfully before sonorant consonants. This is true regardless of which morpheme the following consonant is associated with, as shown by [ā-nobliʁ] ‘to ennoble’ and [ān-amuʁe] ‘to enamor.’ Since potential repair processes are blocked across the affix boundary, I propose that these prefixes do not belong to the same PWdMin constituent as their stems, and are instead directly incorporated into the maximal prosodic word (PWdMax) in an affixal clitic structure. This is illustrated in (14) with enrichir ‘to enrich.’

(14) PWdMax
       └── PWdMin
           └── [ā n̪iʁ iʁ]

The analysis is briefly summarized as follows: the morpheme-internal constraint ranking applies only within PWdMin, where the ranking *Ṽ[+SON]PWdMin >> IDENT(NASAL) prevents nasal vowels from surfacing before sonorants. However, since the nasal vowel associated with the prefix is not contained within PWdMin, that restriction fails to apply across the morpheme boundary. Within PWdMax, the constraint ranking IDENT(NASAL) >> *Ṽ[+SON]PWdMax requires nasal vowels to surface faithfully before sonorant consonants.

The ranking arguments are illustrated by hypothetical inputs containing the ‘wrong’ allomorph. If the allomorph containing a nasal consonant precedes a stem beginning with a sonorant consonant, as shown in (15), the faithful candidate [ān + lase] is prevented from winning by ranking *NCPWdMax above MAX, just like its counterpart *NCPWdMin. The winning candidate [ālase] is obtained by deleting the nasal consonant. Since the prefix nasal vowel retains its nasalization before the stem-initial sonorant, IDENT(NASAL) dominates *Ṽ[+SON]PWdMax. It is additionally necessary for *NCPWdMax to dominate *Ṽ[+SON]PWdMax.

(15) Ranking arguments: *NCPWdMax >> MAX, *Ṽ[+SON]PWdMax

<table>
<thead>
<tr>
<th>/ān + lase/</th>
<th>*NCPWdMax</th>
<th>MAX</th>
<th>IDENT(NASAL)</th>
<th>*Ṽ[+SON]PWdMax</th>
</tr>
</thead>
<tbody>
<tr>
<td>ānlase</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ālase</td>
<td></td>
<td>!</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>ālase</td>
<td>*</td>
<td></td>
<td>*!</td>
<td></td>
</tr>
</tbody>
</table>

In the opposing case, the input contains a nasal vowel before a vowel-initial stem, as in (16). The fully faithful output candidate can no longer be eliminated by *Ṽ[+SON]PWdMax, which is ranked below IDENT(NASAL). To select a non-faithful
candidate, it is thus crucial to invoke the constraint which specifically penalizes nasal vowels before other vowels, *Ṽ[-CONS]. I propose that winning candidate [āniv̟e] is obtained by the epenthesis of a linking consonant (cf. Côté, 2008 for liaison), and not ‘unpacking’ of the nasal vowel. As such, the constraint *Ṽ[-CONS] \text{PWdMax} dominates DEP.

(16) Ranking arguments: \text{IDENT(NASAL)} \gg *Ṽ[+SON] \text{PWdMax}

\begin{array}{|c|c|c|}
\hline
\text{āiv̟e} & *! & \text{IDENT(NASAL)}
\hline
\text{ēiv̟e} & * & *
\hline
\text{āiv̟e} & *! & *
\hline
\end{array}

To summarize, two attested patterns, the morpheme-internal phonotactics and regular prefix allomorphy, are derived through the indexation of markedness constraints to prosodic constituents. Crucially, the constraint *Ṽ[+SON] \text{PWdMIN} must dominate IDENT(NASAL), which must in turn dominate *Ṽ[+SON] \text{PWdMAX}.

(17) \textbf{Regular prefix allomorphy}

Pattern: Ķ precedes obstruents and non-vocalic sonorants.

\begin{center}
\text{\text{NC} \text{PWdMAX} \mid \text{IDENT(NASAL)} \mid \text{DEP} \mid *Ṽ[+SON] \text{PWdMAX}}
\end{center}

3.2 \textbf{Exceptional prefix allomorphy: the case of in-}

The negational prefix in- has a pattern of allomorphy which distinguishes it from the regular class of prefixes discussed above. The prefix has three allomorphs: [in] for vowel-initial stems, [ē] for obstruent-initial stems, and [i] for sonorant-initial stems.

(18) in-imitabl 'inimitable'
in-aksesibl 'inaccessible'

(19) ē-ruv̟ 'impure'
ě-fajibl 'infallible'
ě-byv̟abl 'undrinkable'
ě-vašjabl 'invariable'

(20) i-nŏb̟abl 'innumerable'
i-možal 'immoral'
i-keal 'unreal'
i-ložik 'illogical'

The relevant observation is that the pattern of allomorph selection mimics the morpheme-internal pattern, where *Ṽ[+SON] and *NC are never violated. The
patterning of in- cannot be accounted for by the analysis given for other prefixes. Thus, I propose that the in- is exceptionally contained within the same PWdMin node as its following stem, thus subjecting it to the constraint ranking associated with morpheme-internal phonotactics.

(21) PWdMin

\[ [i \text{ logik}] \]

The constraint ranking proposed on the basis of morpheme-internal phonotactics can account for in- allomorphy with a minor elaboration of the ranking among faithfulness constraints. The allomorph selection for obstruent-initial and sonorant-initial stems is shown in tableaux (22) and (23), which may be compared with (8) and (9) in section 2.1.

(22) Ranking arguments: \(^{*}\text{NC}^{\text{PWdMin}} \gg \text{MAX, UNIFORMITY} \)

\[
\begin{array}{|c|c|c|c|}
\hline
/in+defini/ & \text{MAX} & \text{IDENT(NASAL)} & \text{UNIFORMITY} \\
\hline
\text{indefini} & ! & & \\
\text{idefini} & ! & & \\
\text{ɛ̃ defini} & ! & * & * \\
\hline
\end{array}
\]

(23) Ranking arguments: \(^{*}\text{Ṽ}^{[+SON]}^{\text{PWdMin}} \gg \text{MAX} \)

\[
\begin{array}{|c|c|c|c|}
\hline
/in+loʒik/ & \text{NC}^{\text{PWdMin}} & \text{Ṽ}^{[+SON]}^{\text{PWdMin}} & \text{MAX} & \text{UNIFORMITY} \\
\hline
\text{inloʒik} & ! & ! & & \\
\text{ɛ̃ loʒik} & ! & ! & * & \\
\text{ɛ̃ loʒik} & ! & ! & & \\
\hline
\end{array}
\]

4 Liaison

In its most basic description, liaison is the pronunciation of a linking consonant between two words when the second word is vowel-initial. However, its proper analysis has proven to be one of the most challenging issues in French phonology, largely due to factors concerning its variability (Côté 2011). Here, I exclusively discuss liaison with [n], given its interaction with nasal vowels.

4.1 Variability in liaison

It has long been observed that liaison is sensitive to phrasal structure. As shown by Selkirk (1972), its domains of application correspond indirectly with certain syntactic constituents, an early argument for the independent existence of prosodic organization. This paper focuses solely on syntactic configurations where liaison has traditionally been analyzed as obligatory, roughly characterized as sequences where a noun is immediately preceded by a modifier, or a verb is preceded by a pronoun.
Where liaison is expected, one pattern of variation has received particular attention. Depending on the first word of the pair, liaison may either result in denasalization of a preceding nasal vowel (24a) or have no effect on its nasalization (24b). Furthermore, speakers generally concur as to which pattern any given liaison-triggering word is associated with (Tranel 1981; Sampson 2001). Though the fact has received relatively less theoretical attention, liaison fails to apply at all for certain adjectives, typically those which can be either pre-nominal or post-nominal, as shown in (24c). In this case, the first word’s nasal vowel surfaces faithfully before the vowel-initial second word. Although the zero liaison pattern is statistically infrequent, it appears to be the productive pattern applied by speakers to novel contexts, as shown by Sampson (2001).

(24) Patterns observed across word boundaries
   a. bon ami ‘good friend’ [bɔ̃] + [ami] → [bɔ n ami]
   b. mon ami ‘my friend’ [mɔ̃] + [ami] → [mɔ̃ n ami]
   c. mignon objet ‘cute object’ [mɪɲɔ̃] + [obʒe] → [mɪɲɔ̃ obʒe]

The two classes of liaison-triggering items each display relative syntactic uniformity. Those which are denasalized are exclusively pre-nominal masculine adjectives (but not all of them). Those which retain nasalization are primarily clitics and masculine pronominal possessors; however, this class also includes several adjectives such as commun ‘common’. Between modifier-noun pairs, the zero liaison pattern seems to occur uniquely with adjectives of lower frequency.

I adopt Sampson’s argument that liaison is best analyzed as an exceptional process that deviates from a productive, default no-liaison pattern. The two liaison types can be accounted for using exceptionality through prosodification. To briefly summarize the analysis, words which trigger liaison with nasalization are exceptionally prosodified like regular affixes, while words which trigger liaison without nasalization are prosodified in the same minimal prosodic word as the following item. The analysis is consistent with the fact that clitics, which trigger liaison with nasalization, tend to be prosodically reduced (Selkirk 1996). A similar hypothesis is advanced by Bybee (2001), who analyzes liaison as an exceptional process maintained by high token frequencies.

4.2 Nasal vowels at prosodic junctures: an OT analysis
I consider the productive no liaison pattern to be the one that applies across maximal prosodic word boundaries. Since the no-liaison pattern creates a ÊV sequence across the word juncture, a pattern not tolerated word-internally, *Ê[-CONS] is no longer enforced. This shows that *Ê[-CONS]^{PPh} must be ranked below Dep or any other faithfulness constraint whose violation would repair the structure.
I propose that both liaison patterns are derived by epenthesis of the linking consonant (Côté, 2008 and references therein). All liaison-triggering items are prosodified into the same PWdMax constituent as the following word. As such, epenthesis is driven by the ranking \*\( V\left[-\text{CONS}\right]\)PWdMax >> DEP. The liaison with nasalization pattern is derived by the affixal clitic structure also associated with regular prefix allomorphy. Note the identical patterns of constraint interaction in tableaux (28) and (16).

Liaison without nasalization is derived by prosodifying the triggering item into its following word’s PWdMin node, the same exceptional structure associated with the prefix \textit{in-}. In addition to the insertion of a nasal consonant, the high ranking of \*\( V\left[+\text{SON}\right]\)PWdMin forces the additional denasalization of the nasal vowel.
5 Conclusion

This paper has presented an initial theory of prosodic constraint indexation, the indexing of markedness constraints to prosodic domains. This is shown to derive the blocking of markedness-reducing processes across prosodic junctures. I have also argued that the framework allows certain exceptional phonological patterns to be derived through a prosody-morphology mismatch.

Three distributions of nasal vowels in French arise from the indexation of *\(\tilde{V}[-\text{CONS}]\), *\(\tilde{V}[+\text{SON}]\), and *\(\text{NC}\) to three prosodic constituents. The relative rankings of their prosodically-indexed instantiations are given in (31). The increased tolerance of marked sequences which span morpheme and word junctures is derived from the fact that prosodically-indexed constraints are only violated by structures contained fully within them.

\[
\begin{array}{lcl}
\text{b̃ am} & \Rightarrow & \text{**!} \quad \text{**} \\
\text{b̃ n am} & \Rightarrow & \text{**!} \\
\text{b̃ n am} & \Rightarrow & \text{**!} \\
\end{array}
\]

(31) Liaison with denasalization – PWdMin ranking.

<table>
<thead>
<tr>
<th></th>
<th>*(\tilde{V}[-\text{CONS}])_{PWdMax}</th>
<th>*(\tilde{V}[+\text{SON}])_{PWdMin}</th>
<th>IDENT(NAS)</th>
<th>DEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>b̃ am</td>
<td>**!</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b̃ n am</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b̃ n am</td>
<td></td>
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References