High vowel nasalization and contrast preservation in French

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Main points:

• French appears to present a case of anti-neutralization where regressive nasalization applies only to vowels which do not have contrastive counterparts (i.e., high vowels).

• As partial height neutralization must create the gap for nasalization to apply, this case of anti-neutralization is more difficult to formalize.

• In this presentation, I offer a product-oriented analysis which captures the central role of contrast and does not depend on underspecification, using Preservation of Contrast theory (Łubowicz 2002, 2012).

1. Introduction

(1) Obstacles to anti-neutralization in Optimality Theory (OT):

• Contrast, though still a distributional property, not built into grammar as a pre-derivational restriction (cf. Richness of the Base).

• Rule/process undergoers not specified — determined rather by goodness of output structure and correspondence with input structure

• Without source-oriented generalizations, contrast-based blocking requires ability to “look backwards.”

(2) The French Paradox (cf. §2): input high nasal vowels lowered (/i̯n/ → [e̞]), while only high vowels undergo regressive nasalization (/in/ → [e̞n], /ε̞n/ → [ε̞n], *[ε̞n], etc.).
(3) Previous accounts:

a. **Source-oriented**: high vowels specified as sole undergoers (esp. rule-based analyses); no paradox, but lacks explanatory adequacy.

b. **Representational**: high oral vowels are underspecified and thus can undergo nasalization (e.g., Spears 2006); captures role of contrast but risks circularity and does not address deeper concerns (esp. markedness relations).

(4) Analyzed here as *anti-neutralization*: nasalization applies only insofar as it creates allophonic outputs $\approx$ blocked where neutralized outputs would be created.

(5) Since the gap for nasalization must be created by lowering, single-constraint anti-neutralization approaches *Merge* (Padgett 2003) and NoNeutralization (Kiparsky 2008) prove too strong.


2. Background

2.1. Data

(7) $[\tilde{V}] \sim [VN]$ alternations in French (e.g., masculine $\sim$ feminine):

<table>
<thead>
<tr>
<th>Faithful</th>
<th>Unfaithful</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. $[\text{peiz\tilde{a}}] \sim [\text{peizan}]$</td>
<td>e. $[\tilde{f}e] \sim [\text{fin}]$</td>
</tr>
<tr>
<td>b. $[\text{se\text{'e}rt\tilde{e}}] \sim [\text{se\text{'e}rt\tilde{en}}]$</td>
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<tr>
<td>c. $[\text{b\text{'e}}] \sim [\text{bon}]$</td>
<td>f. $[\text{b\text{'e}\tilde{e}}] \sim [\text{b\text{'e}yn}]$</td>
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</tbody>
</table>

d. $[\text{f\text{\'e}}] \sim [\text{fin}]$

e. $[\text{f\text{\'e}}] \sim [\text{fin}]$

(8) Traditional analysis:

- Underlying vowel quality inferred from [VN] (e.g., Schane 1968).
- Where alternations occur, $[\tilde{V}] \leftarrow$ vowel + floating [nasal], /VN/ (e.g., Tranel 1992).
- High nasal vowel lowering: /i\text{\'e}, y\text{\'e}/ $\rightarrow [\text{\'e}(, \text{\'e})]$ — when motivated phonologically, by markedness (cf. José & Auger 2004 for Picard).

(9) In instrumental studies on regressive nasalization in French, rates often highest on high vowels (cf. below; counterexamples: Clumeck 1976, Montagu 2007).
<table>
<thead>
<tr>
<th>Study</th>
<th>Method</th>
<th>/i/</th>
<th>/ɛ/</th>
<th>/a/</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Delvaux et al. 2008</td>
<td>Aerodynamic</td>
<td>22%</td>
<td>7%</td>
<td></td>
</tr>
<tr>
<td>b. Dow 2014</td>
<td>Nasometric</td>
<td>66–84%</td>
<td>27–40%</td>
<td>23–24%</td>
</tr>
<tr>
<td>c. Rochet &amp; Rochet 1991</td>
<td>Nasometric</td>
<td>60%</td>
<td>25%</td>
<td>20%</td>
</tr>
<tr>
<td>d. Spears 2006</td>
<td>Acoustic</td>
<td>57%</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>e. Montagu 2007</td>
<td>Nasometric?</td>
<td>35%</td>
<td>35%</td>
<td>45%</td>
</tr>
</tbody>
</table>

2.2. Possible explanations

(10) **The paradox:** one part of the grammar penalizes only high nasal vowels, while another seemingly prefers them alone (assume simple threshold: nasality > 50% = [+nasal]).

(11) Competing explanations offer contradictory conclusions regarding markedness relations among \( \tilde{V} \), linked to concerns about the scope of nasalization.

(12) Inventory production: non-high \( \tilde{V} \) less marked than high \( \tilde{V} \)?

- Processes repairing illicit structure lead to a reduction in markedness.
- \( /\i^u/ \rightarrow [\ddot{e}] \) implies the former is more marked.
- **Supporting evidence:** mid & low vowels inherently longer than high, and nasal-ity preferred on long vowels (cf. Hajek 1997).

(13) Regressive nasalization: high \( \tilde{V} \) less marked than non-high \( \tilde{V} \)?

- Processes generally do not favor marked forms *to the exclusion* of less marked.
- If nasalization targets *only* high vowels, they should be least marked.
- **Supporting evidence:** in aerodynamic (Clark & Mackiewicz-Krassowska 1977) and articulatory (e.g., Bell-Berti 1993) terms, high vowels are the easiest to nasalize, as well as perceive as nasal (p. ex. Maeda 1982).

(14) If high \( \tilde{V} \) < non-high \( \tilde{V} \), lowering loses synchronic motivation. With reverse scale, nasalization seems to select only more marked forms (esp. source-oriented analysis).

2.3. Adopted analysis

(15) **Purely phonological approach:** no phonetically-sensitive constraints (e.g., ease of articulation, or height perception in [\( \tilde{V}N \)] vs. in [\( \tilde{V}(C) \)]).

(16) **Markedness scale:** independent evidence for non-high \( \tilde{V} \) < high \( \tilde{V} \):

- Ruhlen’s (1975) survey of 100 inventories (allophonic and phonemic \( \tilde{V} \)): gapped and discontiguous inventories exist, but none lack a low nasal vowel (possible exception: Mohawk).
If low vowels are least marked, typology can be predicted and overgeneration of unattested grammars (e.g., only high \( \tilde{V} \)) preventable, esp. in stringency.

(17) **Scope of nasalization**: selective blocking, vs. selective application. [VN] triggers as marked structure, but vowels with contrastive nasal counterparts resist nasalization, in order to avoid neutralization.

(18) Summary:

- Lowering of high \( \tilde{V} \) occurs because of markedness pressures ([\( \tilde{i} \)] > [\( \tilde{e} \)]).
- Nasalization, driven by markedness of [VN], cannot apply to mid and low vowels because of the existence of their nasal counterparts in contrastive positions.
- Nasalization is not blocked from applying on high vowels because lowering prevents [\( \tilde{i} \)] in contrastive positions.

### 3. Formalization

#### 3.1. PC theory: Fundamental aspects

(19) Lightly adapted from Łubowicz (2002, 2012), radical overhaul of OT which captures opacity, neutralization, and anti-neutralization. (And allophony?)

(20) Contrast plays an active role in grammar, not a distributional epiphenomenon.

(21) Candidates:
• Mappings can reference each other. (“Nothing takes place in a vacuum.”)
• Candidates in \textsc{gen} made up of scenarios, each a finite and limited number of inputs with corresponding outputs.
• From one scenario to the other, only outputs vary (i.e., the inputs stay the same).

(22) Two evaluations: (1) against PC (\textsc{preservecontrast}) and markedness constraints, (2) against faithfulness (if necessary).

(23) PC constraints: input-oriented (compar...: (i.e., /i, e/) because of potential of interaction. Violations involving /a, o/ are subset of those of /e/ (no height neutralization in addition to no nasalization).

3.2. French analysis

(24) Some \textit{a priori} considerations:
• “Docking” occurs early: /V^n/ = nasal input, /V^n + fem./ \rightarrow /VN/ = oral input
• Locus of PC evaluation is \textit{segment}, i.e., the vowel of [\tilde{c}N] = [\tilde{c}(C)], etc.
• Two archetypes of inputs represented (i.e., /i, e/) because of potential of interaction. Violations involving /a, o/ are subset of those of /e/ (no height neutralization in addition to no nasalization).

(25) Constraints:

\textit{Markedness}

a. *VN : Sequences of oral V + nasal consonant are banned.
b. *\tilde{i} : High nasal vowels are banned.

\textit{PC constraints}
c. PC\textsubscript{IN}(nasal) : For each pair of inputs contrasting in the feature [nasal] that map onto the same output in a scenario, assign a violation mark. (“If inputs are distinct in nasality, they must remain distinct in the output, though not necessarily in terms of the feature [nasal].”)
d. PC\textsubscript{OUT}(nasal) : For each output that corresponds to two or more inputs contrasting in the feature [nasal], assign a violation mark. (“No outputs ambiguous with respect to nasality.”)
e. PC\textsubscript{IN}(high) : For each pair of inputs contrasting in the feature [high] that map onto the same output in a scenario, assign a violation mark. (“If inputs are distinct in nasality, they must remain distinct in the output, though not necessarily in terms of the feature [high].”)
f. PC\textsubscript{OUT}(high) : For each output that corresponds to two or more inputs contrasting in the feature [high], assign a violation mark. (“No outputs ambiguous with respect to the feature [high].”)

5
(26) Scenarios & tableau (see (27) for notes)

<table>
<thead>
<tr>
<th>Inputs</th>
<th>a.</th>
<th>b.</th>
<th>c.</th>
<th>d.</th>
<th>e.</th>
<th>f.</th>
<th>g.</th>
<th>h.</th>
<th>i.</th>
<th>j.</th>
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<tbody>
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<td>( \tilde{i} )</td>
<td>( \tilde{\tilde{e}} )</td>
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Ranking: \( PC_{OUT}(nas) \gg *VN \gg ^*i, PC_{IN}(nas), PC_{IN}(high), PC_{OUT}(high) \)

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<tr>
<th></th>
<th>PC(_{OUT})(nas)</th>
<th>*VN</th>
<th>*( \tilde{\tilde{e}} )</th>
<th>PC(_{IN})(nas)</th>
<th>PC(_{IN})(high)</th>
<th>PC(_{OUT})(high)</th>
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| e.     | *!               | *   |                 | \{/i, i\( ^n \)/\} | \{/e, e\( ^n \)/\} |                  |
| f.     | *!               | *   |                 | \{/i, i\( ^n \)/\} |                     |                  |
| g.     | *!*              |     |                 | \{/e, e\( ^n \)/\} | \{/i, i\( ^n \)/\} |                  |
| h.     | *!               | *   |                 | \{/e, e\( ^n \)/\} | \{/e, e\( ^n \)/\} |                  |
| i.     | *!               | *   |                 | \{/i, i\( ^n \)/\} |                  |                  |
| j.     | *!               | *   |                 | \{/e, e\( ^n \)/\} |                  |                  |
| k.     | *!               | *   |                 | \{/e, e\( ^n \)/\} |                  |                  |
(27) Notes on tableau/scenarios:
- Text under PC constraint violations indicate offending output or pair(s) of inputs.
- Scenarios involving raising legitimate, but gratuitous: fare equally under PC constraints, but worse on markedness.
- Denasalization in /V^n/ inputs also legitimate but also gratuitous, especially when oral vowels in non-nasal contexts are considered.

(28) Due to strength & high ranking of PC_{OUT}(nasal):
- If /i^n/ → [i], no nasalization in VN possible.
- If /i^n/ → [ê], nasalization possible in /iN/, though promotion of *i and/or faithfulness in the second pass can prevent, if desired.
- As long as nasal inputs remain faithful, no merged/identical output tolerated if sources differ in nasality (unlike /i^n, e^n/).

4. Discussion & further work

(29) Oro-nasal contrast in high vowels transformed into one of height: partial height neutralization (consistent with markedness) creates small gap for nasalization to apply (seemingly inconsistent with markedness).

(30) French anti-neutralization simple to state informally but requires a formal framework with (a) contrastive “hindsight,” and (b) flexible understanding of neutralization.

(31) Single constraint approaches to anti-neutralization fail to capture this balance:
- NoNeutralization in Stratal OT (Kiparsky 2008) demands different lexical strata (not the case in French).
- Both NoNeutralization and *Merge (Padgett 2003) penalize any neutralization, while in French both height and oro-nasal neutralization must occur partially.

(32) Representational approaches (e.g., “High oral vowels are not specified for [nasal] and thus can undergo nasalization”) capture the system of contrast but fail to capture the link between lowering and nasalization.

(33) Future work (data collected on same participants as Dow (2014)):
- Is high vowel nasalization phonological? Articulatory and durational evidence say maybe not. → Variable-rate reading task (à la Solé (1992)) carried out. (Does duration of nasalized portion increase proportionately to V duration?)
- How does progressive nasalization play into phonological grammar? Phonetically more pervasive in French, but regressive nasalization more likely to be phonological. → Data from normal and variable-rate reading task collected.
Summary: Regressive nasalization in French suggests that not only must contrast be able to play a role in mappings, but also that one (partial) neutralization must be able to pave the way for another process to apply, whether itself neutralizing or allophonic, which PC theory (alone?) can formalize.

References


