Stability and variation in the pronunciation of French: A corpus-based approach

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Introduction

This paper focuses on ongoing research related to the PFC project.

PFC (Phonologie du français contemporain: usages, variétés et structure) is a project that aims at describing the pronunciation of contemporary French in its geographical, stylistic and social diversity.

PFC brings together some 50 researchers from a variety of countries. The corpus includes the recording, partial transcription and coding of over 600 speakers from the French-speaking world on the basis of a common protocol.

The findings reported here are concerned with the behavior of liaison consonants and that of mid vowels in different varieties of French.
Outline of talk

- Brief overview of the PFC project
- Liaison across regional varieties of French: quantitative data
- The distribution of mid-vowels in French: vowel harmony
The PFC project

PFC is a collaborative project coordinated by:

- Jacques Durand (CLE-ERSS, Univ. Toulouse II & CNRS)
- Bernard Laks (MoDyCo, Univ. Paris X & CNRS)
- Chantal Lyche (Univ. Oslo & Univ. Tromsø)

With the support of:

- DGLFLF: Délégation générale à la langue française et aux langues de France
- ILF: Institut de linguistique française
- ANR: Agence nationale de la recherche
- CNRS and many other institutions

www.projet-pfc.net
A sociophonological survey

- Geographical diversity: about 60 areas (both in France and outside France);

- Diversity of registers: two reading tasks (word list, passage), two conversations (semi-directed, informal);

- Diversity of phonological phenomena to be analysed (minimally: segmental inventories, schwa, liaison);

- Quantitative importance: around 600 hours of recorded material with the same protocol.
Locations of PFC survey points
Main objectives of the PFC research project

- Give a better picture of spoken French in its unity and diversity (geographical, social and stylistic);

- Test phonological and phonetic models from a synchronic, diachronic and variationist point of view;

- Favour communication between phonological studies and speech specialists; allow phonological models to be assessed on the basis of quantitative analyses carried out over large-scale speech databases.
In each area being surveyed, the recordings are done on the basis of a common protocol which can be completed according to the theoretical orientations of the investigator.

The protocol is based on methods developed by William Labov in the US and Peter Trudgill in the UK. Speakers are selected according to a network principle (Milroy, 1980).

We usually record around 12 speakers per location, with ideally the same number of males and female speakers and three generations (age-grading).
Protocol

- Reading tasks
  - List of 94 words that includes a number of minimal pairs and allows the establishment of a first phonemic inventory for the speaker
  - One-page passage

- Conversations
  - 20- to 30-min semi-directed conversation with the investigator
  - 20- to 30-min informal conversation with a friend or relative

The protocol allows us to investigate the impact of register on a number of phonological and phonetic phenomena, as well as the relationship between speech and writing.
A new level for prosodic coding (Tier 5) has been added. This level aims to capture the timing and intensity of linguistic elements, providing a more comprehensive transcription.

The transcription process involves several steps:

1. **Manual basic orthographic transcription** (Tier 1): This level provides a straightforward transcription of the spoken text, using standard French orthography.
2. **Manual coding for liaison** (Tier 2): This level codes the phonemes that are linked together in spoken French, such as "le /lə/" instead of "l/ə/".
3. **Manual coding for schwa** (Tier 3): This level focuses on capturing the schwa sound, which is the lack of vowel quality in certain phonetic contexts.
4. **Automatic alignment of phonemes onto speech (LIMSI)** (Tier 4): This level uses automated methods to align phonemes with the spoken signal, enhancing accuracy in transcription.
5. **Prosodic coding (first versions under test)** (Tier 5): This level includes prosodic features such as stress, intonation, and duration, which are crucial for understanding the spoken language.

For Levels 1-3 and 5, transcriptions are done using Praat.
Liaison in French

Liaison refers to the appearance of a consonant (liaison consonant, LC) at the juncture of two words which otherwise are not pronounced with that consonant:

\[
\text{Word}_1 \quad LC \quad \text{Word}_2
\]

• Word 2 phonetically begins with a vowel;
• Liaison consonant: \{n, z, t (r, p, g, v)\}.

Examples (liaison consonant in bold):

- *petit écrou* \[\text{pətɪtek˘ru}\] “small nut”
- *petit cadeau* \[\text{pətikado}\] “small present”
- *il est petit* \[\text{ilepeti}\] “he is small”
Some issues surrounding liaison

- Which of the potential liaison consonants are more frequently phonetically realized;
- Whether the liaison consonant is syllabified with the following vowel (liaison avec enchaînement, linked liaison, e.g. ont eu [œ.ty], “have had”) or the preceding one (liaison sans enchaînement, unlinked liaison, e.g. [œt.ʁy]);
- Boundaries between categorical, variable and erratic/non-attested liaisons;
- Links with morphosyntactic and prosodic structure;
- Links with sociostylistic factors.
Autosegmental account of liaison (Encrevé, 1988)

A liaison consonant is a floating segment with respect to both the skeletal and syllabic tiers.

\[ J'\text{avais un rêve} \] “I had a dream”
When followed by a word with a null onset, the liaison consonant is attributed a skeletal slot, and is generally syllabified into onset position.
Liaison across regional varieties of French: Quantitative data


- 10 PFC investigation points, in both the southern and northern parts of France
- 100 speakers
- Read passage + 10 min of conversational speech
- \(\approx 16000\) potential liaison sites identified in that material
- \(\approx 7500\) (47%) actual cases of liaison

Locations of investigation points:
- +: villages
- +: middle-size towns, larger cities
- +: Paris (inner city and suburb)
Relative frequency of occurrence of liaison consonants

% occurrence with respect to total number of realized liaisons

- /z/, /n/ and /t/ strongly predominate
- Other liaison consonants realized in a few specific words only
- Unexpectedly, /n/ more frequent than /t/
Liaison: Main observed tendencies

In general, liaisons do not occur in conversational speech as frequently as would be expected on the basis of previous descriptions. Indeed, there seems to be a tendency for speakers to avoid potential liaison contexts.

For liaisons referred to as categorical, the observed patterns are not fully consistent with traditional characterizations (Delattre, Léon).

For example, liaison is not systematically realized in Adj + N sequences, e.g. *grand // honneur* “great honor”.

A tendency not to produce liaisons in such contexts seems to increasingly prevail upon the historically well-established tendency to avoid hiatus at word boundaries. Adj + N is no longer a context for categorical liaison, if it ever was.
Liaison: Main observed tendencies

For so-called variable liaisons, there are substantial differences in the observed frequency of occurrence between specific word forms. For ex., liaison is much more frequent for est “is” than for était “was”.

Important geographical variations also exist (higher proportion of liaisons in southern varieties than northern varieties).

*Liaison non-enchaînée* (unlinked liaison) occurred in the reading of the text but almost never in spontaneous speech. It is closely tied to the orthographical system and typically appears in reading aloud or in situations where highly literate speakers use an elevated register,
Traditionally characterized as an assimilation in height of a non-final mid vowel to the following stressed vowel, e.g. *aimer* [eme] “to love” vs *aimable* [ɛmebl] “kind”

Said to be optional, speaker-dependent, more frequent in informal speech

Possibly specific to a subset of midvowels

Possibly sensitive to morphological factors

Effect of regional accent?

Cf. Casagrande, 1984; Coveney, 2001; Dell, 1973; Fouché, 1959; Grammont, 1914, 1939; Tranel, 1987; Walker, 2001…
We recently completed a comprehensive acoustic study on vowel harmony in French (Nguyen & Fagyal, *J. Phonetics*, 2008).

The material was made up of 107 disyllabic word pairs such as été /ete/ “summer” - éther /etεʁ/ “ether”.

Syllable 1 contained a mid vowel which was phonemically identical in both words. Syllable 2 had a nonlow vowel in one of the words (e.g. été) and a low vowel in the other (éther).

Detailed acoustic investigations were carried out for three speakers of southern French and three speakers of northern French (four repetitions for each word).

$F_1$ and $F_2$ frequencies were measured at the midpoint of the first and second vowels.
Vowel harmony: main findings

- $V_1CV_2$ initial parts in *oser* [oze] and *oseille* [ozɛj]
- LPC spectrum associated with $V_1$ in each of the two words

- In general, $V_1$ was higher when followed by a high-mid than by a low-mid vowel;

- These variations were independent of the words’ morphological structure and lexical frequency;
Vowel harmony: main findings (cont.)

Vowel harmony tended to be more systematic for the northern French speakers than for the southern French speakers.

This may be at least partly due to the strong weight of the *loi de position*, i.e. the fact that mid vowels are mid-high in open syllables and mid-low in closed syllables, in Southern French (Durand & Lyche, 2004).
Is vowel harmony categorical or gradient?

We asked to what extent the sound shape of the first vowel, and more specifically the frequency of the first formant $F_1$ in that vowel, depended on:

a) the phonological height of the second vowel (a categorical variable);

b) the second vowel’s own detailed sound shape, and more specifically $F_1$ frequency in that vowel (a continuous variable).

According to assumption a), vowel harmony is a categorical phenomenon that affects non-final vowels in an all-or-none fashion.

In assumption b), vowel harmony tends to be continuous and gradual: V1 is phonetically realized in a way which mirrors V2’s own detailed phonetic properties.
A statistical model of vowel harmony in French

We designed a mixed-effect linear model in which both V2’s phonological height and V2’s acoustic characteristics were used to account for variations in V1’s own acoustic properties.

For word $i$ in word pair $j$

$$F_1(V1) = (\beta_0 + b_j) \ldots \rightarrow \text{intercept}$$
$$+ \beta_1 \text{height}(V2) \ldots \rightarrow \text{V2’s height}$$
$$+ \beta_2 F_1(V2) \ldots \rightarrow F_1 \text{ in V2}$$
$$+ \beta_3 [\text{height}(V2) \times F_1(V2)] \ldots \rightarrow \text{interaction}$$
$$+ \epsilon_{ij} \rightarrow \text{error term}$$

The results showed that gradient effects either were combined with or tended to override categorical effects in vowel harmony in French.
Conclusions and perspectives

The advent of large speech databases has taken place in conjunction with the development of powerful data processing and analysis methods. These methods allow our analyses to be conducted at a scale that was out of our reach still a few years ago. They offer us the possibility to make generalizations from our databases to a yet larger ensemble of possible observations.

They make it possible to empirically address issues that are central to current phonological and phonetic theories, such as the gradient vs categorical character of phonological patterns and representations, or the influence of frequency of occurrence and usage on the words' sound shape.