

## Art des mets, art d'aimer: a preliminary study on the acoustic aspects of vowel harmony in French

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In French, the quality of mid vowels in non-final syllables is known to show a greater variability than in final syllables, and this variability has been ascribed to several phonological factors. One major factor is syllable structure: mid vowels tend to be close-mid in open syllables and open-mid in closed syllables, although this rule is subject to many exceptions in Northern French dialects. Another factor, referred to as vowel harmony (VH), causes a mid vowel in a non-final syllable to be assimilated to the vowel occurring in the following syllable in one or several of its features. VH is also thought to exert an influence in derivational morphology (see Walker 2001:54-55) where faithfulness to the base seems to be the chief factor: the quality of a mid vowel appearing in the final syllable of a base word tends to be preserved in derived words containing a suffix added to the base word (e.g. *fraîche* [frɛʃ] “fresh” - *rafraîchir* [rafreʃir] “refresh”, see Tranel, 1987). The identity of the post-vocalic consonant, when there is one, also has an influence on the quality of a mid vowel in a non-final syllable (e.g. rounded mid vowels are more likely to be close-mid than open-mid before /z/, see *rosé* [roze] “pinkish”).

VH itself has been characterized in different ways in the literature. According to Dell (1972), VH in French applies to [-round,-high,-back] vowels which assimilate in height to a following, heteromorphemic vowel (e.g. *céder* [sed+e] “give in” vs *cédant* [sed+ã]). Tranel (1987) considers that VH affects all mid vowels in non-final syllables, irrespective of the presence/absence of a morpheme boundary between the non-final and the final syllable (e.g. *auto* [ɔto] - [oto] “car”). He, however, also maintains that VH affects rounded mid vowels to a lesser extent than unrounded ones, and that open-mid rounded vowels are sensitive to the influence of close-mid rounded vowels only (e.g. *peureux* [pøʁø] “fearful”, as opposed to *feuillu* [føjy] “leafy”).

Depending on which constraint is emphasized (VH, faithfulness to the base, etc.), widely differing predictions can be made with respect to the quality of mid vowels in non-final syllables. In lack of reliable empirical investigations (one of the most ambitious studies in that domain, carried out by Landick (1995), is based on the author's own perceptual judgments), the way in which mid vowels are realized in non-final syllables yet remains unclear.

The goal of this project is to investigate the empirical foundations of VH French. We hypothesize that classical vowel-to-vowel assimilatory processes are on the basis of VH in French (see Vago 1980, Ohala 1994), and ask the following questions: 1) To what extent does a mid vowel in a non-final syllable assimilate to the following vowel? 2) Does VH apply to vowel height only, or does it extend to place of articulation and rounding? 3) Is VH a discrete phenomenon or a continuous and gradual one?

Our corpus is made up of 136 pairs of bisyllabic words, such as *été-éther* (“summer”-“ether”), where V1 is a mid vowel (front/unrounded or back), and V2 is close or close-mid in the first word and open or open-mid in the second word. The word pairs are subdivided into 14 subsets, depending on the height of the first syllable, and the place of articulation of both V1 and V2. When the first syllable is open, there is in most pairs a single consonant between V1 and V2. The words were chosen among nouns, adjectives, and verbs in the infinitive form, with a high lexical frequency whenever possible.

The corpus was recorded by four female native speakers of French, all in their twenties or early thirties. Two of them originate from the region of Paris and the other two from that of Aix-en-Provence. The recordings were made in a sound-proof booth using a high-quality microphone and a DAT recorder. Each word occurred twice in the following carrier sentence: “Il retape <target word> parfois. <target word>”. The 272 carrier sentences were read in a random order twice. The recordings were transferred onto a CD-ROM for further processing.

For each bisyllabic word, the onset and offset of V1 and V2 were located by hand on the waveform and the associated wide-band spectrogram. The frequencies of the first two formants were measured at the midpoint of V1 and at the

midpoint of V2 using ESPS automatic formant tracker. These values were then carefully checked by hand in several steps.

At the time of writing, statistical results are available for one speaker (34, born in Salon-de-Provence). The analyses were restricted to words with an open first syllable. The results show that when occurring in the first syllable, the back mid vowels vary to a greater extent than the front mid vowels depending on the identity of the following vowel. There was a significant decrease in F2 frequency when V2 was /o/ (e.g. *auto* “car”) as opposed to /ɔ/ (*automne* “autumn”), and when V2 was /a/ (e.g. *nota* “footnote”) compared to /i/ (e.g. *notice* “notice”). In addition, F1 was significantly lower in frequency when V2 was /ø/ (e.g. *moqueuse* 'mockler', fem.) compared to /œ/ (*moqueur* 'mockler', masc.). Differences in F1 and F2 frequency were also observed for the front mid vowel before /a/ vs /i/ (not surprisingly, the frequency of F1 increased and that of F2 decreased before /a/ compared to /i/). Our results suggest that for this speaker, VH is a fine-grained, gradual phenomenon mostly applying to back mid vowels. The data for the other speakers are being processed and the results will be presented at the conference.

## References

- Casagrande, J. (1984). *The Sound System of French*. Washington D.C.: Georgetown University Press.
- Dell, F. (1972). *Les règles et les sons*. Paris: Hermann.
- Landick, M. (1995). The mid-vowels in figures: Hard facts, *The French Review*, 68(1), pp. 88-102.
- Ohala, J. J. (1994). Towards a universal, phonetically-based, theory of vowel harmony; *Proceedings of ICSLP 94*, Yokohama, pp. 491-494.
- Tranel, B. (1987). *The Sounds of French: An Introduction*. Cambridge: Cambridge University Press.
- Vago, R.B., ed. (1980). *Proceedings of the CUNY Linguistics Conference on Vowel Harmony*. Amsterdam: John Benjamins.
- Walker, D.C. (2001). *French Sound Structure*. Calgary: University of Calgary Press.