

A Corpus-Based Approach to French Regional Prosodic Variation

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Résumé

Cet article présente les premiers résultats d'un projet de recherche en cours portant sur la variation des patrons prosodiques dans un corpus de 14 variétés de français parlées en Belgique, en France et en Suisse. Quatre mesures prosodiques sont analysées: la longueur des groupes accentuels, la proportion des accents initiaux de mots lexicaux dissyllabiques, la vitesse d'articulation et l'amplitude du registre mélodique. Des arbres de décision sont utilisés pour évaluer l'existence de différences significatives entre les variétés et un algorithme de classification hiérarchique est utilisé pour modéliser la distance entre les variétés en tenant compte simultanément des quatre mesures prosodiques choisies. L'analyse révèle des résultats inattendus quant à la classification des variétés sur une échelle de régionalité, et des résultats plus encourageants quant au positionnement géographique des variétés.

Keywords: *prosody, regional French, accentuation, phrasing, variation*

1. Introduction

1.1. European French Accents

The fact that French is not as dialectally fragmented as other languages spoken in Europe does not mean it is uniform across the different areas where it is spoken. Francophones from Europe are well aware of the fact that native French speakers more or less geographically distant from their own place of residence have an "accent" different than their own. The boundaries of the various French regional accents areas are difficult to delimitate in a scientifically precise manner, due to their continuous character and due to the fact that their

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homogeneity varies according to the point of view one adopts². On a macro-level, one may nevertheless hypothesise that four main classes of French accents coexist in Europe. According to this hypothesis, Hexagonal France would be divided in two major areas: the North (NoF) and the South (SoF). The NoF geographically corresponds to the area delimited by the cities of Rennes in the East, Nancy in the West, Lyon in the South and Lille in the North (Carton et al. 1983, Léon 1993, 122, Armstrong & Boughton 1997, Hauchecorne & Rodney 1997, Hornsby & Pooley 2001, 306, Coquillon 2005, 138, Boughton 2006, Sertling-Miller 2007, 53, Detey & Le Gac 2008, Woerhling 2009, Lyche et al. 2010, Boula de Mareüil et al. 2012, Simon et al. 2012)³. The SoF corresponds broadly to the *oc* dialectal area, i.e. to the area delimited by the Spanish border on the South, Biarritz in the West, Marseille in the East and Gap in the North (Coquillon 2005; Woerhling 2009, Sichel-Bazin et al. 2012). The accents of Belgium (BeF) would constitute a third area (Hambye & Simon 2009, Woerhling 2009, Boula de Mareüil & Bardiaux 2011, Bardiaux et al. 2012, Bardiaux 2014), and the accents of French-speaking Switzerland (SwF) a fourth one (Woerhling 2009, Andreassen et al. 2010, Avanzi et al. 2012, Racine et al. 2013, Goldman et al. 2014)⁴.

Many authors among the ones mentioned above observed that NoF, SoF and BeF listeners encounter difficulties in perception experiments asking them to precisely locate the city a speaker is coming from. The accuracy of identification of a speaker's origin is often lower than the level of chance. Still, the results obtained in these studies have revealed that speakers living in each of the above-mentioned areas manifested different degrees of regional accent, i.e. had a pronunciation more or less close to the variant described in the teaching handbooks and spoken in the media, a variant called "Reference French" (Morin 2000, Laks 2002, Le Gac & Detey 2008, Lyche 2010). Speakers from the NoF would be the speakers who have the less regionally marked accent, i.e. who have the closest pronunciation to Reference French. In the three other regions, the situation is more

² For example, on a micro-level, a speaker from a village can judge his neighbor living in the heights of the same village as having a different accent, but these differences will not be perceived by somebody who does not belong to this village.

³ The NoF area does not include Alsace and Bretagne, where non-Gallo-Romance dialects were spoken. In the Alsatian area for example, French speakers have a pronunciation marked by the Germanic substrate, which makes it unique (Carton et al. 1983, Woerhling 2009).

⁴ Let us note here that the frontiers of the Belgian and of the Swiss accents do not exactly coincide with the political frontiers. Some pronunciation features of Swiss productions are also found in Savoie and Haute-Savoie, or in Franche-Comté for example (Métral, 1977, Putska & Vordermayer 2006).

convoluted. Regarding the SoF and BeF, there is often a mismatch between the speakers' conceptions and the reality. In the South, the most marked regional accent is associated with the city of Marseille, but in reality, the speakers with the most regionally marked accent are not from Marseille (Woerhling 2009). In Belgium, Tournai and Brussels are associated with a low degree of regionally marked accents, while Liège and Gembloux are associated with strongly regionally marked accents. In fact, speakers from Tournai really have a pronunciation close to Reference French, but this is also true for some speakers of Gembloux and Liège. Brussels speakers, on the other hand, may also have a strong regionally marked accent (Bardiaux 2011). In Switzerland, the situation is slightly less complicated: speakers from Geneva are perceived as having a pronunciation closer to Reference French, while speakers from Fribourg, Martigny, Neuchâtel and Nyon are always identified as having a strong regionally marked accent (Racine et al. 2013, Goldman et al. 2014).

1.2. *The role of prosody in the identification of European French accents*

The role of prosody in the identification of these different accents is not very well understood, despite the recent renewed interest for prosodic regional variation in French (Simon 2012). Actually, most of the studies dealing with French prosody have focused on productions of speakers originated from Paris and from the Northern part of France (the area referred here as NoF). As for this variant, there is a broad consensus regarding the fact that primary accent falls on the last masculine syllable of clitic groups, i.e. of lexical words and their associated functional items (Garde 1965, Mertens 1989). Secondary stress preferentially falls on the first syllables of lexical items, but it can affect any other syllable of a minor prosodic group, including short grammatical words (Astésano 2001, Welby 2006).

The most plausible hypothesis regarding the variants of French spoken in the South of France, Belgium and Switzerland is that they share the same phonological prosodic system as Reference French (Coquillon 2005, Avanzi 2013⁵). Actually, SoF, BeF and of SwF would mostly differ at the level of phonetic realisation. Four main features have been said to vary regionally: (i) The **proportion of accented lexical items**, i.e. the length of minor prosodic constituents in terms of number of syllables; (ii) The **proportion of secondary stressed syllables**.

⁵ It has been shown for example that speakers from BeF and SwF respect in the same extent than speakers from NoF the rules dictating lexical non-accentuation (rules that are commonly referred in the literature by means of *CLASH or ALIGN-XHEAD, Avanzi et al. 2013, Avanzi sub.).

bles, i.e. of accented initial syllables and/or prominent penultimate prominent syllables⁶; (iii) The **rate of speech**, i.e. the pace at which speakers produce their utterances; (iv) The **melodic aspects** of speech, studied in terms of text-to-tune alignment, of melodic span variation or in melodic contours realization.

As for (i), Sertling-Miller (2007) did not find any differences when comparing Vaud speakers with NoF speakers; neither did Avanzi et al. (2012) when comparing data produced by speakers from NoF (Paris and Lyon), BeF (Liège and Tournai) and SwF (Geneva and Neuchâtel). However Avanzi & Schwab (2012) find significant differences between variants spoken in the NoF area (Paris) and various variants spoken in the SwF area (Geneva, Martigny, Nyon and Neuchâtel). As for (ii), Woerhling (2009) examined the productions of speakers from various cities of the SoF (Biarritz, Douzens, Lacaune, Marseille and Rodez), NoF (Brécécy, Paris, Dijon, Lyon and Treize-Vents) and from BeF (Gembloux, Liège and Tournai) and concluded that Swiss speakers from Nyon produce more initial accents and tend to lengthen to a greater extent the last syllables of inter-pause groups, while Belgian speakers (from Tournai, Liège and Gembloux) tend to lengthen the penultimate syllable of inter-pause groups. The fact that penultimate syllable lengthening is a strong cue involved in the perception of BeF accent were confirmed in a perception study, based on both natural and resynthesized stimuli (Bardiaux & Boula-de-Mareüil 2012), as well as in Bardiaux (2014)'s PhD thesis, where the author provides a detailed analysis of regionally marked F0 contours. Avanzi et al. (2012) found that SwF speakers differed from NoF speakers with respect to the proportion of accentuated penultimate syllables. Schwab et al. (2013) conducted a study on the accentuation of initial syllables of disyllabic words, and confirmed these results. Out of the 7 variants they compared, it appeared that speakers from Lyon, Paris (NoF) and Tournai (BeF) produce significantly more prominent syllables in initial /penultimate syllables of disyllabic words position than speakers from Liège (BeF), Geneva, Neuchâtel and Nyon (SwF). As for (iii), an extensive review of the literature is given in Schwab & Avanzi (to app.). In this paper, the authors recall that many conflicting findings exist regarding the effect of regional origin on the articulation rate in French. To shed new light on the question, the authors propose to examine a comparable subset of the data presented in this paper (see §2.1 below), composed of productions of NoF (Paris and Lyon), BeF (Tournai and Liège) and SwF (Geneva, Nyon and Neuchâtel). Their

⁶ Since the majority of the items of French lexicon are disyllabic, these two positions cannot be separately identified in the data.

results confirm that Swiss speakers articulate slower than speakers from NoF and BeF, with the exception of Geneva; speakers from Geneva do not differ from those from Lyon (Coquillon 2005). And finally, as for (iv), Sertling-Miller (2007) demonstrates that speakers from the Vaud canton in Switzerland present differences in text-to-tune alignments (the rise of their final prosodic groups tend to begin on the penultimate syllable, while NoF speakers tend to contain their rise in the last syllable), that they produce a contour unknown to NoF speaker (a contour presenting a LHL melodic profile, spreading on the two last syllables of major prosodic phrases). Coquillon (2005) notes as well the existence of a “flat hat” melodic contour in SoF unknown to NoF speakers, spreading over quite long stretches (6 to 7 syllables) and not associated to any phonological prosodic unit. The author also validates a typical stereotype held by French speakers, namely that the SoF accent is more “singing” compared to NoF. Indeed, she finds significant differences regarding pitch range variation when comparing NoF and SoF productions: speakers from the SoF area manifest greater pitch range than speakers from the NoF area.

1.3. *Summary and Research Questions*

The results of the synthesis drawn in §1.2 do not systematically lead to consensual conclusions regarding the role of prosody in the identification of different regional accents. In our view, such discrepancies are not surprising. They might be due to differences between studies in the material (locations, participants, data collection), the way it was processed (alignment, labelling), the methods used for feature extraction and the statistical models employed. Some authors compare read speech by a small group of speakers, others compare larger groups and include spontaneous conversation speech in their analyses. Some studies control the gender and age of speakers, while others allow for greater variability. Some researchers prefer automatic processing of data, others favour manual labelling, and others a mixed approach.

In this context, our goal was to ensure the comparability of our data and contribute in building a clearer picture regarding which prosodic features vary across regional variants of French and to what extent. We therefore built an annotated corpus consisting of 14 variants of French, spoken in Belgium, France and Switzerland, including key locations in the cartography of regional accents of the NoF, BeF and SwF areas⁷. The corpus and the data processing methodology are described in section 2. The prosodic features used to evaluate the extent of prosodic variation in French, as well as the way these features

⁷ SoF is not included in the present study.

were extracted, are detailed in section 3. In section 4 we present the results of different statistical classification methods and section 5 summarises our conclusions.

2. Methods

The corpus used in this study consists of recordings extracted from the database “Phonologie du Français Contemporain” (Durand et al. 2009).

2.1. Participants and Data

Our corpus includes 14 regional varieties of French, recorded in 3 different countries of Europe: 5 varieties spoken in Metropolitan France (Béthune, Brécey, Lyon, Paris and Ogéville); 5 varieties spoken in Switzerland (Fribourg, Geneva, Martigny, Neuchâtel and Nyon) and 4 varieties spoken in Belgium (Brussels, Gembloux, Liège and Tournai). For each of the 14 locales, 4 female and 4 male speakers were selected; they were born and raised in the city in which they were recorded. The age of the speakers varies between 19 and 82 years, and is controlled for each of the 14 groups of speakers ($F(13, 84) = 0.308$, n.s.), between male and female speakers ($F(1, 84) = 0.110$, n.s.) and between male and female speakers across the 14 groups ($F(13, 84) = 0.114$, n.s.).

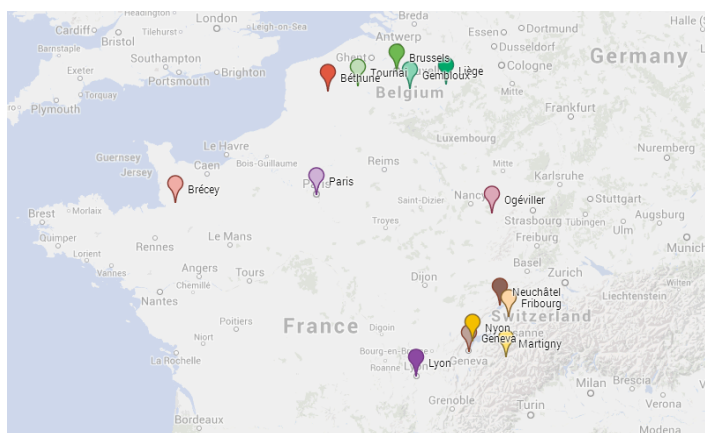


Figure 1: *Locales of the corpus study*

Each speaker was recorded in a reading text task (the text is 398 words-long) and in semi-directed sociolinguistic interviews, in which the informant has minimal interaction with the interviewer. The entire reading text and a stretch of 3 minutes of spontaneous speech for each speaker were orthographically transcribed and automatically aligned within Praat (Boersma & Weenink 2014) with the EasyAlign script,

which provides a 3-layer annotation in phones, syllables and words (see Goldman 2011 for a detailed description of the tool; and Goslin, Content, Goldman & Frauenfelder 1999 for the implementation of the syllabification rules). All alignments were manually verified and corrected when necessary by inspecting both spectrogram and waveforms (e.g. boundary adjustments, segments deletion or addition in the case of schwa and liaison realisation). The orthographic transcription was then annotated with part-of-speech tags using the DisMo software (Christodoulides et al. 2014). A dedicated tier (“delivery”) was added, in order to annotate overlapping speech and short non-audible or unusable segments (e.g. due to the presence of external noises in the recording). In total, the corpus is more than 11 hours-long, and includes approximately 113k tokens. Table 1 presents the basic properties of this corpus.

Area	Locale	Age (years)		Duration (sec)	Nb. syll.	Nb. tokens	Nb. APs
		Min.-Max.	Mean (sd)				
BeF	Brussels	27-65	44 (15)	2810	11446	8565	3944
	Gembloux	22-76	42 (21)	2821	11677	9135	3988
	Liège	21-76	48 (24)	2951	9692	7400	1589
	Tournai	19-82	44 (26)	2837	10518	8031	1717
NoF	Béthune	21-89	46 (25)	2925	11153	8571	3876
	Brécey	19-80	47 (22)	3110	11505	8659	4017
	Lyon	21-74	42 (21)	2677	10866	7783	3467
	Paris	24-86	50 (22)	2896	10088	8188	3637
	Ogéville	23-93	58 (24)	3023	10685	8101	3159
SwF	Fribourg	20-82	43 (24)	2895	10865	8186	3808
	Geneva	21-61	41 (18)	2863	10720	8062	3247
	Martigny	22-80	49 (28)	2963	10199	7726	3282
	Neuchâtel	25-78	53 (24)	2960	10201	7625	3282
	Nyon	30-70	46 (17)	2929	9948	7637	3225

Table 1 : *Participants and Data*

2.2. Labeling

Prominent syllables and syllables associated with a disfluency (fillers, lengthened syllables due to hesitations, false starts, repairs, etc.) were identified independently by two experts on the basis of their perceptual judgment only, following the C-PROM methodology, which is presented in detail in Avanzi et al. (2007, 2010). A third expert intervened in cases of disagreement between the two annotators and decided the final value of the syllable (+/- prominent, +/- associated to a disfluency), saving this annotation on a dedicated tier. Data labelling was performed over a period of almost three years. Four couples of annotators (every team included the author) took turns. Kappa statistics (Cohen 1969) were used to assess the reliability for each pair re-

garding prominence annotation. The resulting Kappa values vary between 0.61 and 0.88, with a mean of 0.72, which is considered as fair agreement according to Landis & Koch (1977). Finally, Accentual Phrase (AP) boundaries were manually identified and annotated on a separate tier. AP boundaries were derived from prominent syllables, and were inserted at the end of any clitic group whose last metrical syllable is prominent (Avanzi 2013).

2.3. Analysis

Four prosodic features were automatically extracted using the software package Praaline (Christodoulides 2014): AP length (mean number of syllables per AP), proportion of initial accents of dissyllabic lexical words (proportion of dissyllabic words carrying a prominence on their leftmost syllables), articulation rate (mean syllabic duration per AP, calculated in sec/syll; see Schwab & Avanzi to app.) and pitch range (span between the lowest and the highest values of F0 per AP, measured in semi-tones, following the methodology outlined in De Looze 2011). APs containing only one syllable were discarded from the analysis.

Due to the large number of variants in our corpus, we did not use classical statistical models that would allow taking into account several factors such as speaking style, speaker age and gender when examining the effect of regional variation on a given prosodic feature⁸. To assess the existence of significant differences between the regional variants of our corpus, the Classification Trees algorithm implemented in SPSS v. 22 was used⁹. The Hierarchical Clustering Analysis algorithm was also used to model the distance between the regional variants of the corpus by taking into account simultaneously a set of different prosodic parameters¹⁰.

⁸ This was possible due to the fact that our corpus is balanced for age, gender and speaking style (see § 2.2.).

⁹ Different algorithms exist to draw classification tree. When the dependent variable is treated as scale, the CHAID (Chi-squared Automatic Interaction Detection) and the CRT (Classification and Regression Trees) methods can be used. Due to the fact that CRT exclusively yields binary trees (which makes the interpretation difficult) and that the risk estimates did not systematically give as good results as the CHAID method, the latter was used.

¹⁰ For this purpose, since the units of the prosodic features are not comparable, data were normalized by z-score. Many alternative methods are proposed in SPSS to conduct Hierarchical Clustering Analysis. For this study, the average linkage within groups method was used (clusters are combined in such a way that the average distance between all cases in the resulting cluster is minimized) and the distance between two clusters is evaluated by means of Squared Euclidean distance.

3. Results

Due to lack of space, the actual decisions trees cannot be provided. In this section, we only present the most important differences observed.

3.1. *AP Length*

In total, 23'644 units were analysed to examine AP Length. The average length of APs corresponds to the one described in the literature. Statistics show that this parameter is sensitive to regional variation ($p < 0.001$): speakers from Brussels, Gembloux, Béthune, Ogéviller and Lyon produce shorter APs than the speakers from the other locales (3.17 syll/AP). Speakers from Paris produce very long APs when compared with the thirteen other groups (3.61 syll/AP).

3.2. *Initial/Penultimate Accentuation Rate*

The database contains 12'194 disyllabic words, which are sites of potential non-final accents. Out of these 12'194 potential sites, 18.8% were annotated as prominent. Statistics show that this prosodic feature is affected by regional variation ($p < 0.001$). As an example, we observe that speakers from Paris and Lyon manifest a very low rate of initial/penultimate prominent syllables (11.38%), when compared with speakers from Fribourg and Ogéviller (30.35%).

3.3. *Articulation Rate*

Articulation Rate describes the listener's perception of the pace at which a speaker talks. It was calculated on the basis of 23'644 APs. Statistics show that speakers from different regions of Europe do not have the same articulation rate ($p < 0.001$). Brussels speakers articulate faster than all other thirteen groups (0.179 sec/syll), while Nyon and Neuchâtel speakers have the slower articulation rate (0.219 sec/syll).

3.4. *Span*

Span refers to the melodic range of a speaker, and gives an idea of the degree of pitch variation in his speech. 20'988 APs were considered as valid (F0 values could be reliably calculated) for this step of the analysis. Statistics show a significant effect of regional origin of the speakers on span ($p < 0.001$), with the speakers from Neuchâtel having a wider pitch range (5.29 semitones) than speakers from Tournai and Gembloux (3.87 semitones).

3.5. *A prosodic map of regional European French varieties*

A dendrogram outlining the classification of our data is presented in Figure 2 below; it was obtained by estimating a distance for each pair of group of speakers (cumulative sum of the differences). Four main clusters emerge: the first one comprises four out of the five locales of

SwF (Geneva and Martigny, Neuchâtel and Nyon). The second one includes the four locales of BeF (Tournai, Liège, Brussels and Liège), which are mixed up with three locales of NoF (Béthune, Lyon and Brécey). A third one is composed of Fribourg (SwF) and Ogéviller (NoF). Paris (NoF) constitutes an isolated variant.

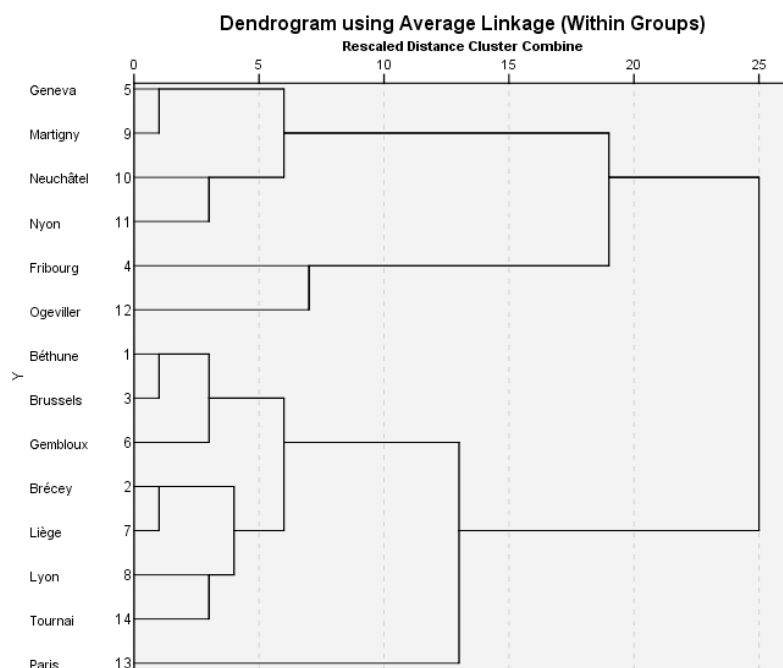


Figure 2: Hierarchical Clustering Analysis

4. Discussion

The classification obtained after the analysis of AP Length is not in line with Sertling-Miller (2007)'s results, who did not find significant differences between Swiss speakers and NoF speakers. Nevertheless, it confirms the conclusions obtained by Avanzi & Schwab (2012), regarding the fact that Parisian speakers produce longer APs than speakers from Switzerland. The analysis of initial/penultimate accentuation rate confirms the results obtained in the literature regarding Swiss varieties (which appear to be true for Fribourg as well), and Belgian varieties. With the exception of Tournai, all these varieties have a greater initial accentuation rate than the NoF varieties. Surprisingly, speakers from Ogéviller also manifest a considerable tendency to accentuate initial syllables of disyllabic words. This might be due to the influence of the language substrate, a fact that was already men-

tioned by Carton et al. (1983) in their chapter dedicated to the variant of French spoken in Lorraine. Statistics regarding articulation rate also corroborate the stereotype that Swiss speakers articulate slower than the speakers from the other areas of Europe. It is worth noting that Fribourg constitutes an exception, and that Parisian speakers are not the fastest of the fourteen groups. Pitch span also appears to be a feature sensitive to regional variation (this is the first time it was tested for NoF, SwF and BeF varieties).

It is interesting to note that none of the results obtained when taking each classifier separately do the support Avanzi et al. (2012)'s hypothesis that speakers from the locales which have been said to have a strong regionally marked (Liège, Neuchâtel, Nyon) produce shorter APs than speakers, or articulate slower, or produce more accentual prominences in non-final position than the speakers who are originated from locales associated to a standard accent (Béthune, Paris, Brécey, Lyon, Tournai). The hierarchical cluster analysis proposed in section 3.5 does not support either the regional hypothesis proposed by Avanzi et al. (2012), but it supports to a greater extent the geographical grouping of the variants. As can be seen in Figure 2, four out of the five SwF variants are classified together and form a homogeneous cluster. Fribourg remains an exception, which might be due to the fact that it is a bilingual city. With the exceptions of Paris and Ogéviller, data from Belgium and from the NoF form consistent clusters, meaning that these two regional accents are not that different from a prosodic point of view. These differences might be due to the fact that the predictors chosen in this study are not the ones on which speakers base their judgments when evaluating the Belgian accents. Finally, we observe that Paris and Ogéviller are not very similar to the other varieties spoken in the NoF.

5. Conclusion

In this paper we presented the preliminary results of an on-going project to study the regional variation of European French prosodic patterns using a corpus-based methodology. We analysed the prosodic properties of 14 regional varieties of French, spoken in Belgium, France and Switzerland. Four prosodic features were included in this analysis: AP metrical length, proportion of initial accents of dissyllabic lexical words, articulation rate and pitch span. Classification Trees were used to assess the existence of significant differences between the variants, and Hierarchical Clustering Analysis was used to model the distance between the variants taking into account these prosodic features simultaneously. The statistical analysis revealed interesting results regarding the geographical classification of the variants but did not support their classification on an a priori "accented-ness"

basis. Further analyses of the data, including other prosodic predictors and perception tests, are necessary to draw a better picture of the extent of prosodic variation in European French.

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