Journal of French Language Studies (2021), **31**, 3–23
doi:10.1017/S0959269519000322

CAMBRIDGE UNIVERSITY PRESS

ARTICLE

Prenominal *bon* and *bonne* in French liaison and *enchaînement*: An acoustic description

Adam F. McBride

Brigham Young University
Email: a_mcbride@byu.edu

(Received 22 December 2018; revised 27 August 2019; accepted 29 August 2019; first published online 16 January 2020)

Abstract

This article investigates the treatment of oronasal vowel /ɔ̃/ of the prenominal adjective *bon* (/bɔ̃/) in liaison, as produced by 19 speakers of Northern Metropolitan French. The oronasal vowel of this word has traditionally been identified as a denasalized vowel in liaison, which, when paired with the liaison consonant [n], is typically understood to be produced identically to the feminine form of the adjective *bonne* (/bɔn/). To verify this supposition, the adjective pair *bon*/*bonne* is produced in various contexts and word sequences by each speaker in a series of reading tasks. Six acoustic measures (i.e., A1−P0, A3−P0, center of gravity, F1 bandwidth, F2 and vowel duration) are taken for each token and the resulting data are analysed in a series of regression models. A brief acoustic description is given for the vowel /ɔ̃/ both in and out of liaison, and comparison is made between *bon* in liaison and the feminine *bonne* in prevocalic position (e.g., *bon ami* vs. *bonne amie*). Analyses indicate that 15 of the 19 speakers seem to produce *bon* in liaison distinctly from non-liaison *bon*, but not distinctly from pre-vocalic *bonne*, which may support suppletive analyses of adjectives in liaison.

1. INTRODUCTION

Liaison has been defined in many different ways, each definition being somewhat distinct from the others and each sharing a few core elements, such as the appearance of a consonant (Liaison Consonant or LC) between two words, of which the first (Word1 or W1) typically ends with a vowel sound in other, non-liaison contexts and the second (Word2 or W2) typically begins with a vowel sound in other, non-liaison contexts. One context in which liaison prescriptively occurs is when vowel-final W1 is a prenominal adjective and vowel-initial W2 is a noun, as seen in (1a). The final -t of *petit* ('small') in this masculine, singular adjective is normally not produced in other contexts, as seen in (1b). The LC is typically viewed as onset of the first syllable of W2 rather than coda of the final syllable of W1 (though whence the LC is generated is hotly debated). This association of an underlying (even orthographic) consonant of W1 with vowel-initial W2 is referred to in French as the process of *enchaînement*, in

which the coda of one word is treated as onset to the following word, as seen in the feminine, adjective-noun sequence of (1c) (note that the second /t/ of *petite* is pronounced in other contexts as well, as illustrated in (1d)). While liaison without *enchaînement* is indeed possible, it is not common; therefore, the term 'liaison' as used here should be understood as liaison with *enchaînement*.

(1) a. petit‿ami
[pə.ti.ta.mi]
'boyfriend'
b. petit $_{X}$frère
[pə.ti.fʀɛʀ]
'little brother'
c. petite_amie
[pə.ti.ta.mi]
'girlfriend'
d. Elle est petite.
[ɛ.lɛ.pə.tit]
'She is little.'

In most cases of liaison, the appearance or realization of the LC seems to be the primary feature that distinguishes a word such as *petit* 'little' in the non-liaison context of (1b) from *petit* in the liaison context of (1a). However, when the ultimate vowel of W1 is nasal, the LC [n] is often accompanied by a secondary distinguishing feature in W1: a change in vowel nasality.

When a prenominal adjective ending in an oronasal vowel is followed by a consonant-initial noun – non-liaison position – the nasal quality of the vowel is maintained and no LC [n] appears, as seen in (2a). However, when that same oronasal vowel-final, prenominal adjective is in position of liaison (as seen in (2b)), the quality of the vowel is typically described as being identical in pronunciation to its feminine counterpart (cf. (2c)): as Delattre (1947/1966: 150) indicated 'Les adjectifs en nasales se dénasalisent dans la liaison avec le nom qui suit. La liaison est alors semblable à l'enchaînement du féminin correspondant' ('Nasal-final adjectives denasalize in liaison with the word that follows. Liaison is therefore similar to *enchaînement* with the corresponding feminine.'). More recently, Sampson (2001: 242) describes masculine, singular W1 adjectives in liaison as 'oral vowel + linking consonant', which corroborates with the Delattre comparison to feminine forms (cf. (2c), below). While phonological descriptions (such as Sampson's 'oral vowel + linking consonant') are certainly appropriate for what has largely been understood to be a phonological phenomenon, additional acoustic analyses of an oronasal vowel in sequences of liaison, such as the *bon ami* of (2b), may help to substantiate or to adjust the traditional view that the ultimate vowel of a masculine, oronasal vowel-final adjective in liaison, as in (2b), is both different from the vowel of (2a) and indistinguishable from the vowel of its feminine counterpart in *enchaînement*, as in (2c). While the transcription in (2b) indicates the identity of the vowel to be oral, this is merely to illustrate the conventional descriptions, as given above; the acoustic similarities between the vowels of the adjectives in (2) have yet to be established. Investigation into the

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

acoustic profile of oronasal vowel-final adjectives in liaison may shed light on and give substance to the often-used (yet rarely-defined) term *denasalization* (e.g., change in duration, change in spectral qualities, etc.).

(2) a. bon père
[bɔ̃.pɛʀ]
'good father'
b. bon_ami
[bɔ.na.mi]
'good friend (*m.*)'
c. bonne_amie
[bɔ.na.mi]
'good friend (*f.*)'

The relationship between the masculine form in liaison and the feminine form in *enchaînement* can also help us better understand the lexical nature of the LC itself. As the LC is absent from either W1 or W2 in other contexts (e.g., pre-pausal W1), the nature of its lexical status has been studied for nearly a century, resulting in a number of different theories that account for its appearance (cf. Côté (2011) for an excellent summary).

In more traditional theories, the LC is understood to be an underlying coda that is truncated in non-liaison contexts (Selkirk, 1974), which can then be resyllabified as onset of the initial syllable of W2. In other theories the LC is seen as being generated directly as W2 onset (Morin, 1986) or as an epenthetic consonant that is neither strictly a part of W1 nor strictly a part of W2 (Klausenburger, 1974). Each of these theories would require a series of phonological processes to take place in order to generate the appropriate phonetic realization. For example, wherever the LC [n] is generated (e.g., as W1 coda, as W2 prefix, etc.) a chain of changes to the structure of W1 *bon* (e.g., vowel denasalization, resyllabification via *enchaînement*, etc.) would need to occur before articulation begins. However, this series of phonological processes isn't required in all theories of the lexical nature of the LC. The theory of suppletion (Tranel, 1990; Steriade, 1999; Côté, 2005) considers the LC to be the ultimate phoneme of a second lexical form of the masculine adjective W1 used in liaison. This suggests the existence of two separate forms for *bon* (i.e., /bɔ̃/ and /bɔn/). In the theory of suppletion this liaison form can be shared with another form of the word existing in the speaker's lexicon, such as a consonant-final, feminine form of W1; that is, the same phonological form stored in a speaker's lexicon would be used for both the feminine *bonne* (i.e., [bɔn] in (2c)) and the masculine *bon* in liaison (i.e., [bɔn] in (2b)) (Steriade, 1999). The theory of suppletion is of particular interest to the present study, as will be illustrated later.

The lack of acoustic description for certain oronasal vowel-final W1 in liaison and the theoretical implications concerning the lexical nature of LC that a phonetic comparison between masculine and feminine forms (as in the examples of (2)) would have, led me to pose the following research questions: 1) What are the acoustic differences between the oronasal vowel /ɔ̃/ in W1 adjectives in liaison and the same vowel in non-liaison adjectives? 2) Is the vowel of *bon* in

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

liaison more like the vowel of non-liaison *bon* or the vowel in *bonne* in *enchaînement* with regards to features associated with nasal voice quality?

The treatment of prenominal, /ɛ̃/-final adjectives is a key part of this question of oronasal vowels in liaison that certainly merits investigation. However, as there are several /ɛ̃/-final adjectives that can be prenominal (e.g., *prochain*(*e*) 'next', *moyen*(*ne*) 'middle', *ancien*(*ne*) 'old, former', etc.), the introduction of the varying degrees of relative frequency for each /ɛ̃/-final adjective introduces a fascinating, though complex, new element to the mix that is beyond the scope of the present investigation. As *bon* is both the only /ɔ̃/-final adjective that can be prenominal and the most frequent prenominal adjective (>10.3M tokens vs. 2.5M for the most frequent /ɛ̃/-final adjective *plein*(*e*) in 10B-word French Web Corpus or frTenTen (Jakubíček, 2013)), it is the sole focus of the present study.

2. ON DETECTING NASALITY

Coupling of the nasal cavity by means of lowering the velum, can affect the speech signal in a variety of ways, typically in the lower 1300 Hz (Delvaux, 2009; Maeda, 1993; Stevens, 1998). By introducing a secondary resonator, nasal coupling changes both the shape and length of the vocal tract, which can result in a strengthening and dampening in the speech signal at different frequencies by means of the introduction of nasal poles and zeros (Schwartz, 1968; Maeda, 1993). Practically speaking, nasal coupling can lead to greater bandwidth of the first formant (Hattori et al., 1958; Hawkins and Stevens, 1985; Stevens, 1998), dampening and loss of prominence in the first formant with regards to intensity (Maeda, 1993), and the appearance of newly-prominent harmonics (Maeda, 1993). These changes in the lower 1300 Hz can affect the overall distribution of energy across the spectrum of the vowel when compared to a similar oral vowel (say /ɔ̃/ vs. /ɔ/), resulting in a difference in spectral tilt (Gordon and Ladefoged, 2001; Kiefte and Kluender, 2005). Capturing these changes to the speech signal will be discussed further below. While many of the changes on the speech signal in oronasal vowels are introduced by nasal coupling, there is evidence for other changes that are introduced by secondary oral articulations in the production of oronasal vowels, which suggests that a given oronasal vowel is more different from its conventionally-paired, oral counterpart (again, /ɔ̃/ vs. /ɔ/) in its articulation than what has been traditionally ascribed to nasal coupling only (Carignan, 2013, 2014; Carignan, Shosted, Fu, Liang and Sutton, 2015; Shosted, Carignan and Rong, 2012; Styler, 2015). While other articulatory differences beyond nasal coupling surely exist between the vowels of an oral-nasal pair, the fact that they are treated as a pair in the language (cf. the examples of (2)) permits direct comparison.

3. METHODOLOGY

Production of the vowel in *bon* (i.e., /ɔ̃/ or /ɔ/) in a variety of phonological contexts is investigated by taking multiple acoustic measures of the vowel as produced by 19 native speakers of Northern Metropolitan French (NMF) in a small series of reading tasks. Data are analysed in a series of regression models.

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

3.1. Participants

A group of 19 native speakers of NMF (10 females and nine males) living in the Austin, Texas area was recruited to participate in the present study. Qualification for status as speaker of NMF was determined by Coveney's (2001: 3) definition of Standard French: 'the well-educated middle classes from the northern two-thirds of France'. While this definition is broad, it is – to the best of my knowledge – suitable to the present study, as I am not aware of any major differences in vowel nasality outside of meridional French. Potential participants completed a questionnaire which identified their French city of origin, and those who identified as speakers of non-meridional French (roughly north of Lyon) were invited to participate. All had completed at least the *baccalauréat* or equivalent (two had moved to the United States before completing the *bac*, and therefore completed American high school instead). Participants range in age from 18 to 35 years old (mean = 22.79, s = 5.64) and all speak English well enough to work or study in the Austin area. Their length of residence in the United States at the time of the study ranged from 2 months to 15 years (mean = 23.4 months, s = 42.3 months), with 14 participants who had spent less than a year in the United States.

3.2. Vowel contexts

The measure of any single vowel is meaningless in isolation. Only in relative comparison against another measure – whether it be of the same vowel in another context or a different vowel altogether – does the value of any measure become meaningful. For this reason, in order to describe *bon* in liaison in a meaningful way, comparison must be made against both *bon* in other non-liaison contexts (i.e., *bon* + C) as well as *bonne* in *enchaînement* (i.e., *bonne* + V). Because these different contexts appear with varying degrees of frequency in natural speech (Durand and Lyche, 2008), reading tasks were prepared to elicit a greater number of viable tokens from each speaker.

3.3. Reading tasks

The reading tasks consisted of three sections: one text of 300 words (see Figure 5 in Appendix), one text of 468 words (see Figure 6 in Appendix), and a randomized word list of 150 two to three-word sequences (e.g., *bonne idée* 'good idea'), which were read into the carrier phrase *Je dis X encore une fois* ('I say X one more time') one after the other (see Figure 7 in Appendix). The targeted collocations consisted of sequences of either [Adjective + Noun] or [Possessive Determiner + Noun], which were embedded in the texts among other collocations and word sequences that served as either targeted tokens for other, related studies or as distractors. Although distractors did exist in the texts, participants were informed that the study was about liaison generally. This candor was motivated by the fact that participants in earlier pilot studies began to hypercorrect with regards to liaison as soon as they encountered more than one of the more-common liaison sequences (e.g., *bon ami* 'good friend' or *bon étudiant* 'good student'). In an effort to alleviate both performance anxiety and

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

linguistic insecurity, participants were further informed that the study is not focused on whether or not participants make the liaisons prescribed in grammar books; rather, they were informed that the study focuses more on what normal speakers do with liaison. Though the methodological risks were high in informing participants of the general focus on liaison, more natural data seems to have been collected as many traditionally *obligatoires* liaisons were not made, and a few participants paused to comment that even though a particular liaison was prescriptively *correcte*, they didn't make it because it didn't feel natural.

While prenominal adjectives and possessive determiners are similar in many ways (e.g., both are prenominal elements, both are traditionally categorized as W1 in contexts of obligatory liaison, etc.), only one subgroup of the prenominal adjectives (i.e., *bon*(*ne*)) is analysed in the present study. Despite the shared oronasal vowel /ɔ̃/, analysis of the possessive determiners (e.g., *ton* and *son*) ought not be grouped with prenominal adjectives (e.g., *bon*) due to morphological and semantic differences that exist between the two; consequently, possessive determiner data generated in the corpus are not considered in the present study. Furthermore, tokens of other prenominal adjectives ending in /ɛ̃/ (e.g., *prochain*(*e*), *ancien*(*ne*), etc.), which were also generated in the corpus, are not included in the present study, due to the varying frequencies of these adjectives and of the W1+W2 collocations in which they occur in the language. These adjectives (i.e., /ɛ̃/-final adjectives) merit a separate, future study in which word and collocation frequency are taken into account in the analysis.

The resulting data for the analysis of *bon*(*ne*) consist of 40–41 tokens (some speakers occasionally neglected a token) for each speaker. These tokens were produced in a variety of contexts in order to provide opportunity to compare *bon*(*ne*) both in and out of liaison and *enchaînement*. Vowels in the following contexts were analysed:

(3)	a.	V	*prof*	/pʀɔf/	'professor'
	b.	Ṽ#C	*bon rythme*	/bɔ̃.ʀitm/	'good rhythm'
	c.	Ṽ#V (liaison)	*bon ami*	/bɔ.na.mi/	'good friend (*m.*)
	d.	VN#V	*bonne amie*	/bɔ.na.mi/	'good friend (*f.*)'

Acoustic measurements of the vowels in any single one of these contexts must be compared against the vowel measurements in another context to give them relative meaning. For example, spectral measurements of the oronasal vowel /ɔ̃/ in the present study are only meaningful if they are distinct from those same spectral measurements in the oral vowel /ɔ/. In order to determine whether *bon* in liaison (3c) is more similar to the feminine *bonne* (3d) or the non-liaison *bon* (3b), comparison against both *bonne* (in as similar a phonological context as possible) and *bon* in other, non-liaison contexts must be made; both comparisons are necessary, for even if *bon* in liaison is not produced indistinguishably from *bonne*, it may also not be produced identically to *bon* in other contexts. Additionally, comparison is made of preconsonantal *bon* (3b) against non-nasal /ɔ/ (3a) (e.g., *prof*, *populaire*, *votre*, etc.) in order to verify the suitability of the selected acoustic measures to the data of each individual speaker. As even the most widely-used measures of nasality are not infallible in detecting nasality every time for every

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

person (Styler, 2015), it is prudent to verify that the selected measures can distinguish the maximally different (with regards to nasality) pre-consonantal *bon* from the oral /ɔ/ in contexts where no nasal segment is present; should the measures clearly predict the differences between these two vowels, they can be applied with a certain degree of confidence to other data (i.e., the other pairings). Analysed pairings are summarized in (4):

(4) a. V compared against Ṽ#C
b. Ṽ#C compared against Ṽ#V (liaison)
c. Ṽ#V compared against VN#V

To summarize: comparison of the maximally-different vowels in (4a) is made to determine whether or not the selected acoustic measures can reliably detect the differences between oronasal and oral vowels; comparison of the word *bon* in non-liaison contexts against *bon* in liaison (4b) is made to determine whether or not the nasality of the vowel (with regards to the most common acoustic measures of nasality) is different in liaison from the vowel in other contexts; and comparison of *bon* in liaison is made against the feminine adjective *bonne* in prevocalic position (*enchaînement*) (4c) to determine whether or not the vowels of these two morphologically distinct forms are phonetically distinct.

3.4. Extraction of acoustic data

Using TextGrids in Praat (Boersma and Weenink, 2017), vowel boundaries are identified manually for each of the targeted vowels in word sequences where liaison occurs; that is, where the LC is produced. Targeted sequences where liaison is not made are excluded, as my interest is primarily focused on what happens to the oronasal vowels when liaison actually occurs (see Sampson (2001) for excellent work on the productivity of liaison for novel [Adjective + Noun] sequences). The boundaries are placed around the more stable part of the vowel, excluding formant transitions as much as possible. A Praat script extracts vowel duration (excluding formant transitions), F1, F2, F3 and F1 bandwidth at five equidistant points across the targeted vowel. A separate script by Lennes (2002) that draws a FFT spectrum at a given point is applied at each of the five equidistant points. In each spectrum values of P0, A1 and A3 are manually identified, relying on the extracted F1 and F3 values from the previously mentioned script. The spectra are also used to identify Center of Gravity from the Praat object window. After these different values are determined at each of the five points, the five values of a given measure (e.g., F1 bandwidth) are averaged in order to generate a single value for the token to be analysed in the regression models (e.g., the five F2 values for a given *bon* token are averaged to yield a single F2 value for that specific token).

3.5. Acoustic measures

Nasality is a complex and difficult feature to measure acoustically due to the influence that the anti-formants and nasal formants have on the spectrum

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

(Maeda, 1993; Schwartz, 1968; Styler, 2015). When a side branch is coupled to a resonator, sounds can get reflected from the side branch back onto the signal, which can cause certain frequencies to cancel each other out (Henning and Jongman, 2011; Maeda, 1993; Stevens, 1998; Styler, 2015). Additionally, Stevens (1998) indicates the configuration of the nasal and sinus cavities to vary greatly from person to person, which can result in various effects on the speech signal when nasal coupling does occur. Consequently, no single acoustic measure has proven completely foolproof for measuring nasality for all vowels or speakers (Glass and Zue, 1985; Styler, 2015). Instead of electing to use a single measure, I have selected six acoustic measures that have proven to be generally reliable in past studies (Carignan, 2014; Chen, 1995; Styler, 2015) and use them in concert to distinguish vowel nasality in the targeted tokens. All measures are made in Praat (Boersma and Weenink, 2017).

A1−P0: Marilyn Chen (1995, 1997) proposes to capture the difference between oronasal and oral segments by calculating the relative difference in A1 (the amplitude of the harmonic with greatest intensity near the expected F1) and P0 (the amplitude of the more intense of the first two harmonics). Because of the nasal formants and anti-formants introduced by nasal coupling, the lower harmonics are often amplified by 3db-6dB (Chen, 1997) and harmonics in the range of F1 can be dampened 'by about 5dB' (Chen, 1997: 2363). The relative change in A1−P0 can reflect some of the acoustic differences between oral and oronasal vowels. This measure is used frequently in acoustic analyses of nasality (cf. Pruthi and Espy-Wilson, 2007; Styler, 2015).

A3−P0: Similar to (and based on) the measure that Chen (1995, 1997) proposes, the relative difference in A3 (the amplitude of the harmonic with greatest intensity near the expected F3) and P0 (same P0 as described in previous measure) was proposed by Styler (2015) as a secondary measure that can capture the impact of nasal coupling on the lower ~1500Hz of the spectrum, which is most affected by the lowering of the velum (Stevens, 1998). As harmonics near F3 typically occur outside of the spectral range most affected by nasal coupling, they should theoretically be relatively similar in amplitude from an oronasal vowel to its oral counterpart (for discussion on the indirect relationship between oronasal vowels and their oral counterparts, see Carignan (2014)), and may serve as a relative point of reference between oral and oronasal vowels—unlike P0. Styler (2015) observed A3-P0 to be a relatively reliable indicator of the spectral tilt caused by nasal coupling.

Center of Gravity and F1 bandwidth: A general leveling and widening of the lower formants is often associated with nasal coupling (Delattre, 1968; Maeda, 1982; Macmillan, Kingston, Thorburn, Dickey, and Bartels, 1999), resulting in a lower Spectral Center of Gravity (CoG) and a greater F1 bandwidth (F1.bw) than are typically found in corresponding oral vowels. In his tests on the efficacy of various acoustic features in predicting nasality, Styler (2015) finds these two features to be good indicators.

F2: Carignan (2014) observes that F2 regularly lowers when producing oronasal vowels in NMF, likely due both to nasal peaks introduced by nasal coupling, which can redistribute spectral energy in the frequencies of F2, as well as to differences that he observed in lingual articulation in the production of oronasal vowels, which may

be used to differentiate further the oral-nasal contrast. This measure proved to be more effective for the other nasal-oral vowel pairs that he analysed, but it was still moderately effective for /ɔ̃/.

Duration: Previous studies in French nasality have indicated that increased vowel duration (V.Dur) can be a quality of oronasal vowels when compared against similar oral vowels. Stevens et al. (1987) found duration to be a salient feature in their perception tests. Delvaux et al. (2012) found the duration of oronasal vowels in NMF to be even longer than the oronasal vowels in Southern French; both were longer than their oral counterparts. Styler (2015) also found duration of oronasal vowels to be about 30ms longer than oral vowels. Styler continues to say that duration is likely a secondary feature of vowel nasality used to indicate further to the listener that the vowel is different from an oral vowel; this is similar to what Carignan (2014) observes for lingual articulation (as described in previous section on F2). Consequently, duration of the vowels is also considered in the present study.

3.6. Regression models

In order to better capture how the six acoustic measures (i.e., A1−P0, A3−P0, CoG, F1.bw, F2, and V.Dur) work in concert, principal component scores – or eigenvalues – were generated by means of prcomp in the R "stats" package (R Core Team, 2016). Styler (2015) suggests that one measure may work better on one set of data (e.g., a particular speaker or a given vowel) than another and that it may be that more than one measure is required to capture the effects of nasal coupling on a given vowel. The first three principal component scores (e.g., PC1) were used as independent variables (as they accounted for 80–90% of the variation) in a linear model, with vowel context (e.g., the non-liaison /ɔ̃/ or the non-nasal oral vowel) as a binary dependent variable in R (R Core Team, 2016), as illustrated in (5).

(5) $\mathrm{lm}(\mathrm{Vowel} \sim \mathrm{PC1} + \mathrm{PC2} + \mathrm{PC3}, \mathrm{data} = \mathrm{mydata})$

In order to verify that the acoustic measures were appropriate for the given speaker's data, a regression was first run between the vowels in the (4a) pairing (i.e., non-nasal oral vowels compared against non-liaison /ɔ̃/), which are maximally-different (with regards to nasality). If this model indicated significant differences between what we expect to be maximally different groups, the suitability of the measures for this speaker were understood to be appropriate, and the remaining data for the speaker would be analysed further in regression models following the pairs in (4b) and (4c).

4. RESULTS AND DISCUSSION FOR ACOUSTIC MEASURES

For each of the 19 participants, the first regression that compared V against Ṽ#C (i.e., oral vowels against non-liaison *bon*), which served as a suitability test for the selected acoustic measures on the data of each speaker, indicated there to be significant difference between these two maximally different – with regards to nasal quality – vowels. Average values for the six acoustic measures as produced

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

Table 1. Average vowel measures for male and female speakers

Male	Vowel type and context	A1−P0 (dB)	A3−P0 (dB)	CoG (Hz)	F1.bw (Hz)	F2 (Hz)	V.Dur (ms)
	V	7.7	−19.2	469.1	193.6	1172.3	59.6
	Ṽ#C	3.3	−22	416.5	282.6	1184.3	70.9
	Ṽ#V	7.5	−16.2	520.8	179.6	1254.8	76.5
	VN#V	10.3	−14.1	556.8	92.4	1320.7	74
Female	Vowel type and context	A1−P0 (dB)	A3−P0 (dB)	CoG (Hz)	F1.bw (Hz)	F2 (Hz)	V.Dur (ms)
	V	5.3	−26.9	489.3	105.1	1267.8	62.4
	Ṽ#C	0.6	−32.5	423.6	267.2	1199.9	72.1
	Ṽ#V	5.9	−21.7	561.6	106.1	1455.5	75.4
	VN#V	6.9	−20.7	574.5	90.9	1528	74.7

by male and female speakers, respectively, are given for each of the four primary vowel contexts (i.e., V, Ṽ#C, Ṽ#V, and VN#V) in Table 1. As one of the primary objectives of the present study is to give acoustic descriptions of the differences and similarities that exist between the oronasal vowel /ɔ̃/ in W1 adjectives in liaison and the same vowel in non-liaison adjectives, these results provide an important, quantitative window into this particular aspect of vowel nasality. While significant differences may exist between some of these values, they are provided here with the intent of describing the vowels in the given contexts and may inform and facilitate future research into the topics of vowel nasality and liaison.

Variation between the values for male and female speakers, respectively, is evident in Table 1: female speakers typically produce higher frequencies on CoG, lower values on F1 bandwidth and higher values on F2, which variation in measured values may very well be due to physiological differences between males and females. No noteworthy difference in vowel duration between male and female speakers was detected. While a greater difference for A1−P0 and A3−P0 values is evident among female speakers, the cause of this variation is not clear. As it is a measure of relative difference within an individual's own speech and not a simple value like a F2 measurement, the difference is not as clearly attributable to physiological or other differences.

Overall, values for both male and female speakers differ between vowel-context pairs (e.g., Δ between Ṽ#C and Ṽ#V) in the same direction; for example, for both male and female speakers, the A1−P0 value is consistently higher for the W1 vowel in Ṽ#V than the W1 vowel in Ṽ#C. The only exception to this among all measures and vowel-context pairs is in the difference for F2 between the contexts V and Ṽ#C: for male speakers, the mean frequency of F2 in the oronasal vowel is 12 Hz higher than the mean frequency of F2 in the oral vowel, but for female speakers, the opposite is true.

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

More informative to the primary questions of inquiry than the differences between male and female speakers are the ways in which the oronasal vowel in liaison (Ṽ#V) differs from both the oronasal vowel in a non-liaison context (Ṽ#C) and the oral vowel /ɔ/ (V). For the oronasal vowel in liaison, both male and female speakers produced mean values for A1−P0, A3−P0, CoG and F1.bw that were more similar to values for those same measures in the oral vowel than in the non-liaison, nasal-vowel context. Often the value from the liaison context even surpasses the value from the oral context, resulting in something that appears at first glance to be more oral than the simple oral vowels. For example, non-liaison oronasal vowels had a lower mean frequency for CoG than their oral counterparts (i.e., for male speakers, CoG for Ṽ#C was 416.5 Hz compared to 469.1Hz for V, a difference of 51.5 Hz), but the mean frequency for CoG in the liaison context (Ṽ#V) was 520.8 Hz, which is 51.7 Hz greater than in context V and 104.3 Hz greater than in context Ṽ#C; with regards to F2, the mean value for Ṽ#V was greater than for both Ṽ#C and V contexts, though the difference in direction observed between genders alters the relationship between the Ṽ#V value and that of the other contexts. These similarities of the ultimate W1 vowel in context Ṽ#V when compared against the vowels of context V may appear surprising, though the data must be viewed with the understanding that the contexts in which V was measured were more phonemically diverse than were the vowels in either *bon* in liaison and pre-vocalic *bonne*. The latter two were very controlled, in that the targeted vowel only occured between the consonants /b/ and /n/, which are both articulated toward the front of the oral cavity. This frontedness likely accounts for higher CoG and F2 values than were observed for the vowels of context V, which occurred in a greater variety of words, syllables and sound sequences (e.g., *prof* 'professor', *populaire* 'popular', *votre* 'your', *offrent* '[they] offer', *Europe* 'Europe', etc.). Thus, the vowels in liaison and *enchaînement* were not more oral than oral; rather, they were oral, but not necessarily identical to /ɔ/. Greater control (e.g., only using ultimate, open-syllable V contexts) could provide greater clarity into the differences and similarities that exist between the vowels in contexts V and Ṽ#V, but they will still ultimately be different phonemic sequences that yield different phonetic results.

While there were many similarities between the vowels of liaison *bon* and *bonne* in *enchaînement*, one major difference was observed in vowel duration (V.Dur) with the vowels of liaison *bon* and *bonne* in *enchaînement* being about 16ms longer than oral vowels in non-nasal sequences. This difference in duration may simply be due to regressive, coarticulatory effects by the nasal consonant [n].

Comparison between the mean values of contexts Ṽ#V and VN#V suggests the differences between the vowels in these two contexts to be much smaller than the differences that exist between most of the other categories analysed. While little can be concluded by simple comparison of the mean values, it appears that the vowels in contexts Ṽ#V and VN#V may be quite similar, indeed; as has been suggested in previous observations of the oronasal vowel in liaison (see section 1, above). To better understand the relationship between the vowels of these contexts, a more in-depth analysis is required.

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

5. RESULTS OF THE REGRESSION MODELS

Regression results for the pairing Ṽ#C and V, which serves as a test of suitability for the acoustic measures selected, indicated there to be significant differences between these vowels in the data for each of the 19 speakers. While not every measure proved significant for every speaker, the measures in concert indicated these vowels to be, indeed, distinct with regards to nasal quality for every speaker. Results from the regression models on the other vowel pairings differed in primarily four different ways for the 19 speakers. In this description and discussion, I hesitate to use the terms denasalized, rather than simply partially nasal, because our understanding of the nature of the LC can influence our view on where the preceding vowel in question comes from and what processes affect it; the nature of LC will be discussed in greater detail in the following section.

The regression model results from 11 of the 19 speakers demonstrated the pattern in Figure 1, in which the selected measures indicated there to be a significant difference ($p < 0.05$) between the vowels in contexts Ṽ#C and Ṽ#V, but not between the vowels in contexts Ṽ#V and VN#V. By far the most common result, this pattern suggests a partially nasal vowel that is found in liaison *bon* and pre-vocalic *bonne* (Ṽ#V and VN#V, respectively) and that is different from a normal oronasal vowel (Ṽ#C). I say partially nasal, and not oral, because it has previously been shown that modest regressive nasal assimilation can occur in French (Delvaux, Demolin, Harmegnies and Soquet, 2008). It may be that the vowel in some liaison sequences was more nasal and in others it was more oral, but the analyses do indicate a clear difference between the vowels in question for 11 of the 19 speakers.

For four speakers, neither regression indicated significant difference between these vowel contexts, as illustrated in Figure 2. It should not be inferred that the vowel of non-liaison *bon* can in any way be equated with the vowel of pre-vocalic *bonne*, but it may indicate variety in the realization of *bon* in liaison. Just as Bybee (2001, 2005) indicates that liaison is more commonly made in more frequent collocations, it may be that *bon* is realized closer to *bonne* in more frequent liaison word sequences. For example, in the French Web Corpus (Jakubíček, 2013) the sequence *bon ami* 'good friend (*m.*)' appears over 11,000 times, and the less common sequence *bon idéal* 'good ideal' appears only six times. The phonetic effects of frequency certainly merit future consideration. It should be noted that one of the speakers in this group had lived in the United States for just over five years, and another since elementary school, which might have an influence on their speech habits.

Results for the data of one speaker patterned in such a way that significant difference was detected between the vowels in pre-vocalic *bonne* and liaison *bon*, but no significant difference was detected between the vowels of *bon* in liaison and non-liaison *bon*, as illustrated in Figure 3. This is not to suggest that perceptually the *bon* vowels would be indistinguishable or even that the vowels are not distinct in other acoustic ways; but it may be that some of the individual Word1+Word2 sequences were more nasal than others – as suggested earlier with collocation frequency – or that, as a whole, the vowels in these sequences were simply more nasal than those in the data from other speakers. Impressionistically,

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

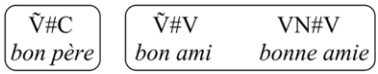

Figure 1. Regression results for 11 speakers, in which significant differences were found between Ṽ#C and Ṽ#V, but not Ṽ#V and VN#V.

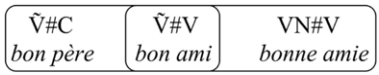

Figure 2. Regression results for four speakers, in which no significant difference was found between either Ṽ#C and Ṽ#V, or Ṽ#V and VN#V.

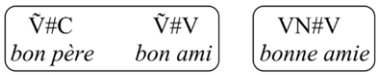

Figure 3. Regression results for one speaker, in which significant difference was found between Ṽ#V and VN#V, but not between Ṽ#C and Ṽ#V.

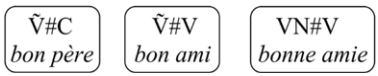

Figure 4. Regression results for three speakers, in which significant difference was found between both Ṽ#V and VN#V, and Ṽ#C and Ṽ#V.

many of this speaker's *bon* liaison (Ṽ#V) tokens sound notably nasal, which may be a result of this speaker being the second to reside in the United States since elementary school.

The data for three speakers demonstrated the pattern shown in Figure 4, in which significant difference was detected between the vowels in both contexts. This pattern of results is difficult to account for. While it is possible that two distinct vowels (i.e., the W1 vowel of Ṽ#V and the W1 vowel of VN#V) exist on a spectrum of nasality between the vowels of V and Ṽ#C, future investigation (such as a perception test) into these data would yield a more likely explanation.

6. DISCUSSION AND THEORETICAL IMPLICATIONS

Based on the above results, 15 of the 19 speakers (those demonstrating the patterns in Figures 1 and 2) seem to produce the vowel in *bon* in liaison indistinguishably from the vowel in *bonne* in the similar *enchaînement* position, with regards to the six acoustic measures associated with vowel nasality as has been suggested in the literature for decades (Delattre, 1947/1966; Fouché, 1959; Sampson, 2001; Côté, 2005, 2011). While these phonetic data shed light on the phonetic research questions posed in Section 1, they may also have theoretical implications with regards to certain phonological questions on liaison and nasality.

In previous sections, I described the vowel of liaison *bon* and the vowel of the feminine form *bonne* as partially nasal, rather than denasalized: the term denasalization for the oronasal vowel in *bon* (/bɔ̃/) implies that the underlying form of *bon* in liaison has an oronasal vowel to which the process of denasalization is applied, or perhaps a nasal feature that must be realized either as an oronasal vowel or as an overt nasal consonant. The term denasalization is often used, but rarely defined in clear phonetic terms. A general definition is

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

given by Laver (1980: 88) as any process that 'minimizes the occurrence of audible nasality', but whether that means a partial or full reduction of nasality in a vowel remains unclear. For some speakers it may be that a partial reduction in nasal quality does occur, implying that denasalized vowels may exist on a continuum of nasality between oral and nasal. However, the present results suggest the vowel of *bon* in liaison to be largely indistinguishable from the vowel in *bonne*. The strong similarities that exist between the pronunciation for the masculine *bon* in liaison and the feminine *bonne* are important for the discussion of the nature of the LC (in this case [n]) for this and other prenominal adjectives. Given the fact that the *bon* liaison form and the *bonne* form are seemingly indistinguishable for many speakers, it seems more likely that the differences between non-liaison *bon* and liaison *bon* are more reflective of the speakers' lexicon than of phonological processes.

My intention in this section is not to argue for one liaison theory over another, but to present how these data may be seen as evidence for two theories of liaison. The first theory is suppletion (Côté, 2005; Morin, 1986; Steriade, 1999; Tranel, 1990), which suggests that separate forms of a given word exist in the lexicon and that a speaker makes a lexical choice for a given context, rather than a series of transformational processes. For example, two forms for the word *bon*(*ne*) would exist in the lexicon: the form /bɔ̃/ would be used for masculine, non-liaison contexts, and another form /bɔn/ would be used for both feminine *bonne* generally, as well as masculine *bon* in liaison. The data in the present study suggest that a shared form /bɔn/ might exist in liaison for many speakers of NMF. It is, of course, possible that phonological transformations (including denasalization) could render *bon* in liaison indistinguishable from *bonne*, but there is evidence for suppletion in other prenominal adjectives elsewhere in the French language.

Other prenominal adjectives exhibit not only a different phonological form pre-vocalically, but also a distinct orthographic form. Tranel (1990) highlights cases of clearly identifiable suppletion with prenominal adjectives that have two orthographically and phonologically distinct forms for masculine singular usages, as seen in (6) (modified from Tranel (1990: 171):

(6)	beau/bel	[bo]/[bɛl]	un *beau* gars/un *bel* homme 'a handsome lad/a handsome man'
	vieux/vieil	[vjø]/[vjɛj]	un *vieux* mec/un *vieil* homme 'an old dude/an old man'

The pre-vocalic forms of the adjectives in (6) (others include *nouveau*/*nouvel*, *mou*/*mol*, *fou*/*fol*, etc.) are phonemically identical to the feminine adjectival forms (e.g., *belle* [bɛl] and *vieille* [vjɛj]). Despite the lack of distinct orthographic forms, the prenominal adjective *bon* behaves in similar ways, in that it seems to have two separate singular lexical forms. In fact, both Steriade (1999) and Côté (2005) specifically offer the adjective *bon* as a case for suppletion, though they do so without the phonetic evidence for the clear distinction between non-liaison *bon* and liaison *bon* that is provided by the present study. Some may argue that the cases of *bon* and *beau*/*bel* are phonologically different enough

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

(i.e., *bon* exhibiting denasalization and *beau*/*bel* exhibiting vocalization) that the cases cannot be considered analogous. While the phonological processes of denasalization and vocalization are indeed different, the apparent existence of a masculine form of the prenominal adjective that is phonemically and phonetically indistinguishable from the feminine form is strong evidence that it is a lexical process – and not a phonological process – that is at play in the case of these adjectives. However, as not all of the speakers here consistently pronounced *bon* in liaison distinctly from non-liaison *bon*, it is worth considering that, perhaps, *bon* may not be entirely suppletive for all speakers, nor that all speakers treat word sequences where liaison may be produced in the same way – neither must they.

A second liaison theory that may be supported by the present study concerns ideas proposed by Bybee (1998, 2001, 2005) that 'constructions are storage and processing units just as words and fixed phrases are' (2001: 22). In her work, Bybee shows that liaison occurs less in lower-frequency collocations than in higher-frequency collocations. While collocation frequency wasn't included in the statistical models of the present study, it may be that a more frequent collocation, such as *bon ami*, may be stored as its own 'precompiled chunk' (Bybee, 1998: 433), which notion also aligns somewhat with the suppletion theory discussed above.

It is, of course, entirely possible that these theories co-exist in a speaker's idiolect with the more traditional phonological processes, as they aren't necessarily mutually exclusive. It may very well be that the more frequently occurring collocations are stored as suppletive forms in the lexicon, and that these forms may be a part of a complex lexical chunk, and that the less frequent collocations undergo processes such as denasalization. Future work in these areas will certainly be welcome.

7. CONCLUSION

In this study, I have sought to bring quantitative, acoustical data to verify conventional understandings of *bon* in liaison that have previously been based solely on impressions. While the narrowness of the study limits us from drawing conclusions about other oronasal vowels in liaison (i.e., /ɛ̃/), it has been shown that the majority of NMF speakers in this study seem to produce *bon* in liaison with a vowel that is distinct from the oronasal vowel /ɔ̃/, as well as similar to its oral counterpart in *enchaînement*. Study of the oronasal vowel /ɛ̃/ in liaison certainly merits future study, as its complexity and richness (both due to the greater number of available prenominal adjectives available with this vowel) would greatly expand our understanding of the behavior of oronasal vowels in liaison. As for other cases of prenominal, /ɔ̃/-final W1, study is already underway on the pronunciation of certain oronasal vowel-final, possessive determiners (e.g., *son* 'his/her') in liaison, which have traditionally been described as maintaining vowel nasality (Delattre, 1947/1966). Finally, I hope that the acoustic description (including the mean values for acoustic measures) will be helpful for others who engage in other studies of vowel nasality, as we strive to demystify this particular aspect of voice quality.

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

REFERENCES

Boersma, P. and Weenink, P. (2017). Praat (Version 6.0.24) [Software]. URL: http://www.fon.hum.uva.nl/praat/download_mac.html

Bybee, J. (1998). *The Emergent Lexicon. CLS 34: The Panels*. Chicago: Chicago Linguistics Society, pp. 421–435.

Bybee, J. (2001). Frequency effects on French liaison. *Typological Studies in Language*, **45**: 337–360.

Bybee, J. (2005). La liaison: Effets de fréquence et constructions. *Languages*, **158**: 24–37.

Carignan, C. (2013). When nasal is more than nasal: The oral articulation of nasal vowels in two dialects of French. PhD thesis, University of Illinois at Urbana-Champaign.

Carignan, C. (2014). An acoustic and articulatory examination of the 'oral' in 'nasal': The oral articulations of French nasal vowels are not arbitrary. *Journal of Phonetics*, **46**: 23–33.

Carignan, C., Shosted, R., Fu, M., Liang, Z.-P. and Sutton, B. (2015). A real-time MRI investigation of the role of lingual and pharyngeal articulation in the production of the nasal vowel system of French. *Journal of Phonetics*, **50**: 34–51.

Chen, M. Y. (1995). Acoustic parameters of nasalized vowels in hearing-impaired and normal-hearing speakers. *Journal of the Acoustical Society of America*, **98**(5): 2443–2453.

Chen, M. Y. (1997). Acoustic correlates of English and French nasalized vowels. *Journal of the Acoustical Society of America*, **102**(4): 2360–2370.

Côté, M. H. (2005). Le statut lexical des consonnes de liaison. *Langages*, **2**: 66–78.

Côté, M.-H. (2011). French Liaison. In *The Blackwell Companion to Phonology*, **5**: 2685–2710. Malden, MA: Wiley-Blackwell.

Delattre, P. (1947/1966). La liaison en français, tendences et classification. In P. Delattre (ed.), *Studies in French and comparative phonetics: Selected papers in French and English*. The Hague: Mouton, pp. 39–54.

Delattre, P. (1968). Divergences entre nasalités vocalique et consonantique en français. *Word*, **24**(1–3): 64–72.

Delattre, P. and Monnot, M. (1968). The role of duration in the identification of French nasal vowels. *International Review of Applied Linguistics in Language Teaching*, **6**(3): 267–288.

Delvaux, V. (2009). Perception du contraste de nasalité vocalique en Français. *Journal of French Language Studies*, **19**(1): 25–59.

Delvaux, V., Demolin, D., Harmegnies, B., and Soquet, A. (2008). The aerodynamics of nasalization in French. *Journal of Phonetics*, **36**(4): 578–606.

Delvaux, V., Huet, K., Piccaluga, M., and Harmegnies, B. (2012). Inter-gestural timing in French nasal vowels: A comparative study of (liëge, tournai) northern French vs. (marseille, toulouse) southern French. In *Interspeech* **2012**, 2683–2685.

Durand, J. and Lyche, C. (2008). French liaison in the light of corpus data. *Journal of French Language Studies*, **18**(1): 33–66.

Fouché, P. (1959). *Traité de la prononciation française*, 2nd edn. Paris: Klincksieck.

Glass, J. R. and Zue, V. W. (1985). Detection of nasalized vowels in American English. In Acoustics, Speech, and Signal Processing, IEEE International Conference on ICASSP '85, 10: 1569–1572.

Gordon, M. and Ladefoged, P. (2001). Phonation types: A cross-linguistic overview. *Journal of Phonetics*, **29**(4): 383–406.

Hattori, S., Yamamoto, K. and Fujimura, O. (1958). Nasalization of vowels in relation to nasals. *Journal of the Acoustical Society of America*, **30**(4): 267–274.

Hawkins, S. and Stevens, K. N. (1985). Acoustic and perceptual correlates of the non-nasal–nasal distinction for vowels. *Journal of the Acoustical Society of America*, **77**(4): 1560–1575.

Henning, R. and Jongman, A. (2011). *Phonetics: Transcription, production, acoustics, and perception*. Hoboken: Wiley.

Jakubíček, M., Kilgarriff, A., Kovář, V., Rychlý, P. and Suchomel, V. (2013, July). The TenTen corpus family. *In 7th International Corpus Linguistics Conference CL* (pp. 125–127).

Kiefte, M. and Kluender, K. R. (2005). The relative importance of spectral tilt in monophthongs and diphthongs. *Journal of the Acoustical Society of America*, **117**: 1395–1404.

Lennes, M. (2002). Draw spectrum from selection [Praat script]. URL: http://www.helsinki.fi/~lennes/praat-scripts/public/draw_spectrum_from_selection.praat

Macmillan, N. A., Kingston, J., Thorburn, R., Dickey, L. W. and Bartels, C. (1999). Integrality of nasalization and F1. II. Basic sensitivity and phonetic labeling measure distinct sensory and decision-rule interactions. *Journal of the Acoustical Society of America*, **106**: 2913–2932.

Maeda, S. (1982). Acoustic correlates of vowel nasalization: A simulation study. *Journal of the Acoustical Society of America*, **72**: S102.

Maeda, S. (1993). Acoustics of vowel nasalization and articulatory shifts in French nasal vowels. *Phonetics and Phonology*, **5**: 147–167.

Morin, Y. C. (1986). On the morphologization of word-final consonant deletion in French. In: H. Andersen (ed), *Sandhi phenomena in the langues of Europe*. Berlin: Mouton de Gruyter, pp. 176–210.

Pruthi, T. and Espy-Wilson, C. Y. (2007, August). Acoustic parameters for the automatic detection of vowel nasalization. *Interspeech* (pp. 1925–1928).

R Core Team. (2016). R: A language and environment for statistical computing (Version 1.0.136). Vienna: R Foundation for Statistical Computing. URL: https://www.R-project.org/

Sampson, R. (2001). Liaison, nasal vowels and productivity. *Journal of French Language Studies*, **11**(2): 241–258.

Schwartz, M. F. (1968). The acoustics of normal and nasal vowel production. *The Cleft Palate Journal*, **5**(2): 125–140.

Selkirk, E. (1974). French liaison and the $\bar{X}$ notation. *Linguistic Inquiry*, **5**(4): 573–590.

Shosted, R., Carignan, C. and Rong, P. (2012). Managing the distinctiveness of phonemic nasal vowels: Articulatory evidence from Hindi. *Journal of the Acoustical Society of America*, **131**(1): 455–465.

Steriade, D. (1999). Lexical conservatism in French adjectival liaison. In: J.-M. Authier, B. E. Bullock, and L. A. Reed (eds), *Formal perspectives on Romance linguistics*. Amsterdam: Benjamins, pp. 243–270.

Stevens, K. N. (1998). *Acoustic Phonetics*. Cambridge: MIT Press.

Stevens, K. N., Andrede, A., and Viana, M. C. (1987). Perception of vowel nasalization in VC contexts: A cross-language study. *The Journal of the Acoustical Society of America*, **82.S1**: S119.

Styler, W. (2015). On the acoustical and perceptual features of vowel nasality. PhD thesis, University of Colorado.

Tranel, B. (1990). On suppletion and French liaison. *Probus*, **2**(2): 169–208.

Appendix

Chaque année l'aéroport Paris-Charles de Gaulle accueille des millions de touristes de partout. Mais il n'est pas le seul aéroport de la Ville Lumière. L'aéroport Paris-Orly est moins connu aux touristes américains, mais le onzième aéroport d'Europe est bien connu sur le continent.

Bien qu'il ne soit pas aussi populaire que l'aéroport CDG, si on remontait un peu dans son histoire, on verrait que Paris-Orly attirait beaucoup plus que les voyageurs. Pour un bon moment, l'ancienne aérogare de sud a été le premier site touristique de France où on venait passer ses « dimanches à Orly. » On pouvait y regarder un bon film, prendre un verre ou écouter un peu de musique en live. Aujourd'hui Orly attire moins de riverains, mais les voyageurs y trouvent des expériences tout confort. Avant de partir en plein aventure, vous pouvez dîner à un bon restaurant, faire un peu de shopping aux boutiques qui offrent une bonne exemption de TVA, ou regarder le prochain match de foot aux kiosques vidéos. Ou si vous avez un peu plus de temps, vous pouvez vous trouver en plein milieu de centre-ville en quelques minutes, grâce aux lignes du RER et du Métro.

A Orly il y a quelques millier d'employés à plein temps pour vous accueillir lors de votre prochaine arrivée ou départ. Tous sont d'une bonne apparence et un certain esprit qui est nécessaire pour la nature imprévisible de leur travail.

Cet ancien aéroport militaire dessert la France, l'Europe, le Moyen-Orient et l'Afrique. Donc, la prochaine fois que vous aurez envie de descendre au niveau de la mer vous promener en plein air aux plages méditerranéennes ou de monter aux hauteurs des Alpes afin de respirer l'air pur des sommets dont la moyenne altitude est 2500m, dépêchez-vous à l'aéroport Paris-Orly ! Bon voyage !

Figure 5. Reading task of 300 words used to generate corpus.

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

Paul est un ado un peu comme les autres de son âge : il aime bien apprendre et il est assez intelligent, mais il a du mal à s'engager dans ses études. Il préfère les médias. Au lieu d'écouter le prof en classe, il regarde souvent les vidéos sur son iPhone (bien qu'il préfère les regarder en plein écran sur son ordinateur chez lui). Il adore tout ce qui est vidéo et cinéma : des séries américaines, des clips sur YouTube, des films de court et moyen métrage (il ne supporte pas les films qui durent trois heures), etc. Il se dit que c'est pour se préparer pour sa carrière de cinéaste, mais, en fait, il ne sait pas ce qu'Il veut faire. Il regarde un peu de tout plutôt pour éviter ce qui lui rappelle de sa mère; c'est à dire : pour tout éviter.

Sa bonne mère. Sa "petite maman" est morte jeune. Pas jeune ; elle était déjà d'un certain âge, mais sa vie a terminé trop tôt. Paul croyait qu'elle avait beaucoup plus à donner au monde. Cette bonne samaritaine était souvent bénévole à son association préférée (la Croix-Rouge), elle faisait des dessins pour les enfants aux foires (elle était trèsbonne artiste) et elle enseignait un cours de français pour les immigrés et les enfants d'un certain milieu. En bref, elle vivait pour les autres. Mais un jour elle est montée dans un bus. Crise cardiaque. Elle est morte avant le prochain arrêt.

Maintenant Paul habite avec son père dans appartement au plein centre-ville. C'est un bon appartement, mais son ancienne maison à côté de la ville lui manque. Ils ont déménagé quand son père est devenu maire. Paul aime bien son père. Bien qu'ils s'amusent très peu ensemble, Paul le respecte beaucoup ; c'est un vrai bon exemple pour un jeune comme Paul. Les gens de la ville l'aiment bien aussi, car il est un bon maire qui fait bien son travail et il a une bonne réputation pour tenir parole. Il fait son possible et Paul le sait. Malgré leur bonne situation, Paul a du mal à s'en habituer.

A chaque fois qu'il pense à la maison de son enfance, à l'ancienne rue avec les copains qu'il aimait, à son ancienne école, il éprouve une certaine nostalgie pour la vie qui lui semble maintenant parfaite. Ça fait déjà 5 ans depuis le déménagement. Et maintenant, le voilà : un jeune homme de 15 ans, en pleine adolescence. Il essaie de se sortir de ce brouillard de qui suis-je ? pour trouver l'avenir prometteur dont lui parle son père. Il fait un bon effort. Peut-être un moyen effort. Moyen, à la rigueur. Mais c'est un effort quand même. Et pour l'instant c'est tout ce qu'il peut faire. Sa maman serait assez fière.

Figure 6. Reading task of 468 words used to generate corpus.

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

à plein nez	bon accent	certain orgueil
à pleine main	bon ami	certain point
à pleine ouverture	bon architecte	certain respect
ancien ami	bon artisan	certain type
ancien écolier	bon auteur	certain week-end
ancien employé	bon cantique	certaine agence
ancien époux	bon écrivain	certaine aura
ancien étable	bon idéal	certaine espèce
ancien état	bon marché	certaine façon
ancien étudiant	bon modèle	certaine humilité
ancien franc	bon nombre	certaine idée
ancien instructeur	bon rythme	certaine manière
ancien jardin	bon samaritain	certaine maturité
ancien magasin	bon souvenir	certaine organisation
ancien maître	bonne accentuation	certaine proie
ancien ministre	bonne amie	certaine rencontre
ancien mobile	bonne architecte	certaine tendance
ancien modèle	bonne auteure	en plein est
ancien navire	bonne cantine	en plein hiver
ancien professeur	bonne écrivaine	en plein ouest
ancien régime	bonne idée	en pleine cité
ancien testament	bonne momie	en pleine euphorie
ancien truc	bonne nuit	en pleine guerre
ancienne amie	bonne santé	en pleine interview
ancienne employée	bonne souveraineté	en pleine nuit
ancienne épouse	certain courage	moyen âge
ancienne étudiante	certain Espagnol	moyen français
ancienne forteresse	certain homme	moyen terme
ancienne galerie	certain humour	moyenne bourgeoisie
ancienne institutrice	certain italien	moyenne section
ancienne maîtresse	certain moment	plein emploi
ancienne marque	certain musée	pleine lune
ancienne montre	certain niveau	prochain ami
ancienne note	certain nombre	prochain amour

Figure 7. Reading task of 150 word sequences embedded in the carrier phrase *Je dis X encore une fois* ('I say X one more time').

https://doi.org/10.1017/S0959269519000322 Published online by Cambridge University Press

prochain champion	prochaine amie	ton diplôme
prochain concert	prochaine coupe	ton esprit
prochain époux	prochaine diffusion	ton expérience
prochain étage	prochaine épouse	ton idée
prochain étudiant	prochaine étape	ton identité
prochain exemple	prochaine étudiante	ton lycée
prochain film	prochaine hyène	ton magasin
prochain membre	prochaine manifestation	ton neveu
prochain mode	prochaine mode	ton nez
prochain mouvement	prochaine montre	ton nom
prochain navire	prochaine nuit	ton objectif
prochain numéro	prochaine occasion	ton œil
prochain ordre	prochaine Peugeot	ton oiseau
prochain train	ton activité	ton rôle
prochain yacht	ton ami	ton sport
prochaine âme	ton avis	ton walkman

Figure 7. (continued).

Cite this article: McBride AF (2021). Prenominal *bon* and *bonne* in French liaison and *enchaînement*: An acoustic description. *Journal of French Language Studies* **31,** 3–23 https://doi.org/10.1017/S0959269519000322