Epenthesis Positioning and Syllable Contact in English and French

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Abstract: This study addresses the positioning of an epenthetic element used as a marker of emphasis in English and French within Optimality Theory (Prince & Smolensky 1993/2004). The epentheses to be analyzed here are mostly considered "syllable structure optimization" (Sommerstein 1977: 227), which introduces a less than ideal syllable structure to the CV-structure. The source epentheses highlight an application of a Markedness constraint SYLLCON (Rose 2000), which requires that "the first segment of the onset of a syllable must be lower in sonority than the last segment in the immediately preceding syllable" (Rose 2000: 401). Following Rose (2000), we suggest that the generation of the grammatical output satisfying SYLLCON embodies the emergence of the unmarked (McCarthy & Prince 1994) in the source languages.

Keywords: epenthesis, emphasis, syllable contact, Optimality Theory

1. Introduction

The goal of this paper[1] is to account for epentheses that could arise due to intensification in English and French. The words *emphasis* and *intensification* are used interchangeably in this paper. Emphasis in spoken language is generally defined as a phenomenon which involves the stressing of a stressed syllable further, the rendering of the pitch range more salient, the lengthening of the stressed syllable, and the switching of stress pattern (*The Kenkyusha companion to the English language and linguistic terms* 2002), or the inserting of a mora (Hyman 2003) will occur as a marker of emphasis. French also uses emphatic stress "to signal a variety of semantic or affective contrasts" (Walker 2001: 181). For the most part, it is critical in investigating what marker of emphasis or combination of specific markers, as the case might be, is implemented because an individual case of emphasis in the spoken language may varyingly utilize a marker of emphasis. With that said, a comprehensive analysis of the mechanisms that drive intensification in the source languages goes beyond the scope of our paper and we will not deal with vowel length, shift in stress pattern, or pitch range phonetically or acoustically. Instead, the cross-linguistic nature of the paper led us to investigate epenthesis in Optimality Theory (OT, hereafter) (Prince & Smolensky 1993/2004) because OT is an inherently typological theory, enabling us to characterize the epenthetic forms arising due to violations of the Faithfulness constraint in the target languages though the languages might require different interactions of constraints in generating the epenthetic forms. The vowel epenthesis examples investigated here do not arise under normal circumstances (in "normal" pronunciation) in the target languages

except obligatory schwa epenthesis in French (See (9)), whereas they are induced to arise only under emphatic pronunciation. This feature allows us to reason that the epentheses that this paper is addressing involve nonuniformity, which is defined as "systematically inconsistent behavior" (McCarthy 2008: 32). The presence of nonuniformity is often translated into interactions of inviolable constraints in OT. We reason that non-emphatic pronunciation requires the Faithfulness constraint to dominate the Markedness constraint, whereas emphatic pronunciation reverses this constraint domination in ranking, where an epenthetic element is not disallowed in the grammatical output. As Rose (2000) suggests, the emergence of the grammatical output satisfying syllable contact law is considered as "the emergence of the unmarked" (TETU, hereafter) (McCarthy & Prince 1994), our specific interest revolves around a crucial role of syllable contact law in defining an epenthetic position in a word. Both English and French may well share the implementation of this law in their grammar. Typically, TETU refers to a scenario in which a language allows the marked structure in general situations, but under certain circumstances the language often blocks the Faithfulness constraint from being undominated in grammar, allowing the unmarked structure to emerge (Pater 1997). If the constraint SYLLCON (Rose 2000) embodying syllable contact law is universal, i.e. common in other world languages, then we can predict that syllable contact law plays a role in finding an epenthetic position for a segment in a word, and that position can be within the morpheme or syllable boundary in English and French, where a falling sonority profile is observed.

We review data from past studies in English and French, which show similarities and dissimilarities of the epenthesis for situations in which emphasis is applied. For the epentheses for emphasis in American English, Hooper (1976), Wolfram & Johnson (1982), Cassidy (1983), and Kobayashi (2014a, 2014b) offer some data relevant to the investigation of syllable contact in the assessment of an epenthetic position. Côté (2000) and Braun (2005) provide useful data on schwa epenthesis as a marker of emphasis in French. Though it is well known that in both English and French, schwa epentheses for emphasis arise for some pragmatic reasons, and as such the epenthesis improves on the syllable structure, ultimately generating the CV-syllable, less known is that syllable contact law plays a crucial role in locating an epenthetic site in English and French words. A phonological process which changes a less than optimal syllable structure into a preferred CV-structure is referred to as "syllable structure optimization" (Sommerstein 1977: 227).

We need to be cautious about "the fallacy of the view that all dialects of the same language must have the same underlying representations" (Tranel 1981: 291), and hence an example shown here cannot be understood as representative in the entire communities of speakers of that language; numerous factors, such as "individual variation (idiolects)" (Skaer 2001: 7), regional variation, age, gender and socio-economic status, might influence the production of the target epentheses. This study does not intend to investigate these contributory factors in the generation of the individual epentheses in both English and French largely because it is well beyond the scope of our research capacity.

The organization of this paper is as follows. Section 2 reviews past studies on epenthesis and syllable contact, followed by the providing of the linguistic data from various published materials. Section 3 conducts an OT constraint-based analysis of individual patterns of epenthesis: schwa epenthesis in American English and French. Section 4 offers conclusions and suggests a potential area into which future research could be made.

2. Literature review

2.1. Epenthesis and epenthetic elements

Epenthesis can be defined as the insertion of a vowel or consonant to break up a consonantal cluster or vowel sequence for phonotactic considerations (Kager 1999). Therefore, epenthetic elements do not have input correspondence in OT. Markedness constraints influence the phonological properties of an epenthetic element with no input preserved (de Lacy 2002) whereas Faithfulness constraints are demoted to a lower rank, thereby allowing the epenthetic element in the output.

Epenthetic elements tend to be either minimally marked or contextually rich (Selkirk 1981; Itô 1989). Past studies show that minimally marked segments that are context-free are vowels such as /ɪ/, /ɨ/, and /ə/ in most world languages (Kager 1999). Note "the misconception that all epenthesized neutral vowels are schwa (they aren't)" (Skaer 1995: 121). In English, indeed, the epenthetic vowel [ɨ] is used in the pluralizing mapping of 'miss' /mɪs/ → 'misses' [mɪsɨz] (Skaer 1995). Here, let us get a sense for schwa epenthesis cross-linguistically. Schwa is the well-known epenthetic vowel as well as "the vowel of least effort" (Skaer 2001: 7), as for example, the word *film* is pronounced disyllabic [fɪ.ləm] in Irish English (van Donselaar, Kuijpers, & Cutler 1999) and the word *Laden* 'store' is pronounced disyllabic [laː.dən] in German (Hall 2002). We adopt the convention that a dot between segments represents a syllabic boundary. In Chaha, an Ethiopian Semitic language, the normal epenthetic vowel /ɨ/ is used as in /srt/ → [sɨrt] 'cauterize (masculine singular imperative form)' (Rose 2000). Vowel epenthesis due to emphasis is also reported in Chaha, as in "/səß-m/ [səßɨm] 'people-EMPH'" (Rose 2000: 407). In this paper, we are treating /ə/ (mid-lax vowel) as the standard epenthetic vowel in English and French. Schwa is unstressed cross-linguistically (Urbanczyk 1999), including English. Of note, epenthesis is believed to "serve to actually increase overall actual articulatory effort" (Skaer 2001: 7) while velocity is potentially on the decrease. The articulatory effort refers to the amount of effort needed to make for physical distance from the static state of various speech organs to the intended place of articulation inside the oral cavity, and subsequently retrieve the speech apparatuses to individual static states (Skaer 2001). Skaer (2005) ranks a range of phonemes based on the notion of articulatory cost, which is illustrated in (1). The symbol, '>', in (1) reads 'lower than' in terms of articulatory cost;

(1) Articulatory cost (ranked low to high)
Low vowels > Mid vowels > High vowels > Stops > Fricatives > Nasals > Glides > Liquids (where low cost is favored over high)

(Skaer 2005: 90)

This ranking shows that as the mid-lax vowel [ə] is categorized as a mid-vowel it is therefore ranked below high vowels and above low vowels, thus, schwa epenthesis appears at least slightly more effortful than low vowel epenthesis.

Wells (2000: 52) suggests that the epenthesizing of the /ə/ in the heterosyllabic boundary is considered incorrect, as in /æθlɛtɪk/ → [æθ.ə.lɛt.ɪk], though it is "in widespread use" (p. xiv). *Why* is this epenthetic form considered incorrect? Does OT have the explanatory power to account for this epenthesis? One reason that we think this epenthetic form is not considered correct partly stems from the fact that the epenthetic form lacks an onset in the ultimate, antepenultimate and initial syllable, where generally a syllable with an onset is favored. We will come back to this issue when dealing with a constraint ranking to account for the epenthetic mapping of /æθlɛtɪk/ → [æθ.ə.lɛt.ɪk] in Section 3.1.3.

2.2. Syllable Contact Law

Vennemann (1988: 40) shows that "a syllable contact A$B is the more preferred, the less the Consonantal Strength of the offset A and the greater Consonantal Strength of the onset B; more precisely – the greater the characteristic difference CS(B) – CS(A) between the Consonantal Strength of B and that of A." The Consonantal Strength is defined as "a phonetic parameter of degree of deviation from unimpeded (voiced) air flow" in world languages (Vennemann 1988: 8). For example, lower vowels produce the most unimpeded and voiced air flow since there is little constriction in the oral cavity in its production; so, as indicated in (2), lower vowels are ranked the lowest in terms of Consonantal Strength. By contrast, voiceless stops produce the least unimpeded air flow and therefore leaves them top ranked in Consonantal Strength. The symbol, ">", in (2) reads 'greater than' in terms of Consonantal Strength.

(2) Increasing Consonantal Strength
Voiceless plosives > Voiced plosives > Voiceless fricatives > Voiced fricatives > Nasals > Lateral liquids (l-sounds) > Lateral liquids (r-sounds) > High vowels > Mid vowels > Low vowels
(Vennemann 1988)

For the sonority of vowels and consonants, we reason that by and large, it has universal application with minor exceptions depending on the language. The diagrams in (3) and (4) are helpful in assessing the sonority level of individual segments in English and French respectively according to the scale. Consonantal Strength bears a close resemblance to the Sonority Hierarchy, where vowels, particularly lower vowels, exhibit the highest sonority level due to effects of the least unimpeded production of airflow in the oral cavity whereas stops, especially voiceless stops, rank at the lowest level of the Sonority Hierarchy due to the lowest level of resonance of these sounds. Let us observe, here, the Sonority Hierarchy for English, which is diagramed in (3);

(3) Sonority Hierarchy in English
Low vowels > Mid vowels > High vowels > Glides > Liquids > Nasals > Fricatives > Stops
(Skaer 2003: 31)

As noted above, the symbol ">" reads as 'greater than, in terms of sonority,' and thus /ə/ (mid-lax vowel) ranks higher than high vowels but lower than low vowels in English. The sonority ranking of /ə/ in French is covered in (4) as Féry (2001: 9) suggests the Sonority Hierarchy for French, following Clements (1990);

(4) Sonority Hierarchy in French
Vowels > Glides > Liquids (l/r) > Nasals > Fricatives > Stops

An obvious difference between the sonority hierarchies in (3) and in (4) lies in the fact that the latter does not factor height of vowels into calculating the degree of sonority, but are otherwise identical.

As shown in (5), Rose (2000) translates syllable contact law into the OT constraint SYLLCON in her analysis of the epenthetic vowel /ɨ/ in Chaha. We find this constraint helpful in accounting for issues at hand in English and French epenthetic cases. If SYLLCON is literally universal, then it can and should have ramifications that go beyond the solving of an epenthetic phenomenon in just Chaha. We find it worthwhile to investigate what takes place when this constraint might be ranked differently with other constraints in other languages (McCarthy 2008) – that is, what is to be noted here is the importance of investigating the typological consequences of a newly proposed

constraint beyond just a single language.

(5) SYLLCON
"The first segment of the onset of a syllable must be lower in sonority than the last segment in the immediately preceding syllable" (Rose 2000: 401).

As noted by Rose (2000), the epenthetic position is determined by not only the application of SYLLCON but also by the syllable structure of the target word in source languages. Importantly, here, we need to remind ourselves that epenthesis generally helps reduce the markedness of the syllable structure, such as the creating of CV- syllables, the preferred "simple syllable" (Clements 1990: 303). The simple syllable is defined as "one with the maximal and most evenly-distributed rise in sonority at the beginning and the minimal drop in sonority (in the limit case, none at all) at the end" (Clements 1990: 303). Conformity to the CV-structured syllable is the basic function of the constraint ONSET (McCarthy 2008), which is listed below in (6)[ii];

(6) ONSET: "Syllables must have onsets"
(Kager 1999: 93).

2.3. Data

Here, we review some data, gleaned from earlier studies. Let us start with intensive schwa epenthesis in the consonantal clusters in American English, and then emphatic schwa epenthesis in French. Well known is that in languages of the world, onsetless syllables often are changed into onset-filled syllables through the phonological process of consonantal insertion or vowel deletion (Odden 2006). However, formal accounts of schwa epenthesis for emphasis in American English and French have been scarce in the literature.

Hooper (1976), among others, offers solid evidence supporting the minimal vowel epenthesis for emphasis in English. English permits word-initial CC- and CCC- clusters. A violable constraint *COMPLEX^{ONSET} (Kager 1999) is demoted to a low rank in such clusters. This constraint is listed below in (7);

(7) *COMPLEX^{ONSET}: Complex onset cluster is not allowed (Kager 1999).

The rationale behind schwa epenthesis for emphasis largely stems from the alleviating of the complexity of consonantal clusters. In CC-syllable cases, minimal vowel epenthesis induces the word-initial CV-syllable, resulting in a disyllabic word as in 8(a) except the word *crazy* which is realized as trisyllabic. In CCC-syllable cases, 8(b), minimal vowel epenthesis produces a word-initial CV-syllable, breaking up a word into a disyllabic word. This is another instance of syllable structure optimization.

Evidence for the role of syllable contact law is obtained from the seeking of an epenthetic site. The syllable boundary between the penult and the ultima satisfies syllable contact in each case in 8(a) and 8(b), where the onset of the ultimate syllable is lower in sonority than the immediately preceding epenthetic vowel. For some native Californian speakers, the epenthesizing of /ə/ in front of the liquid /l/ is the norm as opposed to the epenthesizing of /ə/ immediately after the initial fricative (See 8(b)). We will deal with this issue as variation of an epenthetic site within the complex consonantal cluster.

(8) Examples of intensive schwa epenthesis
(a) [CC-
b[ə]low (/bloʊ/→[bə.loʊ])
(Wolfram & Johnson 1982: 98)
g[ə]reat (/greɪt/→[gə.reɪt])
c[ə]rash (/kræʃ/→[kə.ræʃ])
c[ə]runch (/krʌnʧ/→[kə.rʌnʧ])
(Cassidy 1983: 291)
c[ə]razy (/kreɪ.zi/→[kə.reɪ.zi])

(Kobayashi 2014a)

(b) [CCC-

s[ə]plash (/splæʃ/→[sə.plæʃ])

s[ə]trap (/stræp/→[sə.træp])

?*sp[ə]lash* (/splæʃ/→[spə.læʃ])

(Kobayashi 2014b: 228-229)

(c) -C.C-

ath[ə]letic (/æθ.lɛt.ɪk/→[æ.θə.lɛt.ɪk])

(Wolfram & Johnson 1982: 98)

ath[ə]lete (/æθ.lit/→[æθ.ə.lit])

arth[ə]ritis (/ɑ:θraɪtɪs/→[ɑ:θ.ə.raɪt.ɪs])

(Hooper 1976: 236)

(d) -C#C- (French)

donne[ə]lui! (/dɔn.lɥi/→[dɔ.nə.lɥi])

(Côté 2000: 84)

(9) Obligatory schwa epenthesis -(C)C.C-

stricte[ə]ment

(/striktmã/→ [strik.tə.mã])

(Braun 2005: 24)

douce[ə]ment (/dusmã/→[du.sə.mã])

(Côté 2000: 84)

In 8(c), an epenthetic schwa intervenes in the fricative-liquid /θl/ or /θr/ sequence. In 8(d), an epenthetic schwa intervenes in words in an emphatic context. This epenthesis might be a typical trace of "[s]outhern French where schwas are rather pervasive" (Tranel 1981: 29). In (9), the presence of an epenthetic schwa is obligatory in the hetero-syllabic boundaries in French (Tranel 1981). This shows that syllable contact is strictly obeyed when a stem ending with a coda consonant gains a derivational suffix beginning with an onset consonant. Côté (2000: 84) claims that in both cases of 8(d) and (9), "schwa may serve to avoid a clash between the (emphatic) initial stress and the (regular) final one," and she leaves the issue aside there. We will follow up with her analysis of schwa epenthesis for emphasis in conjunction with our own analysis in OT, so that some resemblance between emphatic epenthesis in English and that in French may be highlighted formally. In French, schwa epenthesis occurs even in normal pronunciation, as in /strikt+mã/ → [strik.tə.mã] / *[strikt.mã] (Braun 2005: 24), where the legal form obeys syllable contact particularly the hetero-syllable boundary between the penult and ultima. The form with an asterisk denotes an illegal form. The presence of this schwa epenthesis is obligatory "only when a stem ends in a consonant cluster and the suffix begins in a consonant" (Tranel 1981: 289). The illegal form without an epenthetic schwa (*[strikt.mã]) disobeys syllable contact because falling sonority does not emerge at the hetero-syllable boundary. The sonority of the nasal onset in the ultima is greater than that of the last coda of the preceding syllable (See (4)). In Section 3 we will look at constraint interactions for individual cases in OT, where the epenthetic schwa intervenes in the syllable, optimizing the syllable structure.

3. OT analysis

3.1. Schwa epenthesis in American English

In this section, we address schwa epenthesis shown in 8(a) *b[ə]low* (/bloʊ/→[bə.loʊ]), 8(b) *s[ə]plash* (/splæʃ/→[sə.plæʃ]), and 8(c) *ath[ə]lete* (/æθ.lit/→[æθ.ə.lit]), particularly in the context of Californian English (Kobayashi 2014a, 2014b). We suggest that this epenthesis demonstrates TETU in two senses in terms of prosodic structure: the creating of the CV-syllable, where C is followed by an epenthetic schwa, and the generating of the unmarked, i.e. iambic foot structure ("a light syllable followed by a heavy syllable" (Causley 1996: 66)). Thus, by definition, schwa epenthesis into the CC-cluster and CCC-cluster due to intensification would be categorized as the inserting of a mora (See Section 1). The attested forms obey syllable contact at the hetero-syllable boundary. Of note, the saliency of the word-initial onset has improved as a result of schwa epenthesis breaking up the consonantal clusters, as in 8(a) and 8(b), where the onset is followed by an epenthetic schwa[iii]. This

immediately satisfies a requirement of the *principle of perceptual salience* (PPS, hereafter) (Côté 2000), particularly CV, which is listed below in (10);

(10) CV: "A consonant is followed by a vowel" (Côté 2000: 158).

Côté (2000) shows that consonants are optimally salient before a vowel and non-optimally salient in any position that lacks this transition. PPS states that "all segments are perceptually salient" (Côté 2000: 135).

3.1.1. [CC-

Here, we deal with an epenthetic schwa in a monomorphemic word, such as in 8(a), which breaks up the consonantal cluster with an iambic foot structure. Hayes (1995) indicates that the ideal quantitative shape of disyllabic iambs is (LH) cross-linguistically. As an example, let us consider how the word *blow* is assigned stress when it is emphatically spoken with a schwa epenthesized in its complex consonantal cluster;

(11) Iambic structure
(a) blow [bloʊ] (CCVC) →|μμ| → (H)
(b) *balow!* [bə.loʊ] (CV.CVC) →|μ.μμ| → (LH)

The word *blow* is a heavy monosyllabic word (H) in normal pronunciation, as in 11(a), whereas the emphatic form *balow* has the preferred bisyllabic form (LH) in 11(b). (The symbol "μ" denotes prosodic unit mora.) In 11(b), intensification, resulting in a schwa epenthesis in the consonantal cluster, makes for the unmarked foot structure as well as the CV-syllable in the penultimate syllable. From this consideration, let us make a descriptive generalization regarding schwa epenthesis for emphasis; that is, the minimal vowel is epenthesized for intensification in the complex consonantal cluster of a monosyllabic word only when the epenthesis helps improve on the syllable structure. This requires constraints *COMPLEX^{ONSET} to dominate DEP(ə) (See (12)). The presence of an epenthetic schwa improves the sonority profile of the ultimate syllable, and hence SYLLCON is an undominated obligatory constraint. We suggest that the constraint ranking ⟦SYLLCON, *COMPLEX^{ONSET} » DEP(ə)⟧ accounts for the target phenomenon. The constraint DEP(ə) is listed below in (12);

(12) DEP(ə): No schwa epenthesis is allowed (Féry 2001).

Let us see how each candidate fares in the constraint interactions in Tableau 1. Candidate (a) is the optimal, incurring the fewest violations of constraints; that is, the epenthesizing of a schwa only violates DEP(ə). The grammatical output obeys syllable contact in that the hetero-syllable boundary exhibits a descending sonority profile, and as such the output also satisfies *COMPLEX^{ONSET} because the epenthetic schwa breaks up the consonantal cluster. The output no longer has a complex consonantal sequence. Candidates in (b) and (d) disobey the *COMPLEX^{ONSET} constraint because each candidate retains a complex consonantal sequence. Candidate (c) fails to obey syllable contact in that the output exhibits an ascending sonority profile at the hetero-

Tableau 1

Input /bloʊ/	SYLLCON	*COMPLEX^{ONSET}	DEP(ə)
a. ☞ bə.loʊ			*
b. bloʊ		*!	
c. əbl.oʊ	*!		*
d. blo.ʊə		*!	*

syllable boundary. The ranking argument we made here sufficiently applies to words listed in 8(a).

3.1.2. [CCC-

Let us now turn to another area where an epenthetic schwa is employed, namely, word-initial three-member consonantal clusters. Here, again, we can see that syllable contact plays an important role in determining an epenthetic site in a word. The inserting of the /ə/ in the CCC- cluster also causes SYLLCON to be active in the constraint ranking. The target words such as 'splash' and 'strap' violate the SON-SEQ constraint in that their word-initial CCC-'s undergo sonority reversal (Goldwater & Johnson 2005). This constraint is listed as (13);

(13) SON-SEQ: "Complex onsets rise in sonority, and complex codas fall in sonority" (Kager 1999: 267).

The word-initial /s/ has slightly higher sonority than the following plosive /p/ or /t/, which demonstrates that sonority is lower at the beginning of the target word (See 8(b)). The third member of the complex consonantal cluster, the liquid /l/ or /r/, has significantly higher sonority than the preceding plosive. This indicates that sonority is rising from the second member of consonantal cluster towards the nucleus vowel. In this respect, the aforesaid CCC- clusters exhibit a marked sonority profile. When schwa epenthesis for emphasis helps repair the marked sonority profile in the clusters, SON-SEQ crucially outranks *COMPLEX^{ONSET}, which is ranked equal to DEP(ə). Tableau 2 shows that the constraint ranking without the active SYLLCON generates two potential winners (a) [sə.plæʃ] and (e) [səp.læʃ], at the level of SON-SEQ evaluation, but (e) also satisfies the *COMPLEX^{ONSET} and is thus selected as the optimal candidate: ⟦SON-SEQ » *COMPLEX^{ONSET}, DEP(ə)⟧ . However, candidate (e) [səp.læʃ] has the marked syllable contact in the hetero-syllable boundary /-p.l-/. As we have already seen in (3), the sonority of /p/ is significantly lower than that of the liquid (Hall

Tableau 2

Input /splæʃ/	SON-SEQ	*COMPLEX^{ONSET}	DEP(ə)
a. sə.plæʃ		*	*
b. spə.læʃ	*!	*	*
c. splə.æʃ	*!	*	*
d. splæ.ʃə	*!	*	*
e. ☞ səp.læʃ			*
f. əspl.æʃ	*!		*
g. splæʃ	*!	*	

Tableau 3

Input/splæʃ/	SYLLCON	SON-SEQ	*COMPLEX^{ONSET}	DEP(ə)
a. ☞ sə.plæʃ			*	*
b. spə.læʃ		*!	*	*
c. splə.æʃ	*!	*!	*	*
d. splæ.ʃə		*!	*	*
e. səp.læʃ	*!			*
f. əspl.æʃ	*!	*!		*
g. splæʃ		*!	*	

2006). To account for this, Tableau 3 incorporates SYLLCON into the constraint interactions, where it is undominated in conjunction with SON-SEQ: ⟦ SYLLCON, SON-SEQ » *COMPLEX^{ONSET}, DEP(ə)⟧ . The grammatical output is candidate (a) without violations of SYLLCON and SON-SEQ, and matches the actual real-world pronunciation of the item. The remaining candidates violate at least one of these two super-ordinate constraints. Candidate (a) obeys the *principle of onset maximization* (POM, hereafter) which may be encoded in the definition of ONSET and NO-CODA (Martínez-Gil & Colina 2007). POM entails that as many consonants as possible should be assigned to word-medial consonantal clusters in accordance with syllable template and phonotactic constraints (Selkirk 1999). The rest of the candidates (b), (c), (d), (f) and (g) fatally violate SON-SEQ. We suggest that schwa epenthesis in 8(b) exemplifies the case of syllable structure optimization.

3.1.3. -C.C-

Here, we investigate schwa epenthesis for emphasis in the hetero-syllabic boundary as shown in 8(c). Tableau 4 shows a constraint ranking to attempt to account for epenthesis in /æθlɛtɪk/ → [æθ.ə.lɛ.tɪk]: ⟦SYLLCON » ONSET » DEP(ə)⟧ . The DEP(ə) constraint is a prohibition on epenthesis, which is crucially dominated. Schwa epenthesis for emphasis violates this constraint. Candidates lack the onset in the initial syllable (See Tableau 4). The candidates in (d) and (e) fail since the hetero-syllable cluster /-θ.l-/ violates SYLLCON (See Tableau 4). The sonority of /θ/ (voiceless fricative) is lower than that of the lateral (Hall 2006). Inevitable is that the notion of "economy (epenthesis only when necessary)" (Kager 1999: 117) comes into play in the evaluation of [æθ.ə.lɛt.ɪk] as the grammatical output. Constraint interactions in Tableau 4 fall short of accounting for this incorrect form as optimal. As a result, we determined that it was unproductive to form a descriptive generalization to account for the incorrect form. The potential optimal output, though unacceptable (Wells 2000), is indicated by the symbol ☠. After all, the incorrect form does not improve any aspect of the syllable structure of the prosodic word[v].

Tableau 4

Input /æθlɛtɪk /	SYLLCON	ONSET	DEP(ə)
a. æθə.lɛt.ɪk	*!	*	*
b. ☠ æθ.ə.lɛt.ɪk	**!	***!	*
c. æ.θə.lɛt.ɪk	*!	**	*
d. æθ.lɛ.tɪ.kə	*!	*	*
e. æθ.lɛt.ɪk	**!	**	

For the incorrectness of candidate (b), which is suggested by Wells (2000), we now see in Tableau 4 that the incorrect form is considered highly marked because of fatal violation of SYLLCON at the hetero-syllable boundary between ultimate and penultimate syllables and between antepenultimate and initial syllables. There is no winner in Tableau 4. As Skaer (2001: 17) shows "vowels in open, unstressed, light syllable are well known to be candidates for deletion," the antepenultimate schwa flanked by heavy syllables at each side in [æθ.ə.lɛt.ɪk] is considered incorrect at best and thus needs deleting; indeed, this helps us rank DEP(ə) over ONSET and SYLLCON in the ranking. As shown in Tableau 5, Faithfulness constraints MAX-IO (anti-deletion constraint) as listed in (14) and DEP(ə) dominate Markedness constraints ONSET and SYLLCON: ⟦MAX-IO, DEP(ə) » ONSET, SYLLCON⟧.

(14) MAX-IO: "Input segments must have output correspondence" (Kager 1999: 165).

Candidate (c) is optimal, obeying the high ranked constraints. Here, the winner is candidate (c) without an epenthetic segment though as such the candidate violates the lowest ranked SYLLCON at the hetero-syllable boundaries.

Tableau 5

Input /æθltɛɪk/	MAX-IO	DEP(ə)	ONSET	SYLLCON
a. æθ.ə.lɛt.ɪk		*!	***!	**
b. æθə.lɛ.tɪ	*!			
c. ☞ æθ.lɛt.ɪk			**	**

3.1.4. Schwa epenthesis in French

In this section, we first address [ə] epenthesis arising at the word boundary in 8(d). As suggested by Kobayashi (2015), the target epenthesis in the word boundary occurs in French only if the insertion of schwa for emphasis triggers syllabification in the segmental sequences and the syllabified segments satisfy syllable contact law. When the insertion of schwa for emphasis occurs in the word boundary, as in [*dɔnə lɥi*], stress clash must be avoided (Côté 2000). This is largely because "emphasis falls on the first syllable of the word or phrase" (Walker 2001: 181), and such "emphatic stress does not replace phrase-final stress but is in addition to it" (Walker 2001: 181-182). This relation can be written as the ⟦*CLASH » DEP(ə)⟧ hierarchy. The constraint *CLASH is listed in (15);

(15) *CLASH: Stressed syllables must not be adjacent (Kager 1999).

Inserting /ə/ at the word boundary helps improve the syllable structure of the word *donne* since two CV-syllables [*dɔ.nə*] emerge. This output also respects SYLLCON and thus requires the constraint to be active, compared to [*dɔn lɥi*] under normal pronunciation where the word-final /n/ is lower in sonority than the word-initial /l/ (Kager 1999). A descending sonority profile is not formed at the word boundary. Thus, SYLLCON is not satisfied when the phrase is normally pronounced. For the French syllable, "the onset can be absent, or simple or complex, but the coda, if present, is always simple" (Féry 2001: 10-11). This property can be written as the ⟦NO-CODA » ONSET⟧ hierarchy[vi]. The constraint NO-CODA is listed below in (16);

(16) NO-CODA: Syllables must not have a coda (McCarthy 2008).

NO-CODA prohibits the syllable from having a coda whereas ONSET bans vowel-initial syllables. Thus, it can be argued that the aforesaid hierarchies can be combined to form the ⟦SYLLCON, NO-CODA, *CLASH » ONSET, DEP(ə)⟧ ranking (See Tableau 6).

Candidate in (a) is the grammatical output with the fewest fatal violations of the constraints. The output form satisfies all high-ranked constraints. All other candidates fail to obey SYLLCON and NO-

Tableau 6

Input /dɔn lɥi/	SYLLCON	NO-CODA	*CLASH	ONSET	DEP(ə)
a. ☞ dɔ.nə lɥi					*
b. dɔ.ən lɥi	**!	*!		*	*
c. dɔn lɥi	*!	*!	*!		
d. dɔn.ə lɥi	*!	*!		*	*

CODA because the candidates have not improved the well-formedness of the syllable structures with the epenthetic schwa. The candidate in (c) sustains a fatal violation of *CLASH with emphatic stress on [*dɔn*] and normal stress on [*lɥi*].

Let us now turn our focus to the applicability of syllable contact in an unfaithful mapping of /strik.t+mã/→ [strik.tə.mã] in French, as in (9), where the epenthesis of a schwa is compulsory. The morpheme *-ment* [mã] is derivationally suffixed to an adjective, creating its adverb. As mentioned in Section 2.3, this arises only when a stem ends with a cluster of codas and a derivational suffix starts with an onset (Tranel 1981). Consequently, when a stem ends with a single coda consonant, the presence of an epenthetic schwa is not required. Representative examples are listed below in (17);

(17)

(a) **lascive[ə]ment* (/la.si.v.mã]/ → [la.si.və.mã])

(b) **honnêt[ə]ment* (/ɔ.nɛ.t.mã/ → [ɔ.nɛ.tə.mã])

(c) **dogmatique[ə]ment* (/dɔ.g.ma.ti.k.mã/→ [dɔ.g.ma.ti.kə.mã])

(d) **riche[ə]ment* (/ri.ʃ.mã/ → [ri.ʃə.mã])

It has been long since the literature dealt with this obligatory epenthesis of a schwa before a derivational suffix as shown in (9). Past studies failed to address the role of syllable contact in determining this epenthetic site.

Based on the abovementioned descriptive generalization, we suggest a constraint ranking ⟦*CLASH » SYLLCON, NO-CODA, DEP(ə)⟧ to account for the obligatory presence of an epenthetic schwa in front of the derivational suffix in French. Stress is assigned in the final syllable in the French word and phrase (Côté 2000; Walker 2001).

Tableau 7 shows constraint interactions. The optimal candidate is (a), which avoids stress clash between syllables [strɪk] and [mã] by means of creating the CV-syllable [tə] in between these syllables. As Féry (2001: 15) shows "sequences of segments can be resyllabified across boundaries." In French, an epenthetic schwa forms a syllable with the semisyllable /t/, resulting in the CV-syllable. A semisyllable is defined as "a degenerate syllable, i.e. a syllable whose rime consists of a nucleus which is not associated with distinctive features" (Dell 1995: 19), as in *garde* /ɡar.d/, *marbre* /mar.br/ and *dogme* /dɔɡ.m/ among others. The degenerate syllable becomes fully licensed when an underspecified nucleus is filled with a schwa. This characterization accords with her analysis that "French can readily add a nucleus to a semisyllable in the form of an epenthetic schwa" (Féry 2001: 12). Candidates in (b) and (c) fail to obey the constraint *CLASH, which requires the stressed syllables to avoid stress clash (Kager 1999). After all, the outputs in (b) and (c) suffer fatal violation of NO-CODA because French does

Tableau 7

Input /strikt+mã/	*CLASH	SYLLCON	NO-CODA	DEP(ə)
a. ☞ strik.tə.mã		*	*	*
b. sə.trikt.mã	*!	*	**!	*
c. stə.rikt.mã	*!	*	**!	*
d. strik.ət.mã		**!	**!	
e. stə.ri.kət.mã		*	*	**!

not allow a complex cluster of codas (Féry 2001). Here, we can see that not only syllable contact, but also other factors, such as avoidance of stress clash in a word, enter into the assessment of a well-formed epenthetic site.

4. Conclusion

As we have observed up to this point, segmental epentheses such as are illustrated in 8(a), 8(b), 8(d) and (9) displayed a lack of uniformity, which required us to suggest separate descriptive generalizations for each of the observed types of epenthesis, which we have done within the context of Optimality Theory. Syllable structure optimization is witnessed in all epenthetic cases except the minimal vowel epenthesis in 8(c). As Sommerstein (1977) shows certain phonological processes, for instance, the epenthesis of unmarked vowels between adjacent consonants and the epenthesis of non-vowels between vowel in hiatus, enables the marked syllable to turn into the less marked syllable, oftentimes resulting in a CV-syllable, the minimal vowel epenthesis as in 8(a), 8(b), 8(d) and (9) is considered instances of syllable structure optimization. All the attested forms with an epenthetic form except the ones in 8(c) resulted in the unmarked syllable structure, or at least a less marked structure than the forms without an epenthetic segment due to intensification. The epenthetic processes motivated by syllable structure optimization involve the Markedness constraint SYLLCON becoming active or partially active, depending on the syllable structure into which an epenthetic segment is introduced for the requirement of syllable structure optimization. Cross-linguistically, the satisfying of syllable contact earns the concerned syllable the less marked sonority profile, which exhibits a sonority profile falling from the immediately preceding segment to the following segment.

Of further note, as Sections 3.1.1 and 3.1.2 show, the epenthesis of the minimal vowel in the word-initial CC- and CCC- clusters allows for an iambic meter when the monosyllabic words under study are emphatically pronounced; and, the generating of an iambic foot structure leads to the emergence of unmarkedness in terms of prosodic structure, as Causley (1996) indicates.

A potential research area that is relevant to the present work would be the treatment of certain final consonants in French (cf, Sommerstein 1977: 227; Plénat 1987: 867). They are deleted when the following word begins with a consonant, but certain final consonants surface as onsets, as in C.#V → .CV (Sommerstein 1977).

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Notes

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ii In order to save space, a constraint that has already mentioned is not relisted in the text.

iii Onset is “a prosodically salient position” (Zukoff 2012: 45).

iv In an earlier version of our paper, an anonymous referee recommended that we adopt a “2 by 2 tableau” in order to show ranking arguments, but this would unnecessarily lengthen the already long paper. So, we have chosen to use the more common tableau form, with its inherent ranking system, as first proposed by Prince & Smolensky (1993/2004).

v One anonymous reviewer made a helpful comment on this epenthetic form: if such epenthetic form in widespread among the native English speakers, possibly due to the ease of pronunciation, then the epenthetic form should be recognized as acceptable and hence treated accordingly because today’s linguists place higher value on descriptive grammar over prescriptive grammar.

vi The simplicity of coda position in French is justified by the assumption that “allowing more than one consonant in codas would lead to unnecessary complications” (Dell 1995: 16).