Secondary stress in contemporary British English: An overview

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RESUME

Cet article présente une revue de la littérature sur la nature et le placement de l'accent secondaire en anglais ainsi que des résultats d'études récentes utilisant des données dictionnairiques, qui confirment l'essentiel de ce qui était connu sur le fonctionnement de l'accent secondaire en anglais mais apportent une compréhension plus détaillée du phénomène.

SUMMARY

This paper presents a review of the literature on the nature and placement of secondary stress in English along with results from recent studies using dictionary data, which overall confirm what was known about secondary stress in English but bring a more fine-grained understanding of the phenomenon

Mots-clés : accentuation lexicale, corpus, anglais, phonologie, morphologie, accent secondaire

Keywords: corpus, English, lexical stress, phonology, morphology, secondary stress

1. Introduction

The literature on English phonology is rich with analyses of secondary stress patterns, which are tied to a number of crucial issues such as foot well-formedness, phonological domains, cyclicity or paradigmatic dependencies. Although a lot of proposals and analyses have been put forward, empirical studies on secondary stress are quite scarce (but see Collie 2007, 2008, Tokar 2017, 2018 and Wenszky 2004).

The aim of this paper is to review previous analyses of secondary stress in English, underline the issues that are raised and propose a summary of my own research on the issue over the last eight years, in which I have sought to provide new empirical evidence to test out previous analyses. The results discussed here are mostly taken from my own dissertation (Dabouis 2016a) but also from later extensions of this work, where several datasets have been extended and analyses have been refined (Arndt-Lappe in preparation; Dabouis 2016b, 2019; Dabouis *et al.* 2017).[1]

I will focus on British English and will seek to answer one main research question: When and where can we find secondary stresses in contemporary British English? In order to answer that question, I will first present what my understanding of what secondary stress in English is (§2). Then, I will review the different proposals that have been made in the literature on when and where secondary stresses should be placed (§3) before I present the data that I will be using (§4) and discuss the main results of the analyses of this data (§5).

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2. What is secondary stress?

Before considering what the generalisations regulating secondary stress placement are, it is crucial to define what it is exactly that we mean by "secondary stress". This question is far from being trivial as, although there is generally little disagreement on what syllables should be analysed as carrying primary stress, the question of what syllables should be analysed as carrying subsidiary levels of stress is quite controversial. For example, should the last syllable of *demonstrate* /ˈdemənstreɪt/ or the second syllable of *importation* /ˌɪmpɔːˈteɪʃən/ be analysed as carrying secondary stress? Some authors, such as Cruttenden (2014: 244), Kenyon and Knott (1953) or Guierre (1979), have proposed that there are four levels of prominence, which could be summed up as (1), where the main point of controversy is level 3, as some approaches tend to assimilate all full vowels to a certain level of stress.

(1) The four degrees of prominence in English
1. Primary stress
2. Secondary stress
3. Unstressed full vowel
4. Unstressed reduced vowel

The whole issue is further complicated by the confusion between the terms "stress" and "accent" which have been used in various (and sometimes contradictory) ways, as discussed by Fox (2000: §3.1.1), Schane (2007) and van der Hulst (2012, 2014). If one consults different pronunciation dictionaries, different transcription choices have been made with regard to the treatment of full vowels. According to John Wells, the difference has to do with different "traditions":

> It would be nice if vowels were always weak in unstressed syllables. But clearly that is not the case in English […] Some analysts (particularly Americans) argue in the other direction, claiming that the presence of a strong vowel is sufficient evidence that the syllable in question is stressed. In the British tradition we regard them as unstressed. (John Wells, "strong and weak", in John Wells's phonetic blog, 25 Mars 2011 [Consulted on 17/05/2016])

However, I am here going to argue that there is a fundamental difference between the first two and last two levels in (1), so that we are not simply dealing with a question of terminology or traditions.

First, let us briefly discuss phonetic evidence. The use of phonetics is limited by the fact that stress is "parasitic", i.e. it is realised using phonetic resources which might be used for other phonological purposes (Hayes 1995), such as pitch, intensity and duration, and so it cannot be reduced to a single parameter (see Fox 2000: §3.2; Fry 1955, 1958). The fact that phonetic studies do not converge on a single set of criteria can be interpreted in two ways: either these different studies actually study different phenomena, and the terminological confusion around the term "stress" complicates comparisons between different analyses because these do not actually refer to the same object, or it is possible that the phonetic evidence really is unclear and that other criteria should be used. There is one study that has sought to identify the phonetic properties of stress and to control the covariation between pitch accents and lexical stress (here, stress being defined in the sense of the "American tradition", i.e. all full vowels bear some degree of stress). Plag *et al.* (2011)study primary and secondary stressed syllables with or without pitch accents by analysing the same words in focus position (e.g. "She said X again", X being the target word) and non-focus position (e.g. "Did PETER say X again? No it was JOHN who said X"). They compare what they call "right-prominent" words, i.e. words with primary stress being the rightmost stress (e.g. *vìolátion, pùblishée*), and "left-prominent" words, i.e. words with primary stress being

followed by a secondary stressed syllable (e.g. *rándomìze, áctivàte*). Their results show significant differences between the left position and the right position for fundamental frequency (F0) and intensity but not for duration or for pitch slope. In pitch-accented positions, these differences are large for left-prominent words but quite small for right-prominent words. The same results are found in unaccented positions, although they are less marked. The authors underline a problem posed by their data:

> This implies that the notion of secondary stress is to some extent problematic. While the primary stress syllable and the secondary stress syllable are both strong syllables irrespective of their respective positions within the word, the acoustics as well as the phonology (in terms of accentuation) of the two secondary stress syllables in right-prominent vs. left- prominent words are quite different from each other. (Plag *et al.* 2011)

These results lead the authors to assert that there is no clear phonetic difference between primary stress and secondary stress, regardless of the prominence pattern. The only clear difference can be found in pitch-accented positions: right-prominent words receive two pitch-accents while left-prominent words only receive one, on their first stressed syllable. Therefore, the difference between pretonic secondary stress and post-tonic secondary stress is that the former may receive pitch-accents while the latter may not. This observation is in line with Gussenhoven's (2004: 21-22) observation:

> The primary stress in an English word is defined by the syllable that receives the last intonational pitch accent when spoken in isolation. A secondary stress after the main stress, like *-ga-* in *álligàtor* is never pitch-accented. […] English words frequently have two pitch accents, one on the main stress and one on a preceding secondary stress, like *sar* in *sàrdíne*, *Cal-* in *Càlifórnia*, or *-so-* in *assòciátion*.

These observations suggest that the first two levels of prominence in (1) correspond to pitch-accented syllables, which are treated as “stressed” in the “British tradition” referred to by Wells, while the first three levels of prominence in (1) correspond to syllables containing full vowels, which are treated as “stressed” in the “American tradition”, regardless of pitch-accents. As noted by Abercrombie (1976) and Schane (2007), most pronunciation dictionaries adopt the “British tradition”. In this approach, post-tonic secondary stresses are almost never used, except in certain compound words. In sum, Plag *et al.*'s (2011) study suggests that the phonetic facts are not as elusive as some have claimed when pitch-accents are controlled for.

Hayes (1995: Ch. 2) assumes that phonetic evidence is unclear and that other types of evidence should be used. He uses the properties of syllables receiving the starred tone, i.e. primary stressed syllables, to identify subsidiary stresses. He observes that certain phenomena only occur if the following syllable is “unstressed”: flapping of /t/ and /d/, /t/-insertion between /n/ and /s/ and /l/-devoicing between /s/ and a vowel. These criteria lead him to assume that certain vowels are always “stressed” while others may or may not be, and yet others never are. If we use the British equivalent of the vowels used by Hayes, then all full vowels are always stressed in his analysis, except word-final /əʊ/ (notably because flapping may occur before that vowel in words such as *photo* or *tomato*). Therefore, the phenomena discussed by Hayes are generally conditioned by the presence or absence of full vowels, i.e. the first three levels in (1).

Hayes also discusses intonation among his diagnostics of stress, and notably non-nuclear tones. He recognizes three possible tones: L, M and H. In words such as *collaboration* or *classification* pronounced with the “surprise-redundancy” contour, he notes that the H* falls on the primary stressed syllable while the L* falls on any pretonic syllable that is not schwa. In words which have more than one pretonic non-schwa vowel (e.g. *sensationality, Constantinople*), he argues that L* can be placed on either of these vowels. Gussenhoven

(2011) also discusses intonation and argues that pitch-accents may be assigned to any syllable containing a full vowel that:

- does not immediately precede primary stress (which also receives a pitch-accent), unless it is part of a semantically transparent prefix (e.g. *EX-COLonel*, *UNMODest*),
- does not follow primary stress (i.e. no post-tonic pitch-accents),
- is accented in the base of the word (e.g. *conSIDer* → *conSIDeRAtion*), unless that would generate a sequence of two accents (e.g. *exPLAIN* → *EXplaNAtion* (**exPLAINAtion*)).

Therefore, pitch-accents are assigned to primary stressed syllables and syllables that are treated as secondary stressed in the "British tradition", but not to all full vowels. The only counterexample is discussed by Hayes (1995: 18). He discusses the placement of the M* tone in the "chanted vocative" contour. In this contour, primary stress receives H* and M* is placed on the strongest stress after primary stress. If there is no post-tonic stressed syllable, then M* is placed on the last syllable as a default. This pattern is illustrated in (2).

(2)

a. *Poindexter!*	b. *Annabel!*	c. *Pamela!*
/pɔɪndekstə/	/ænəbel/	/pæmələ/
| |	| |	| |
H* M*	H* M*	H* M*

Rhythmic alternation is also often discussed in analyses of stress or accent, in both the "British tradition" and the "American tradition". Authors that reject the notion of "stress" or its parallelism with the absence of vowel reduction nevertheless assume that it is the alternation between full vowels and reduced vowels which structures rhythm in English (Bolinger 1986: 39; Cruttenden 2014: 271). Rhythmic alternation is often discussed through analyses of the "Rhythm Rule", which is defined by Hayes (1995: 18) as in (3), where the numbers represent stress levels.

(3) **Rhythm Rule**
3…2…1 → 2…3…1

According to this rule, the relative prominence between secondary and tertiary stress is reversed if secondary stress is closer to primary stress (e.g. *Mississippi mud*), but no change occurs if the pattern is already 2…3…1 (e.g. *alligator alley*). However, Gussenhoven (2004, 2011) argues that this rule actually targets pitch-accents and that it consists in deleting an accent rather than shifting stress levels. Szigetvári (2012) discusses other cases of impossible (4a) or possible (4b) stress shifts caused by the Rhythm rule.

(4) a. **Óctober ráin; *Títanic bánd*
b. *sárdine sándwich; kángaroo mérchant.*

In these examples, the first words all have a pretonic full vowel when pronounced in isolation and, in analyses which assume that all full vowels are stressed, all these vowels should be able to receive the main stress of the word if stress is shifted. However, only *sardine* and *kangaroo* may undergo a stress shift. Szigetvári assumes that the difference has to do with stress levels: the words in (4)(4) have initial tertiary stress while those in (4b) have initial secondary stress, and only the latter may be targeted by the Rhythm Rule. If we assume

that not all full vowels are stressed, an alternative could be to assume that the words in (4b) have initial stress while the ones in (4a) do not.

The last phenomenon which I will discuss is syncope. Hammond (1999) and Szigetvári (2007) report that the syncope of a reduced vowel may occur when that vowel follows the primary stressed syllable and is followed by another reduced vowel, but not if it is followed by a full vowel (which they interpret as carrying secondary stress), as shown by the examples in Table 1.

Syncope possible	Syncope impossible
*sep**a**rate* (adj)	*sep**a**rate* (vb)
*mem**o**ry*	*mem**o**rize*
*op**e**ra*	*op**e**ratic*
*gen**e**ral*	*gen**e**rality*
*glor**i**fication*	*glor**i**fy*
*resp**i**ratory*	*resp**i**rate*

Table 1. Examples of possible or impossible syncope (taken from Hammond (1999) and Szigetvári (2007))

In sum, we have seen that there are properties that are associated to syllables containing full vowels except final /əʊ/, which are treated as "stressed" in the "American tradition", and other properties which are associated to a subset of these syllables, which are treated as "stressed" in the "British tradition". The properties are summed up in Table 2, where properties 1 and 2 distinguish what I will assume to be stressed syllables from other syllables, while all the properties in the table may be used to distinguish full vowels from reduced vowels. An alternative could be to assume that 1 and 2 distinguish what some call "accented" syllables from other syllables, which would be a subset among "stressed" syllables. I prefer to reserve the term *accent* to the phrase-level and favour a distinction between stressed syllables and unstressed syllables, which may contain full or reduced vowels.

Property	Reduced vowel (+ final /əʊ/)	Post-tonic full vowel (≠ final /əʊ/)	Primary or secondary stressed vowel
1. May receive pitch accents	No	No[2]	Yes
2. May be targeted by the Rhythm Rule	No	No	Yes
3. Flapping is possible in the onset	Yes[3]	No	No
4. /t/-insertion	Yes	No	No
5. /l/-devoicing	Yes	No	No
6. Aspiration is possible word-internally	No	Yes	Yes
7. Blocks the syncope of a reduced vowel in the preceding syllable	No	Yes	Yes

Table 2. The properties associated to the different degrees of prominence

Therefore, in the rest of this paper, I will assume that not all full vowels carry stress. Following the "British tradition", I assume three levels of stress: primary stress (noted as /1/ or with an acute accent), secondary stress (noted as /2/ or with a grave accent) and no stress (noted as /0/).

3. The determiners of secondary stress placement

3.1. The phonological word

The general constraints that will be presented in §3.2 are conditioned by morphological structure. Some morphological constituents form a phonological domain, which I will call the phonological word, in line with much of the previous literature, especially that of Prosodic Phonology. Here, I will assume that a phonological word is defined by what Fournier (2010: 12) calls a "lexical unit", i.e. as an inseparable unit of meaning. He claims that there are two main types of lexical units: semantically transparent prefixes and words.

The evidence which shows that semantically transparent prefixes may form a phonological word is that:

- Such prefixes may bear stress regardless of the stress of the presence or absence of stress on the initial syllable of the base (Fournier 2010: Ch. 1; Guierre 1979: 317; Raffelsiefen 1999; Siegel 1974: 136-139). This can generate stress clashes (e.g. *cò-áuthor, dèfórest, èx-áctor*);
- When unstressed, the vowel in these prefixes does not reduce. In analyses in which a full vowel is analysed as stressed, this point can be merged with the previous one;
- Monosyllabic prefixes ending in a vowel contain long vowels regardless of their right-hand context (e.g. /èɪ/*polítical*, *d*/íː/*stábilize*); [4]
- Consonant-final prefixes may generate gemination (see e.g. Ben Hedia & Plag 2017; Kaye 2005; Oh & Redford 2012), although this is conditioned by factors such as the productivity of the prefix, the frequency of the prefixed word or the presence or absence of stress on the syllable following the prefix.

A number of similar arguments can be made for the constituents of compound words, which can be analysed as having their own phonological domain. Therefore, from now on, I will refer to the "phonological word" to designate the phonological domain formed by either a semantically transparent prefix or by a word (which can be part of a compound).[5]

3.2. General constraints

All analyses of secondary stress assume that there are some general constraints which dictate which stress patterns are well-formed and which ones are not. These can be expressed directly as restrictions on stress patterns or on foot structure in theories that use feet. I will discuss three of these constraints[6], which are shown below.

(5) ***/00-/**
No phonological word may begin with two unstressed syllables.

(6) ***CLASH**
There cannot be a sequence of two successive stresses within a single phonological word.

(7) ***LAPSE**
There may not be sequences of more than two unstressed syllables within a phonological word.

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The constraint in (5) is expressed in similar ways by Fournier (2010: 12), Guierre (1979: 317), Schane (2007), Trevian (2015: 455) and Wenszky (2004: 66-67). In foot-based analyses, this constraint is expressed through markedness constraints on foot structure (see e.g. Burzio 1994: 165; Hammond 1999: 167; Pater 2000). Analyses using Optimality Theory (hereafter, OT; Prince & Smolensky 1993) generally use FTBIN (feet must be minimally bimoraic), TROCH (feet are trochaic) and PARSE-σ (all syllables must belong to feet). The interaction of these constraints achieves the effects of (5). The only reported exceptions to */00-/ that I am aware of are of two kinds:

- Guierre (1979: 331) reports a few cases of */00-/ violations, but his data is taken from the 12th edition of Daniel Jones' *English Pronouncing Dictionary*. All of these words are listed as having a secondary stress on one of their first two syllables in more recent editions, with most of the /001(-)/ patterns being replaced by /021(-)/.
- Semantically transparent prefixed words in which the base begins with two unstressed syllables. Such cases are discussed by Wenszky (2004: 89), who points out the problem that they pose: in a word such as *mìsinformátion*, if we assume that the prefix has its own phonological word, then the domain structure should be (*mìs*)ω(*informátion*)ω, and therefore */00-/ is violated in the base. A possible explanation is that, under conditions that remain to be specified, there can be a form of prosodic fusion and that *misinformation* actually has only one phonological word.

This is by no means a universal constraint. As brought to my attention by Alexander Tokar, Russian words may begin with two unstressed syllables (e.g. *molokó* 'milk'). It can be assumed that this constraint came about in English through two main processes. First, it can be interpreted as a form of continuation of root-initial Germanic stress, as suggested by Fournier (2007):

> On very long words, primary stress could now fall on a syllable further than the first two. The idea is that Germanic logic reasserted itself by inserting a compensating secondary stress. Indeed, secondary stress shows all characteristics of the Germanic system: preservation of the relationship with the deriving form whenever possible; otherwise demarcative stress on the beginning of the word.

Second, this constraint possibly came about through a form of analogy between the accentual patterns of phrases and those of words, as suggested by Vassilyev (1970: 273):

> It was the use in English speech of short words, many of which are unstressed form words, that has created the […] rhythm consisting of alternating a stressed syllable with an unstressed one. This rhythmic tendency of English speech must have caused the appearance in borrowed polysyllabic words of a secondary stress on the syllable separated from the word-final principal stress by one unstressed syllable. These words began to be pronounced, in isolation, on the model of short phrases in which a stressed syllable alternates with an unstressed one. Thus, a word like *radical*, borrowed from French, was originally stressed on the last syllable. Later, while this stress was still retained, this word received the recessive stress on the initial syllable, the result of which was the characteristically English alternation of a stressed syllable with an unstressed one.

The constraint in (6), *CLASH, is expressed in similar terms by Fournier (2010: 12), Guierre (1979: 133) and Trevian (2015: 455). In Metrical Phonology, this constraint has been expressed through the Rhythm Rule (Hayes 1980, 1995; Kiparsky 1979; Liberman & Prince 1977; Schane 1979), which states that a WSS sequence (where W stands for a weak constituent and S for a strong one) should be modified to SWS to avoid two adjacent strong

constituents. This rule applies above the word level but also word-internally to account for the absence of stress preservation in derivations such as *expéct → èxpectátion*, where the stress on the second syllable of the base is not preserved in the derivative to avoid a stress clash. In OT analyses, different *CLASH constraints have been used (e.g. Pater (2000) uses *CLASH-HEAD: "No stressed syllable may be adjacent to the head syllable of the Prosodic Word"). However, in the view adopted here, these constraints have actually expressed two generalisations: the one expressed in (6) and the tendency for vowels which are adjacent to stressed syllables to reduce. I argue that (6)(6) is stronger than the second generalisation, which is subject to a considerable number of exceptions, some of which can clearly be attributed to specific factors (see Dabouis & Fournier 2019). As will be seen below, violations of *CLASH are quite rare, although some exceptions also exist, as has been noted previously in the literature. These can be grouped into two categories. The first are words with final stress and ending in *-ee*, *-ade* or *-ese* (e.g. *divòrcée, àrcáde, Chìnése*; Trevian 2003: 82-87). The second are derivatives stressed /021(-)/, which can be attributed to stress preservation and have been noted to have often a second heavy syllable and a "regular" variant with initial secondary stress (e.g. *acòustícian, depàrméntal, elèctrícity*; Collie 2007: 79; Hammond 1999: 329; Kager 1989: 171; Pater 2000; Tokar 2018; Trevian 2015: 456).

Finally, the constraint in (7), *LAPSE, complements *CLASH in that they are both part of what Selkirk (1984: 52) calls the "Principle of Rhythmic Alternation", according to which languages tend to have a rhythm which alternates between stressed and unstressed syllables. As cases with two unstressed syllables are quite common, I will focus on "long" lapses, i.e. cases with more than two unstressed syllables. This constraint is more controversial than the previous ones, as many do not use it or explicitly reject it, such as Bolinger (1986: 57), who claims that "there is no theoretical limit to the number of syllables, whether full or reduced, that may come between the secondary and the primary: *ántiphlogístine, írremediabílity, ródomontáde, gástroenterítis*".[7] Exceptions such as *cànnibalizátion* or *dìsciplinabílity* are also cited by Stanton and Steriade (2014). Although this constraint is probably not required in non-derived words as they only rarely have pretonic sequences of more than two syllables, let us consider how it might manifest in derivatives. The first possibility, discussed by Nespor and Vogel (1989) for the phrase level, consists in adding a stress to break a sequence of unstressed syllables. Therefore, we could expect to observe derivations such as /(-)2001(-)/ → /(-)20201(-)/. The second possibility could be to reduce the number of syllables through processes of syncope or compression.

3.3. Non-derived words

Let us first consider what I will call "non-derived" words, i.e. words which are not formed from another word and relatively free of morphological influences. These will include words without any identifiable structure and words formed from a bound root and (an) affix(es). In these words, the general constraints discussed in §3.2 are crucial and will strongly determine the possible stress patterns, along with another key factor: the length of the pretonic sequence. Indeed, if there is only one pretonic syllable, we expect *CLASH to prevent the first syllable to receive secondary stress. If there are two pretonic syllables, secondary stress should fall on the first syllable as *CLASH bans stress on the second syllable and */00-/ requires that one of the first two syllables be stressed.[8] If the pretonic sequence is longer than two syllables, then there are theoretically more options as *CLASH only bans secondary stress on the syllable that precedes primary stress.

The first question that needs to be asked is whether secondary stressed should be assigned from the end of the pretonic sequence or from the beginning of the word. Early works in Metrical Phonology argued for the first option, where different retraction modes were used to account for the different patterns (Hayes 1980, 1982; Liberman & Prince 1977):

- Weak Retraction: allows for one light syllable between two stresses;
- Strong Retraction: allows for one syllable between two stresses, regardless of its weight;
- Long Retraction: allows for at the most two syllables between two stresses, one of which should be light.

Guierre (1979: 325-327) makes a similar analysis and argues that the presence of a consonant cluster between the last two vowels of the pretonic sequence is often associated to penultimate stress (e.g. *amòntilládo, mesàmbryánthemum*). Note that this includes orthographic geminates (e.g. *affètuóso*) but Guierre notes that <rC> clusters, which usually behave like regular consonant clusters in stress assignment, do not determine stress in the same way as other clusters here (e.g. *àberdevíne, àvoirdupóids, lègerdemáin*). He claims that words without such a cluster have antepenultimate stress, although most of his examples have three pretonic syllables (e.g. *èlecampáne, catamaran, àbracadábra*). However, most recent analyses assume that secondary stress is computed from the left edge of the word. Approaches using OT (often along with Prosodic Phonology) generally use alignment constraints such as ALIGN-L, requiring the left edge of the word to be aligned with the left edge of a foot (Benua 1997; Bermúdez-Otero & McMahon 2006; Collie 2007; Pater 2000).

All these more recent analyses assume that syllable structure somehow impacts secondary stress placement. For words with three pretonic syllables, Collie (2007: 90) notes that there are hardly any attested cases with a heavy third syllable and that, as a consequence, secondary stress placement mainly depends on the weight of the first two syllables. The different proposals found in the literature are shown in Table 3. Note that not all authors define heavy syllables in the same way. Guierre does not use that notion at all and only refers to the presence of consonant clusters (including orthographic ones) following the vowel, Burzio makes reference to weight through his set of well-formed feet, Hammond's proposal here only concerns heavy syllables made up of a short vowel and a consonant, while Pater's proposal is the most "standard" one with heavy syllables being defined as being made up either of a long vowel or of a short vowel and at least one consonant. Remember also that authors may use definitions of stress which diverge. Guierre uses the same definition as the one I am using in this paper while the other authors in Table 3 treat most full vowels as stressed. This can explain why Guierre is the only one not to assume that /22-/ sequences are to be expected.

	Guierre 1979	Burzio 1994	Hammond 1999	Pater 2000
#LL	/20-/	/02-/ or /20-/	/02-/ (default) or /20-/ (if initial lexical accent)	/20-/
#LH	/02-/	/02-/	/02-/ or /22-/ (if initial lexical accent)	/02-/
#HL	/20-/	/20-/ or /22-/	/20-/ or /22-/ (if lexical accent on 1st or 2nd syllable)	/20-/ or /22-/
#HH	?	/22-/	/20-/ (if initial lexical accent) or /22-/ (if lexical accent on 1st or 2nd syllable)	/22-/

Table 3. The different proposals regarding the impact of syllable weight on secondary stress placement (H = Heavy and L = Light)

When the pretonic sequence is made up only of light syllables, most authors assume that the default pattern is initial secondary stress, after what is sometimes called the

"Abracadabra Rule" (after Selkirk 1984: 113-119). However, several authors (Bermúdez-Otero 2012; Bermúdez-Otero & McMahon 2006; Collie 2007: 102-103; Halle & Kenstowicz 1991; Hammond 1989; Hayes 1982) have noted exceptions to this rule, with pen-initial stress (e.g. *apòtheósis, egàlitárian, amànuénsis, Apòlliná́ris, Epàminóndas*;. Halle and Kenstowicz (1991) note that these exceptions are often borrowed from Greek and do not have an initial onset. Collie (2007: 103) rejects the etymological argument on the grounds that speakers do not have access to this information[9] and explores the effect of initial onsetlessness. She does find that pen-initial stress is more common in words without an initial onset, although this is not systematic.

For the rare cases with four pretonic syllables, most authors agree upon the fact that the default pattern is /2020-/ (Halle 1998; Halle & Kenstowicz 1991; Hammond 1989, (1999: 300; Hayes 1980: 292; Liberman & Prince 1977; Pater 2000; Schane 2007). Only Hammond (1999: 300) finds cases with /0200-/ (e.g. *aficionádo, appàssionáto, Asclèpiadéan*). Guierre (1979: 325), who does not include proper nouns in his analysis, only finds two cases with different stress patterns (*ìpecacuánha* and *villègiatúra*) and is unable to conclude what the default pattern should be for words with four pretonic syllables.

3.4. Stress preservation in stress-shifted derivatives

The phonological patterns observed in complex words sometimes differ from those found in simplex words and this difference can be accounted for by assuming that complex words preserve properties of a morphosyntactically related word. This general principle can be called "paradigmatic dependency" and be defined as in (8).

(8) **Paradigmatic dependency in morphophonology** (Bermúdez-Otero 2016: section 7)
The form of a linguistic expression *a* is predictable from the surface representation of one or more morphosyntactically related expressions {*b, c,* …}.

Some have argued that this sort of dependency may only occur if *b* is contained within *a*. This is the choice made by Chomsky and Halle (1968) when they introduced cyclicity, which constitutes one of the defining properties of generative phonology (Scheer 2011: 85). Others assume that containment is not necessary and that related words which are not necessarily contained within *a* may influence its phonological properties. This is the choice made by approaches such as Output-Output Correspondence (Benua 1997).

In analyses of secondary stress placement, most authors assume that the position of secondary stress in complex words depends on the stress pattern of their immediately embedded base (Bermúdez-Otero 2012; Bermúdez-Otero & McMahon 2006; Burzio 1994: 228; Collie 2007, 2008; Fournier 2010: 79; Guierre 1979: 335; Halle & Kenstowicz 1991; Halle & Vergnaud 1987: ; Hammond 1989; Hayes 1980: 257, 1982; Kiparsky 1979; Pater 2000; Schane 2007; Trevian 2003: 11), although some claim that this is not the case and that complex words have stress patterns that are independent of that of their base (Fudge 1984; Liberman & Prince 1977) or that the evidence is unclear (Hammond 1999: §8.4.2). One of the arguments in favour of stress preservation is that pen-initial stress is almost systematic when the base also has pen-initial stress, as in the examples in (9a). This argument is particularly strong for #LL words where pen-initial stress is extremely rare in non-derived words. Initial secondary stress is claimed to be the norm when the base also has initial stress, as shown in (9b), although this does not clearly differ from what is found in non-derived words.

(9) a. *exàminée* (← *exámine*), *imàginátion* (← *imágine*), *orìginálity* (← *oríginal*)
b. *nàvigabílity* (← *návigable*), *spìrituálity* (← *spíritual*), *mòdificátion* (← *módify*)

Another argument in favour of a mechanism of stress preservation is the fact that complex words derived from a base exhibiting stress variation also show stress variation (e.g. *démonstrable ~ demónstrable → dèmonstrabílity ~ demònstrabílity*; Kager 1995).

However, we can find three limitations to stress preservation in the literature. First, as discussed in §3.2, *CLASH normally bans stress preservation on the syllable preceding primary stress so that we expect patterns of the type /1(-)/ → /01(-)/ and /01(-)/ → /201(-)/. As noted previously, there are certain exceptions with a /021(-)/pattern which appear to be attributable to a form of stress preservation, although no previous work has been able to identify the conditions in which it applies. Second, stress preservation in contexts where it should be free to apply has been noted to sometimes fail (e.g. *authórity → authòritárian ~ àuthoritárian*). Collie (2007, 2008) reports that these cases of stress preservation failure can be attributed to relative frequency, with stress preservation failure being more likely if the derivative is more frequent than its base. This is in line with a series of works exploring what has been called the "segmentability hypothesis" (see Plag and Ben Hedia 2018 for a review), in which relative frequency is seen as one way to access how segmentable a complex word is, with the assumption that more segmentable words are more likely to preserve properties of their base (Hay 2001, 2003). However, studies have failed to confirm systematic segmentability effects for a number of phenomena. Collie's work also presents two major drawbacks which question the validity of the results she reports. The first is the insufficient control of possible morphological biases as she includes items with semantically transparent prefixes (which have been argued to have their own phonological word; see §3.1), items with semantically opaque prefixes (which have been argued to be stress-repellent; Fudge 1984: §6.2) and neoclassical compounds (which have been argued to be accentually invariant; Guierre 1979). The second drawback is that her dataset is quite small and may not be representative of the whole relevant class of words. Finally, the last limitation to stress preservation is syllable weight. As we have seen in the previous section, syllable weight may impact secondary stress placement in non-derived words and so it could be expected to influence stress preservation. Certain authors have proposed that stress preservation applies regardless of syllable weight (Burzio 1994: 313; Fournier 2010: 79; Guierre 1979: 335) but Pater (2000) proposes a hierarchy of constraints in which the "Weight-to-Stress Principle" dominates the stress preservation constraint. This predicts that we could expect stress shifts to the second syllable in #LH words if the base has initial stress (e.g. *cháracter → *charàcterizátion*).

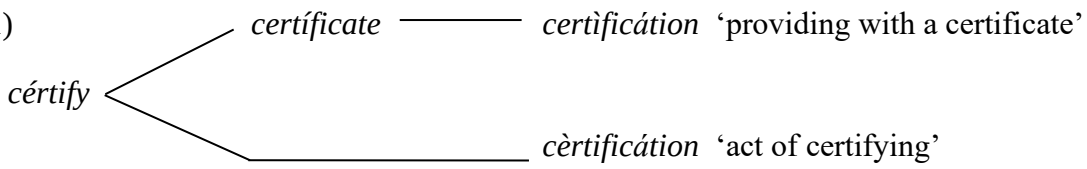
As mentioned previously, when a complex is formed through several successive affixations, it is generally assumed that only the local base, i.e. the immediately embedded base, may be used as a reference for stress preservation. Guierre (1979: 323) illustrates this with the examples in (10).

(10)	*canál, cánalize, cànalizátion*	(/20-/ and not /02-/)
	repúte, réputable, rèputabílity	" " "
	órigin, oríginal, orìginálity	(/02-/ and not /20-/)
	fámily, famíliar, famìliárity	" " "

In these examples, the more deeply embedded bases do not seem to influence the stress pattern of the derivative. However, there are reported cases of what Collie (2007: 288) calls "leap-frogging" preservation, where the more deeply embedded base transmits some of its properties to the derivative, and Collie suggests that some cases of stress preservation failure may be attributed to stress preservation from a more distant base (e.g. *tótal → totálity → totàlitárian ~ tòtalitárian*).[10] Some cases which could be analysed as leap-frogging

preservation have been mentioned on many occasions in the literature, e.g. *ácademy* → *àcadémic* → *acàdemícian* ~ *àcademícian*. Although these cases appear to be quite rare, it is possible that semantics are a key in determining which base's stress pattern is to be preserved. The two possible meanings of *certification*, each associated to a different stress pattern, illustrate this, as shown in (11), which is taken from Guierre (1979: 325).

(11)



The case of *academician* seems to be comparable, as noted by Tokar (2018):

> We note that the choice between initial and pen-initial secondary stress is often a matter of semantics. For example, *academician* is in American English mainly used to express the meaning "[a]n **academic** or intellectual" (OD; boldface Tokar). The preferred stress pattern of *academician* in American English is therefore, as pointed out above, /ˌækədəˈmɪʃən/, which preserves the secondary stress of *ˌacaˈdemic*. In British English, by contrast, *academician* is mainly associated with the sense "[a] member of an **academy**" (OD; boldface Tokar), which is why it is usually stressed /əˌkadəˈmɪʃ(ə)n/, preserving the stress of *aˈcademy*.

Finally, as mentioned previously, analyses conducted within the framework of Output-Output Correspondence may assume that bases which are not contained within the word whose stress pattern is to be accounted for may be relevant. For example, Stanton and Steriade (2014) assume that any form that is semantically related to and more frequent than the derivative may be used as a remote base. In more recent work, they find in both dictionary data and a nonce-word judgement task that derivatives tend to adopt more optimal stress patterns (e.g. which do not have extended lapses or stress clashes) when there exists a word in their lexical family whose stress pattern which, if reproduced in the derivative, allows for an optimal stress pattern (Steriade & Stanton 2020). For example, the resolution of a stress clash in *-ee* derivatives with primary stress on their third syllable is more common if there exist a word in the lexical family with initial stress (e.g. non-preservation from *invíte* in *ìnvitée* would be more likely because the lexical family contains *ìnvitátion* than in *selèctée*, which preserves the stress from *seléct*, and for which there is no word in the lexical family with initial stress).

3.5. Prefixed words

As mentioned in §3.1, semantically transparent prefixes may have their own phonological word. The most common type of construction which contains this type of prefix concerns semantically compositional constructions such as *abnormal, co-author, decentralize* or *reactivate*. However, previous work has found that a comparable behaviour can be observed in non-compositional constructions in which the meaning of the prefix is still transparent, and these often have bound stems (e.g. *cohabit, deflate, exterior, intersperse*; Fournier 1996; Raffelsiefen 1993, 2007, 2015). These often occur in series in which Fournier (1996) notes that the semantic opposition between words can be reduced to that between the prefixes (e.g. *include* ↔ *exclude; inflate* ↔ *deflate*). The issue with this category of words is that it is difficult to draw a clear line as to where it should stop: when can we consider that the meaning of the prefix of a word can be perceived by speakers? As we cannot ignore this

possibility, I will include words in this category for which the definition suggests that the meaning can be perceived, although this will not necessarily be the case for all speakers.

These semantically transparent prefixes will be opposed to semantically opaque prefixes in words such as *accede*, *betray* or *receive*. This type of word is often treated as monomorphemic or simplex as the constituents in these words are generally quite opaque and many judge them to be impossible for speakers to perceive. However, there are a number of arguments to include them among potential determiners of phonological behaviours as certain phenomena do appear to be determined by the presence of this type of prefix and that there is psycholinguistic evidence that speakers are sensitive to these prefixes in visual morphological decomposition and in reading (Dabouis 2017). As mentioned in the previous section Fudge (1984: §6.2) treats this type of prefix as "stress-repellent" so we will need to include them among possible determiners of secondary stress placement. If Fudge's analysis is correct, we might expect that words with monosyllabic opaque prefixes are more likely to:

- have pen-initial secondary stress in non-derived words,
- show exceptional stress preservation on the second syllable,
- resist second-syllable stress preservation failure

than non-prefixed words.

3.6. A summary: The potential determiners of secondary stress placement

Before we turn to the data and results, let us briefly sum up the list of all the potential factors which have been claimed to impact secondary stress placement:

- **General constraints:** */00-/, *CLASH and *LAPSE.
- **Morphology**:
  - Semantically transparent prefixes should have their own phonological word and so be stressed regardless of the stress pattern of the base.
  - Monosyllabic semantically opaque prefixes should tend to repel secondary stress.
  - Stress-shifted suffixal derivatives should preserve the stress(es) found in their base. There is a question regarding whether only the local base, more deeply embedded bases or other words from the lexical family are relevant.
- **Syllable structure:**
  - Heavy syllables should tend to receive secondary stress. This would be particularly relevant for the second syllable in non-derived words, and more so for closed syllables. There is also a question of whether syllable weight can override stress preservation.
  - The absence of an initial onset could favour pen-initial secondary stress.

Now we can state the general aim of this paper more specifically: to seek to test all of these factors and to evaluate their scope and possible limitations.

4. Data

In order to better comprehend the issues discussed in the previous sections, large-scale empirical studies would be welcome. Unfortunately, such studies are scarce, as noted by Collie (2007) and Wenszky (2004), who conducted two of the rare empirical investigations of secondary stress placement:

> My last general remark about some of the stress theories that I reviewed is that it seemed that the stress rules in them were developed on the basis of the analysis of some typical words, but not whole classes of words. (Wenszky, 2004: 12)

> Up until now, stress preservation has simply been assumed to occur in English, with no support from any serious and extensive empirical investigation. (Collie, 2007: 3)

Following up the tradition initiated by Guierre (1979), the main source of data which I will be using will be taken from a pronunciation dictionary. I will not claim that this is the only way to study English stress, as other methods of investigation have been used to do so and each presents their own advantages and drawbacks.[11] Obviously, using dictionary data is no exception. Among the advantages, we can cite the fact that this allows access to the pronunciation of a large number of words, including pronunciation variants (which would be difficult to get otherwise), the uniformity of the idiolect reported in the dictionary (even though it is an "artificial" idiolect). Moreover, the dictionary which I shall use, Wells (2008), does not use systematic rules for the listed pronunciations, as reported by Collie (2007: 119). On the other hand, the drawbacks are that certain choices operated by the lexicographers can be questioned, such as the choices made for syllabification (see Ballier and Martin 2010), the nature of the transcription (see Dahak 2006), the rarity of certain words listed in the dictionary or the unavoidable presence of errors. It also seems important that what is found in such a dictionary are data and not facts, as Scheer (2015) reminds us that "there is no such thing as an observational fact independent of the observation". Finally, a pronunciation dictionary by itself cannot be the sole source of data, and I have complemented the corpus with a number of other dictionaries or corpora, which will be cited in this paper when or where relevant.

Let us briefly discuss one point regarding dictionary data which is important regarding the analysis of secondary stress in prefixed words. In speech, it is possible to contrast two words by placing contrastive stress on a prefix. The previous literature has found that this was possible for semantically transparent prefixes (12a-b) but also for more opaque ones (12c-e).

(12)

a. Sarah thought her cousin was liberal, but I found him completely **il**liberal. (Hay 2003: 78)
b. That country has both **in**ternal and **ex**ternal problems. (Wennerstrom 1993)
c. Robert Siegel: there is one memo from I believe it's from the British Foreign Office uh saying that uh it would be very difficult to claim that Iraq was stepping up its unconventional weapons programs cos in fact Saddam Hussein was **de**celerating that effort rather than **ac**celerating it. (NPR - All Things Considered, 15/6/2005, cited in Videau (2013: 307))
d. This function is **de**creasing here, but **in**creasing there. (Wennerstrom 1993)
e. [Y]ou may **de**tain them, but don't **re**tain them. (Bolinger 1961)

Although I do not know of studies which have quantified whether semantically transparent prefixes are more likely to receive contrastive stress than opaque ones, it could be expected that they would be.[12] One can then wonder whether the secondary stresses shown in the dictionary represent potential contrastive stresses or lexical stresses. Normally, the citation forms given in pronunciation dictionaries are free from contrastive phenomena found in speech, although they occasionally give pronunciations that are specific to contrastive contexts, such as the example in (13), which is taken from Wells (2008).

(13) *affect* (verb): ə ˈfekt — Also, to highlight the contrast with effect, sometimes (ˌ)æ-

Therefore, following Collie (2007: 215), it is to be hoped that the pronunciations listed in pronunciation dictionaries are relatively free from connected speech phenomena such as contrastive stress and I will assume that the stresses given for prefixed words correspond to their "normal" pronunciation, i.e. in the absence of any form of emphasis.

The main corpus used in this paper is a 5,829 words corpus containing a secondary stress mark in Wells (2008). Details of how it was constituted can be found in Dabouis (2016a: §6.3) but let us briefly see its main characteristics:

- It is based on an automatic extraction of all the words in Wells (2008) containing a secondary stress mark;
- Only British pronunciations are taken into consideration;
- Certain types of entries have been left out:
  - Proper nouns (e.g. *Albuquerque*, *Peloponnese*, *San Antonio*), as they often have specific phonological properties (Guierre 1979: §1.4.5);
  - Phrases and acronyms (e.g. *ad nauseam*, *ipso facto*, *quid pro quo*, *LSD*, *MI5*);
  - Bound constituents or second elements of compounds (e.g. *-ism*, *-meter*, *-worthy*);
  - Words receiving secondary stress only when receiving focus, as indicated by a dictionary note (e.g. see (13));
  - Compound words (e.g. *aircushion*, *flame-thrower*, *open-jaw*), including constructions in which the first element is one of the following prepositional particles: *after-*, *back-*, *by-*, *down-*, *fore-*, *forth-*, *in-*, *on-*, *off-*, *out-*, *over-*, *under-* or *up-*;
  - Blends (e.g. *advertisement* + *editorial* → *advertorial*);
  - Words containing a neoclassical root as these have been claimed to be accentually invariant (Guierre 1979: 740; Tournier 1985: 92)[13];
  - Entries which are either absent or marked as obsolete, rare, historical, archaic or as belonging to a variety of English other than British English in the online *Oxford English Dictionary*.

All the words in the corpus were analysed morphologically and analysed in morphologically defined classes.

In Dabouis (2016a), a distinction was made between words which could be analysed as "foreign", those that can be analysed as "learned" and the remaining words. These distinctions were made because borrowings have often been used as illustrations of the stress rules proposed in the literature. For example, the words *Ticonderoga* and *Monongahela* have been used in Burzio (1994), Chomsky & Halle (1968), Collie (2007), Halle & Kenstowicz (1991), Hayes (1982, 1984), Kiparsky (1982), Liberman & Prince (1977), Pater (2000), Schane (1979a) and Selkirk (1980). However, to my knowledge, no previous work had sought to verify that these words do not have a distinct stress behaviour. Such a verification was carried out in Dabouis (2016a) and no significant difference was found. Therefore, in this paper, I will not make these distinctions.

I will also include more recent results from subsets of this corpus which have been expanded in order to include proper nouns. These expanded datasets will be presented in the relevant sections. Finally, let us point out that, for reasons of length, the whole dataset will not be discussed, and I will focus on the parts of the dataset which inform us on the issues presented in the previous sections.

5. Results

5.1. Non-derived words

In these words, the general rhythmic constraints are generally respected, with only occasional *CLASH violations in words with a single pretonic syllable. The dataset contains 146 such cases (see the examples in (14)), among which 128 (88%) are disyllables.[14] This initial secondary stress could be the sign of an ongoing stress retraction in these words, an

analysis which is supported by the fact that 48 of these disyllables (38%) may also be stressed /10/.[15]

(14) *arcane, archaic, banjo, baptize, campaign, cascade, corvette, donee, harpoon, hotel, mundane, museum, mystique, ornate, pastel, salvation, scalene, segment* (vb), *spontaneous, supine, tirade, tutee…*

The situation is quite straightforward for words with two pretonic syllables: they all have stress on their first syllable. The corpus contains 510 non-prefixed words in this class, and 186 non-compositional prefixed words. Examples are shown in (15).

(15) *adolescent, anniversary, apprehend, balustrade, condescend, coriander, diabolic, ebullition, entertain, fortuitous, guarantee, intersperse, jeremiad, Neapolitan, perpendicular, persevere, represent, sempiternal, simultaneous, solidarity, vegetarian…*

This confirms the observation found in the literature that the /021(-)/ pattern is not attested in the absence of stress preservation effects. There are a handful of words outside of the corpus which are not clearly suffixal derivatives and which may have that stress pattern: *electrolysis* /02100/ ~ /20100/, *refractometer* /20100/ ~ /02100/ and *reluctivity* /20100/ ~ 02100/. However, all these words are related to words with stress on the second syllable (all the words sharing the root *electro-*, *refract* and *reluctant*, respectively). We could add *Araucania* and *Myanmar*, which may only have that stress pattern in American English.

The dataset on which I base my analysis of secondary stress placement in words with longer pretonic sequences is that of Dabouis *et al.* (2017), which is an expanded version of Dabouis (2016a) so as to include proper nouns. The selection of the relevant data was particularly difficult as it is hard to find long words without some form of morphological structure. Words which can be related to other free-standing words such as the examples listed in (16a), along with certain words with "obscure" morphology, such as the examples in (16b), were left out.[16]

(16) a. *rèstauratéur*[17] ↔ *réstaurant*
comèdiénne ↔ *comédian*
intelligéntsia /02-/ ~ /22-/ ↔ *intélligence*
Louisiána /02-/ ~ /20-/ ↔ *Lóuis, Louíse*
Apòllináire, Apòllináris, Apòllodórus ↔ *Apóllo*
Chàteaubriánd (US /02-/) ↔ *cháteau* (US /01/)

b. *Àbergavénny, Àbertilléry* cf. *Ábercròmbie* (~ /2010/), *Àberdéen, Àbernéthy*
Mèditerránean ↔ *médi(o)-* cf. *médifixed, mèdio-dórsal*
Dnèpropetróvsk (< Petróvsk)
Hàrdicanúte (< Canúte)

The final dataset contains 139 words, including 85 proper nouns. Among these, the six words in (17) have two secondary stresses.

(17) /(2)2-/: *condottiere, chinoiserie, aggiornamento*
/22-/: *Constantinople, Rhosllanerchrugog*
/2020-/: *Antananarivo*

The remaining 133 words are stressed as shown in Table 4.

First syllable only	118 (89%)	**99 (74%)**		*abracadabra, Apalachicola, Ballymacarrett, caricature, didgeridoo, elecampane, fanfaronade, Kalamazoo, Nebuchadnezzar, Peloponnese, rodomontade, Semipalatinsk, Valladolid…*
First or second syllable		**19 (14%)**	34 (26%)	*amontillado, boutonniere, conquistador, egalitarian, Navratilova, taramasalata…*
Second syllable only		**15 (11%)**		*amanuensis, appoggiatura, Epaminondas, Monongahela, Scheherazade, Vientiane…*

Table 4. Distribution of secondary stress patterns in non-derived words with three or more pretonic syllables

As can be seen in Table 4, the vast majority are (74%) or can be (89%) stressed on their first syllable. However, a quarter of the words may have pen-initial stress, which raises the question of the determiners of this stress pattern. To answer that question, words were coded for the weight and closedness of their first two syllables and for the presence or absence of an initial onset. When tested in binary logistic regression in which the dependent variable was the possibility of having pen-initial stress, three variables turned out to be significant predictors. The results of the regression analysis are shown in Table 5.

	95% C.I.			p-value
	Lower	OR	Higher	
SYLL1-OPEN	0.17	11.76	39.62	0.026795
SYLL2-OPEN	0.0002	0.009	0.08	0.000558
ONSETLESS-YES	1.83	4.74	12.63	0.001462

Table 5. Binary logistic regression for the position of secondary stress in non-derived words with three or more pretonic syllables

The results show that pen-initial secondary stress is more likely if[18]:

- the first syllable is open (but this variable is only weakly significant);
- the second syllable is closed;
- the word does not have an onset.

The distribution of the data depending on these three variables is shown in Figure 1.

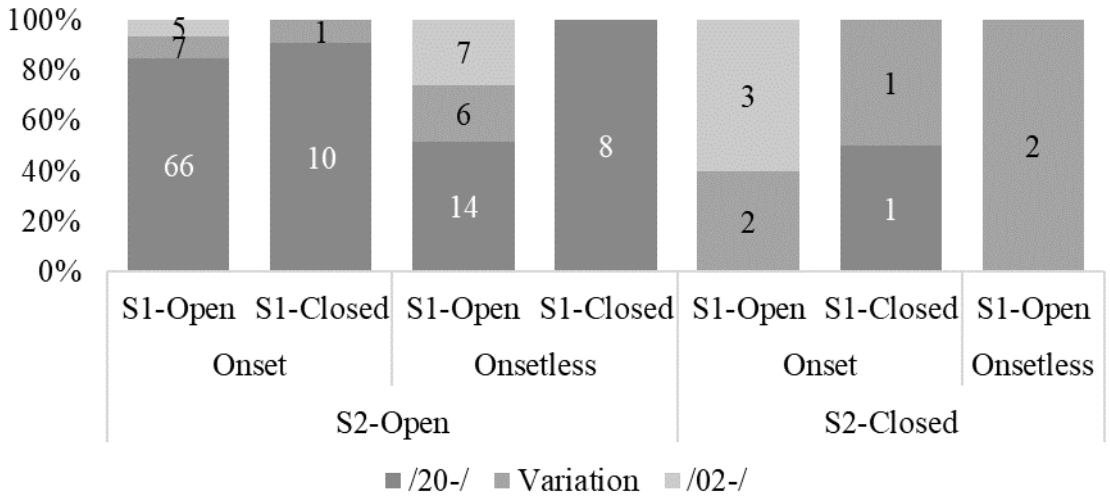


Figure 1. Secondary stress placement in non-derived words depending on the closedness of the first two syllables and the presence or absence of an initial onset

The results shown in Figure 1 show that the vast majority of words (78%) have two initial open syllables, and that pen-initial stress is attested even when syllable structure is controlled for. They also show that, among words with a closed second syllable, only one word has consistent initial stress, *Quetzalcoatl*, and that the only words with stable pen-initial stress have an open first syllable: *Balenciaga, Monongahela, Seringapatam, Vientiane*. Finally, we can see that half of the onsetless words with two open syllables may have pen-initial secondary stress.

Therefore, the results can be interpreted as supporting the idea that initial secondary stress is the "default" pattern. This idea is consistent with the fact that English words generally begin with a stressed syllable (Cutler & Carter 1987), with the history of English as this default initial stress can be seen as a form of preservation of Germanic root-initial stress (Fournier 2007) and with the concept of Edge Prominence discussed in van der Hulst (2012). Although the effects of syllable structure are statistically significant, they do not determine a categorical stress behaviour but rather a probabilistic one, subject to a considerable amount of variation.

5.2. Prefixed words

In the dataset used in Dabouis (2016a), there are 1,508 prefixed words which may have a stress clash on their first syllable (i.e. which can have the stress patterns /21(-)/ or /22(-)/, either as a main pronunciation or as a variant). The distribution of the different types of prefixed words within that subset is shown in Table 6.

Type of prefixed word	Count	Examples
Opaque	113 (8%)	*abduct, convex, direct, forswear*
Transparent – non-compositional	197 (13%)	*conjoint, demote, export, inhale*
Transparent - compositional	1,198 (79%)	*astable, copilot, decode, misread*

Table 6. The distribution of the different types of prefixed words which may have a stress clash on their first two syllables

As can be seen in Table 6, there is only a small number of opaque prefixed words which may bear stress on their prefix (8%). It is interesting to interpret those results from the point of view of a listener. If one hears a prefixed word with a stress clash, one can correctly

assume that the prefix is semantically transparent in 92% of cases, and in 79% of cases the construction is also fully compositional.

Wells' pronunciation dictionary (2008) often gives more than one possible pronunciation for each entry, and many of the words counted in Table 2 also have alternative pronunciations in which their prefix is not stressed. Therefore, it is also worth comparing the different types of prefixed words with regard to whether or not the secondary stress on their prefix is optional. This is shown in Figure 2.

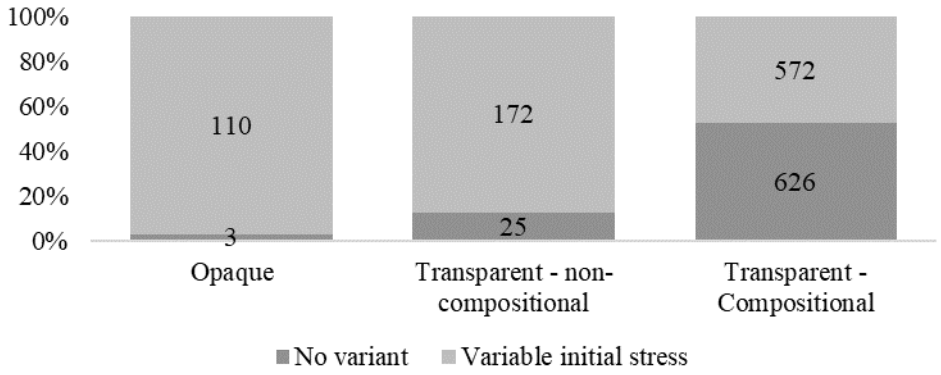


Figure 2. The proportion of variable initial stress in each type of prefixed word

As can be seen in Figure 2, more than half of the transparent prefixed words that have a compositional meaning (52%) only have pronunciations in which the prefix bears stress, as opposed to only 25/172 (13%) for transparent prefixed words with non-compositional meaning and 3/113 (3%) for opaque prefixed words. Among non-compositional constructions, the difference between words with opaque prefixes and those with transparent prefixes is statistically significant ($\chi^2 = 7.6229$, $p < .01$). In sum, these observations show that stress clashes are more common and more stable in transparent prefixed words with compositional meaning.

However, the datasets used here do not allow for direct counts regarding production, i.e. the proportion of stressed prefixes for each type of prefixed word. However, it is possible to get a rough estimate by crossing two datasets. Dabouis (2016a) contains all the words in Wells (2008) which may bear a secondary stress mark and Dabouis & Fournier (2019) contains only words whose first syllable can be unstressed in Jones (2006). Although the two datasets have been designed for different purposes and are based on two different dictionaries with different transcription systems, they both use the three categories of prefixed words used here. Therefore, comparing the figures can give us an estimate of the proportion of words in each category which may receive secondary stress. The figures are shown in Table 7.

	May get secondary stress (Dabouis 2016a)	Strictly unstressed (Dabouis & Fournier 2019)	Estimated proportion of words whose prefix may be stressed
Opaque	113	1,157	≈ 9%
Transparent - non-compositional	197	265	≈ 43%
Transparent - compositional	1,198	298	≈ 80%

Table 7. Estimated proportion of stress clash in the three types of prefixed words

Although these figures are to be approached with caution for the reasons exposed above, a clear difference between the different types of prefixed words can be seen: more transparent prefixed words are more likely to receive stress on their prefix.[19]

A closer look at the data allows for an additional observation. Dabouis' dataset contains 13 words which are members of an antonymic pair (e.g. *debark* ↔ *embark*, *demote* ↔ *promote*, *inhale* ↔ *exhale*) and for which the second member of the pair may not receive secondary stress on its prefix, according to Wells (2008). This raises the question of why only one member of the pair may bear stress on the prefix while the other may not. In some cases, it is possible to assume that it is because the other member of the pair has a prefix that is semantically opaque (e.g. *accelerate, assimilation, progress*) while the member which may bear stress always has a prefix which may be transparent. However, that cannot account for all these cases. Another possible explanation is that the member of the pair whose prefix may be stressed is the marked member of the pair while the one whose prefix may not be stressed is the unmarked member of the pair. This would mean that the secondary stress on the prefix of the marked member of the pair indicates that the meaning of the word is constructed with reference to the meaning of the unmarked member of the pair, through the opposition of their prefixes. One possible way to test this hypothesis is to study the relative frequencies of these words, as it has been shown that unmarked words are generally more frequent than marked words (Bybee 2001: 115; Haspelmath 2006; Lehrer 1985; Waugh 1982). Moreover, the effect of markedness could be combined with another frequency effect: since Fidelholtz's (1975) work, it has been shown that a high frequency facilitates lenition[20], which could manifest here through the loss of secondary stress on the prefix in the unmarked member of the pair.

In order to test out this hypothesis, word frequencies were collected from SUBTLEX-UK (Van Heuven et al. 2014), which is a frequency database based on television subtitles from nine British channels collected between January 2010 and December 2012 with a token count of about 200 million. Frequencies were log-transformed (as $\log_e(x+1)$) so as to resemble the way "humans process frequency information" (Hay and Baayen 2002). I also collected prevalence values for these words (Brysbaert *et al.* 2019). Word prevalence refers to the number of people who know the word. The database used for these values is based on a survey of 221,268 native speakers of English from the US and the UK, and each word has been judged on average by 388 participants (282 from the US and 106 from the UK). Word prevalence has been shown to be a better predictor of decision times in lexical decision tasks than lexical frequency. Therefore, it is possible that some of the facts that have been captured using frequency can be better accounted for using prevalence values. The data collected are shown in Table 8.

Stressed prefix	Frequency (log)	Prevalence	Unstressed prefix	Frequency (log)	Prevalence
conjunct	0	1.102	*disjunct*	0	-
debark	0	0.807	*embark*	1,328 (3.12)	2.173
decelerate	52 (1.72)	1.764	*accelerate*	1,134 (3.05)	2.576
decrease (vb)	655 (2.82)	2.576	*increase* (vb)	16,615 (4.22)	2.223
demote	178 (2.25)	2.014	*promote*	5,310 (3.73)	2.576
dissimilation	1 (0.30)	1.279	*assimilation*	26 (1.43)	2.028
exterior	812 (2.91)	2.431	*interior*	2,012 (3.30)	2.444
extrinsic	3 (0.60)	0.912	*intrinsic*	169 (2.23)	1.699
inhale	270 (2.43)	2.443	*exhale*	53 (1.73)	2.441
intravasation	0	-	*extravasation*	0	-
prebuttal	0	-	*rebuttal*	17 (1.26)	1.676
regress	51 (1.72)	2.072	*progress*	2,452 (2.39)	2.427
subjacent	0	0.311	*adjacent*	342 (2.53)	2,424

Table 8. Prefixed antonymic pairs where only one member of the pair may be stressed. Word frequencies are taken from SUBTLEX-UK (Van Heuven *et al.* 2014) and prevalence values are taken from the dataset presented in Brysbaert *et al.* (2019). Log-frequencies are shown in brackets.

First, we can observe that, with the exception of *inhale* ↔ *exhale*, in all pairs for which both frequencies are not equal to zero, the word whose prefix may not be stressed is the most frequent. The fact that some words do not occur in SUBTLEX-UK may be due to their rarity or to the fact that this corpus is based on spoken English. Other frequency corpora can be used for these words. If we consult the *British National Corpus*, we get 12 occurrences for *conjunct* and 41 for *disjunct* but none for *extravasation* and *intravasation*. For these last two words, we can use the *Corpus of Contemporary American English*, which presents the drawback of being based on American English only and that, consequently, we may expect frequencies to be different in British English. Nevertheless, this corpus has the advantage of being large enough (520 million tokens) so that we can find 14 occurrences for *extravasation* but none for *intravasation*. These additional searches confirm the fact that the pair *inhale* ↔ *exhale* is indeed the single exception to what the markedness hypothesis predicts.

Let us now consider the prevalence values. First, some words are not attested in the database used for these values and, consequently, nothing can be said regarding the pairs to which they belong. Indeed, the absence of a word from the database does not imply anything regarding its prevalence, apart from the fact that it has not been tested by the investigators, as opposed to the absence of a word from a frequency database, for which it could be assumed that the word is too rare to occur in that database. For most of the pairs which can be interpreted (8/10), we do find higher prevalence values for the member of the pair whose prefix may not be stressed. Again, the *inhale* ↔ *exhale* pair is an exception to this tendency, although the prevalence values of the two words are almost identical. The other exception is the *decrease* ↔ *increase* pair. In this case, the difference observed between the frequencies and the prevalence values may have to do with the corpora used. Indeed, in SUBTLEX-UK, there are different entries for the nouns and verbs *decrease* and *increase* so it is possible to isolate the frequency for a given syntactic category. The corpus used for prevalence values does not offer that feature and therefore noun and verb are merged into a single prevalence value.

Although it is rather limited by its size, the study of these 13 antonymic pairs suggests that mechanisms such as markedness and semantic opposition may sometimes override the effects of semantic transparency observed above. Indeed, what is most interesting is perhaps not the presence of secondary stress in the marked words but rather its absence in the

unmarked words where, for some of them at least, the prefix could be expected to be stressed on the basis of its intrinsic semantic transparency. For example, is the locative meaning of *in-* less perceptible in *interior* than it is in *inhale* so that it would explain why the former may not receive secondary stress on its prefix while the latter may? It seems difficult to give a definite answer. In any case, more empirical work will be needed to consolidate these findings.

In sum, we have seen in this section that the presence of a stress clash is a lot more frequent among prefixed words whose prefix is semantically transparent and that, most of the time, this is associated with the semantic compositionality of the prefixed construction. We have also seen that markedness and semantic opposition may, in some cases, override the effects of semantic transparency.

5.3. Stress-shifted suffixal derivatives

This section deals with items for which primary stress in the derivative is further to the right than it is in its local base. Words with non-standard terminal elements (e.g. *cigar**illo***, *collect**anea***, *infus**oria***) are included, following Raffelsiefen's (1993) argument that an identifiable suffix is not necessary for the recognition of morphological complexity. Derivatives for which the final syllable of the base is truncated are also included (e.g. *anonymous* → *anonym**ity***, *psoriasis* → *psoriat**ic***).[21] After, reviewing the overall results on stress preservation, I will focus on two datasets, each dealing with a specific issue:

- Exceptional stress preservation, in violation of *CLASH (e.g. *re'turn* → *re,tur'nee*, *col'lective* → *col,lec'tivity*).
- Stress preservation failure (e.g. *an'ticipate* → *,antici'pation*, *Vic'toria* → *,Victori'ana*).

5.3.1. Overall results

The results confirm that stress preservation is the main determiner of secondary stress placement in stress-shifted derivatives. As the data does not allow for a systematic analysis of words with a single pretonic syllable because the dataset does not contain words with no stress on their first syllable, and as words with two pretonic syllables will be discussed in detail in the following section, I will focus on derivatives with at least three pretonic syllables. For these words, the overall results are shown in Figure 3.[22]

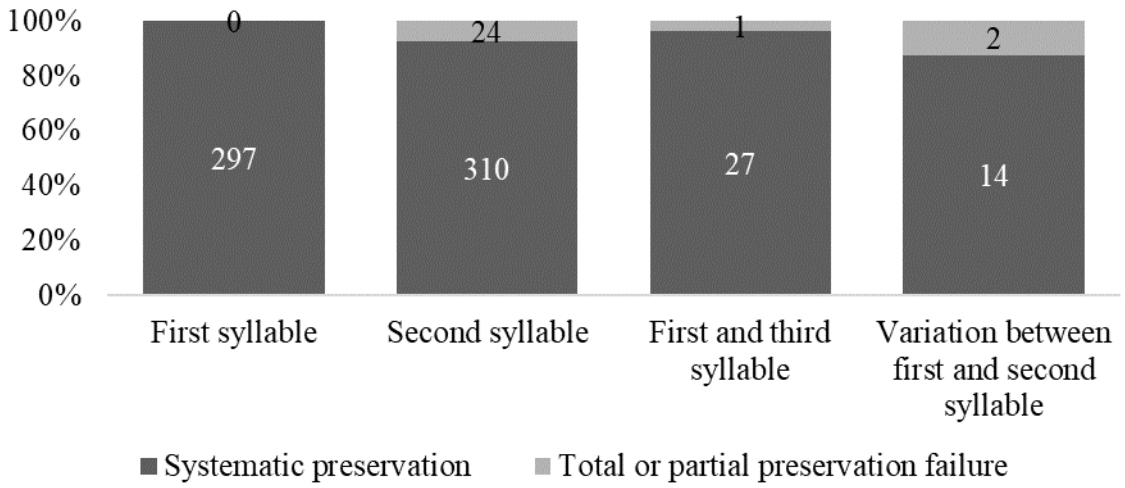


Figure 3. Proportion of systematic preservation in stress-shifted derivatives with at least three pretonic syllables depending on the stress pattern of the base

Two things are particularly striking in Figure 3. First, in all configurations, stress preservation is clearly the rule, ranging between 88% and 100% efficiency. Second, there are no cases of stress preservation failure when the base has stress on its first syllable. This second observation is particularly significant for two reasons. The first is that it supports the idea that the default pattern of secondary stress placement is initial stress. Failure to preserve stress on the second syllable can be seen as the application of the default pattern, in spite of what stress preservation would predict. The second reason is that this shows that the constraint hierarchy proposed by Pater (2000), in which the constraint requiring heavy syllables to be stressed dominates the one requiring stress preservation, makes incorrect predictions. This hierarchy predicts that derivatives whose base has a stressed light first syllable and a heavy second syllable should have pen-initial stress. This never occurs, as shown by all the relevant cases listed in (18).

(18) *cháracter → chàracterístic*
cháracterize → chàracterizátion
fráternize → fràternizátion
módernize → mòdernizátion
sìmultáneous → sìmultanéity
sólemnize → sòlemnizátion

However, two cases which could be analysed as cases of (variable) failure to preserve initial stress have not been included in Figure 3. These are the two cases listed in (19a), and the reason for not being included in Figure 3 is that the pen-initial secondary stress in the derivative may in fact be attributed to stress preservation from the more deeply embedded base. However, this kind of preservation appears not to be systematic as the only two other comparable cases shown in (19b) do not show the same sort of stress variation. Let us also mention the two cases in (19c), for which two possible bases are attested, each with a different stress pattern, and so this can be taken to explain the stress variation found in the derivative.

(19) a. *acádemy* → *àcadémic* → *academician* /020100/ ~ /200100/
aróma → *àromátic* → *aromaticity* /200100/ ~ /020100/

b. *immúne* → *ímmunize* → *ìmmunizátion*
repúte → *réputable* → *rèputabílity*

c. *aríthmetic* (n) / *àrithmétic* (adj) → *arithmetician* /020100/ ~ /200100/
cértify / *certíficate* → *certification* /200100/ ~ /020100/

The cases of stress preservation failure for bases with stress on their second syllable will be discussed in detail in §5.3.3. All the cases for which the base is stressed on the first and third syllables are shown in (20). Some marginal cases in which the base shows stress variation are shown in (20c). For these, the stress behaviour of the derivative is apparently unpredictable.

(20) a. **Systematic preservation**
aboriginality, apprehensibility, artificiality, compartmentalization, comprehensibility, comprehensivization, confidentiality, constitutionality, differentiation, excommunication, exhibitionistic, exponentiation, impecuniosity,

individualistic, individuality, individualization, individuation, institutionalization, perpendicularity, ratiocination, reprehensibility, sentimentalization, superannuation, superficiality, territoriality, tintinnabulation, valetudinarian

b. **Preservation failure**

supererogate	/20100/	→ *supererogation*	/2000100/

c. **Variation in the base**

falsifiable	/1000/ ~ /2010/	→ *falsifiability*	/2000100/
justifiable	/2010/ ~ /1000/	→ *justifiability*	/2000100/
reconcile	/100-/ ~ /201/	→ *reconciliation*	/2000100/
recognizable	/1000/ ~ /2010/	→ *recognizability*	/2020100/

As seen in Figure 3, there are only two cases of failure to preserve the stress pattern of a variably stressed base. All the relevant cases are listed in (21)(21).

(21) a. *alveolarity, applicability, capitalization, comparability, computability, demonstrability, despicability, idealistic, interpellation, palatalization, phosphorylation, preferability, systematization, volatilization,*

b. *amicable, capitalist* /10-/ ~ /01-/ → /20-/: *amicability, capitalistic*

In sum, this first section has shown that stress preservation is a major force determining secondary stress placement in stress-shifted derivatives. Let us now turn to the specific cases of exceptional stress preservation and stress preservation failure.

5.3.2. Exceptional stress preservation

As discussed in §3.2, the previous literature has found that the /021(-)/ pattern exclusively occurs in derivatives whose base bears stress on its second syllable, but has not established the conditions in which such exceptional stress preservation occurs. This phenomenon has been investigated in detail in Dabouis (2019). The relevant words which are used to study the phenomenon follow the general conditions discussed in §4 for the general dataset, although the dataset used here includes proper nouns. Otherwise, the words retained here have the following properties:

- They have primary stress on their third syllable.
- Their local base has primary stress on its second syllable and bears no stress on its first syllable.
- If there is a prefix, it must be semantically opaque.

The dataset contains 291 words, among which 32 (11%) may be stressed /021(-)/ (see (22a), while the remaining 259 words may only be stressed /201(-)/ (see (22b). Among the words in (22a), only four words may not also be stressed /201(-)/ (*adoptee, remittee, returnee, semantician)* and four have /021(-)/ as their main pronunciation in Wells (2008) (*appointee, escapee, retiree, selectivity*).

(22) a. *addressee, adoptee, appointee, Beninese, collectivity, connectivity, consignor, debauchee, departmental, detainee, diffusivity, directorial, elasiticity, electoral, ellipsoidal, encrustation, eructation, escapee, expellee, fermentation, Gibraltarian,*

perceptivity, receptivity, receptivity, reflectivity, reflexivity, refractivity, remittee, resistivity, retiree, returnee, selectivity, semantician

b. *abjuration, abolition, acoustician, bombardier, charismatic, combination, conductivity, degradation, detestation, disposition, eccentricity, exclamation, fomentation, gerundival, infectivity, information, lamentation, Magellanic, magisterial, occultation, perturbation, proclamation, relaxation, requisition, specificity, unanimity, Viennese…*

In order to determine the variables which are good predictors of exceptional stress preservation, the whole dataset was coded for a number of variables: the log-transformed frequency of the base and its derivative[23], the relative frequency of the base and derivative, the closedness of the first two syllables, the nature of the first two vowels of the base (full vs. reduced for the first syllable; short vs. long for the second syllable), the absolute and relative weight of the first two syllables. These variables were tested in a binary logistic regression with the possibility of exceptional stress preservation as the dependent variable and three factors were found to be significant predictors of exceptional stress preservation: the relative frequency of the base and its derivative, and the closedness of the first two syllables. Exceptional stress preservation is more likely if:

- the base is more frequent than its derivative;
- the first syllable is open (however, this effect is only weakly significant);
- the second syllable is closed.

An additional test was conducted to evaluate the role of more deeply embedded bases. The logistic regression was conducted again but the frequency of the base that was included was that of the most frequent embedded base. For example, the local base of *connectivity* is *connective*, which has 77 occurrences in SUBTLEX-UK, while the more deeply embedded base, *connect*, has 7109 occurrences in that same corpus. In such a case, the frequency of *connect* would be used as the base frequency. In rarer cases, in which the local base is more frequent than the more deeply embedded base (e.g. *directorial* ← *director* (9236) ← *direct* (3435)), the frequency of the local base is taken into consideration. The binary logistic regression analysis finds the same significant predictors, with a stronger effect of relative frequency.

Therefore, the results show that exceptional stress preservation is mainly conditioned by the relative frequency of the base and its derivative and by the closedness of the first two syllables, mainly the second. The frequency effects are reinforced by the integration of the frequencies of more deeply embedded bases. These results are consistent with the segmentability hypothesis discussed in §3.4, according to which derivatives whose base is more frequent are more likely to be accessed through a decomposed route in lexical access and to preserve properties of their base. However, at this stage I have not tested out Steriade & Stanton's (2020) proposal, which was discussed in §3.4, on the role of the stress patterns attested in the lexical family of the derivative, possibly in words which are not contained within the derivative.

5.3.3. Stress preservation failure

As was seen in §3.4, Collie's (2007, 2008) study of stress preservation failure has several important drawbacks which may question the validity of the results she reports. Therefore, I set out to replicate her findings with a more controlled dataset. The results are presented in detail in Arndt-Lappe & Dabouis (in preparation). As for exceptional stress preservation, the dataset is an expansion of that used in Dabouis (2016a) so as to include

proper nouns. The same criteria as those used in the previous section were used to select the data, except the stress configuration, which is as follows:

- The derivative should have at least three pretonic syllables.
- The base should have primary stress on its second syllable and no stress on its first syllable.

The dataset contains 277 words, among which 21 (8%) may show stress preservation failure (see (23a)) while the remaining 256 words show consistent second-syllable stress preservation (see (23b)).

(23) a. *ambassadorial, antagonistic, anticipation, anticipatory, humanitarian, humiliation, inauguration, infinitival, miscegenation, municipality, participation, participatory, pontification, prognostication, Pythagorean, somnambulation, subsidiarity, totalitarian, utilitarian, vaticination, Victoriana*

b. *abbreviation, accentuation, Americana, boliviano, collapsibility, commiseration, degradability, dissemination, effectuation, expectoration, familiarity, gesticulation, hallucination, initiation, intoxication, Napoleonic, originality, peculiarity, predictability, provinciality, retaliation, reverberation, superiority, vociferation*

As for exceptional stress preservation, a binary logistic regression was conducted. The variables that were tested are: absolute and relative weight of the first two syllables, the presence or absence of an initial onset, the absolute and relative frequency of the base and its derivative, the existence and stress pattern of a more deeply embedded base, semantic transparency[24] and the presence or absence of a semantically opaque monosyllabic prefix. Only two variables turned out to be significant predictors of stress preservation failure: the presence or absence of a semantically opaque monosyllabic prefix and the relative weight of the first two syllables. As can be seen in Table 9, stress preservation failure is more likely to occur if:

- The word is not prefixed.
- The first syllable is equally or more prominent than the second syllable.

	Non-prefixed		Prefixed		Total	
	Inconsistent preservation	Consistent preservation	Inconsistent preservation	Consistent preservation	Inconsistent preservation	Consistent preservation
S1 ≥ S2	12 (48%) *ambassadorial participation totalitarian*	13 (52%) *authentication gesticulation imagination*	4 (17%) *antagonistic irradiation prognostication subsidiarity*	20 (83%) *acceleration examinee impetuosity*	16 (33%)	33 (67%)
S1 < S2	4 (8%) *humanitarian humiliation municipality utilitarian*	47 (92%) *abbreviation familiarity Napoleonic*	1 (1%) *inauguration*	150 (99%) *appreciation evaporation respectability*	5 (2%)	197 (98%)
Total	16 (21%)	60 (79%)	5 (3%)	170 (97%)	21 (8%)	230 (92%)

Table 9. Stress preservation in stress-shifted derivatives with at least three pretonic syllables depending on their morphological structure and the relative weight of the first two syllables

A first look at the data suggest a form of cumulative effect, with the most extreme distributions found when the two significant variables make the same predictions. However, a closer look at the data suggests an even more clear-cut picture. Indeed, all the cases of possible preservation failure among non-prefixed words have /u/ in their first syllable, which is used by Wells (2008) to represent the neutralisation of the /uː/ ~ /ʊ/ contrast in certain unstressed syllables. As it is treated as a weak vowel, it was analysed as having little or no weight. However, if it happens that these words are actually often realised with /uː/[25], then the first syllable would be more prominent than the second syllable, which is light in all of these words. Three words with /u/ in their first syllable show systematic preservation: *euphorbiaceous*, *superiority* and *Thucydidean*. Among these, only *Thucydidean* has a light second syllable. Therefore, if these words were to be classified among the words whose first syllable is more prominent or as prominent as the second syllable, more than half of such words would have possible stress preservation failure.

These results have two important implications. First, they show that we cannot confirm Collie's findings on relative frequency with a more controlled dataset. Second, they show that semantically opaque prefixes are relevant to the phonology, even though they do not fit traditional definitions of the morpheme. Finally, the results do not show any evidence that the existence and stress pattern of a more deeply embedded base influences stress preservation from the local base in this configuration.

5.4. On general constraints

5.4.1. */00-/

The only possible exceptions to */00-/ that can be found in the data are prefixed words in which a monosyllabic prefix can be argued to have its own phonological word and in which the base starts with two unstressed syllables. The 17 words in (24) have this structure, and those shown in bold are listed in Wells (2008) as having no other possible stress pattern than /2001(-)/, while all the others may be stressed /2201(-)/.

(24) ***analphabetic***, *disinformation, dissatisfaction, dissimilarity,* ***illiberality***, *implacability, inelasticity,* ***inopportune***, *irregularity, irresolution,* ***misinformation***, ***non-residential***, ***non-scientific***, ***postmenopausal***, *reapplication,* ***reincarnate*** (vb), ***reintroduce***

As discussed in §3.2, this /2001(-)/ pattern could be analysed as resulting from a form of prosodic fusion, but the conditions in which this sort of fusion would occur are unclear. Dabouis (2016a) tested a number of variables to try and predict this fusion (e.g. the segmental shape of the prefix and that of the base, the frequencies of the derivative and the base), but none turned out to be a clear predictor.

5.4.2. *CLASH

We saw that there are two main categories of *CLASH violations. The first are found in non-derived words, mainly disyllables (e.g. *àrcáne, hàrpóon, scàléne*), and for which I have proposed that they might be the sign of an underway change towards stress retraction. The second are found in stress-shifted derivatives as a result of what I have called exceptional stress preservation (e.g. *appòintée, connèctívity, depàrtméntal*). Otherwise, stress clashes are commonly found in words with semantically transparent prefixes, especially compositional ones (e.g. *èx-cónvict, mìddáy, rèárm*), but these have not been analysed as *CLASH violations as the two stresses belong to different phonological words.

5.4.3. *LAPSE

This last rhythmic constraint bans sequences of more than two unstressed syllables. As was seen in §3.2, we can expect this constraint to regulate the patterns of non-derived words, but also to manifest through two types of changes in stress-shifted derivatives: the insertion of a stress that is absent from the base to break a long sequence of unstressed syllables or the deletion of a syllable to reduce the number of unstressed syllables. Let us also note that this constraint has generally been formulated in frameworks which assume a strong parallelism between stress and vowel reduction, and so it is possible that what it describes, if one assumes the position adopted in this paper in which a full vowel may be unstressed, is that there is a tendency to alternate between full vowels and reduced vowels. This is what Dahak (2011) calls "full vowel timing".

There are 84 words in the dataset which constitute relevant cases for the evaluation of the efficiency of *LAPSE, i.e. words with at least three syllables between the first secondary stress and primary stress. Five of these words are non-derived. Two of these have a full vowel in the middle of the sequence of medial unstressed syllables, *ìpec*/æ/*uánha, còmvers*/æ/*zióne*, and two others have /ɪ/ in that position, which could be analysed as a full vowel, *càrab*/ɪ/*niéri*, *prèstid*/ɪ/*gitátion*. The only case which may have a sequence of three unstressed and reduced vowels, although the position of secondary stress is variable, is *taramasalata* /ˌtærəməsəˈlɑːtə/ ~ /təˌrɑː-/. The remaining 79 words are stress-shifted derivatives. Among these:

- 8 have a full vowel in the middle of the sequence of unstressed syllables (e.g. *àlphab*/e/*tizátion, jùstif*/aɪ/*abílity, sỳstem*/æ/*tizátion*);
- 5 have /ɪ/ in that position (e.g. *desert*/ɪ/*ficátion, màscul*/ɪ/*nizátion, rèconc*/ɪ/*liátion*);
- 6 have sequences of syllables which could be analysed as being phonologically disyllabic but are systematically realised as monosyllabic (e.g. *fic**tio**nalization, parl**ia**mentarian, rat**io**nalistic*);
- 58 have an optional syncope (e.g. *criminalization* [ˌkrɪmɪn**ə**lɪˈzeɪʃən], *naturalization* [ˌnætʃ**ə**r‿əlaɪ zeɪʃən]) or compression (e.g. *inalienability* /ɪnˌeɪl**i**‿ənəˈbɪləti/, *sexualization* /ˌsekʃ**u**‿əlɪˈzeɪʃən/), which may phonetically reduce the number of unstressed syllables.

The two remaining words are of the form /2020-/. For the first, *recognizability*, the presence of a secondary stress on the third syllable can attributed to stress preservation from the stress variant of its base, *recognizable* /100/ ~ /201/. For the second, *latitudinarian*, whose base *látitude* has no such variant, the secondary stress on the third syllable may not be accounted for in such a way and could be interpreted as a way to avoid a violation of *LAPSE.

To sum up, the only word with a systematically unresolved violation of *LAPSE is *taramasalata*. All the other relevant words have either an alternation between full and reduced vowels and could be argued not to violate *LAPSE, if this constraint is taken to target sequences of reduced vowels rather than sequences of stressless syllables in the sense adopted here, or a possible deletion of a stressless syllable either through syncope or compression. I interpret these results as showing that this constraint actually targets reduced vowels and not stressless syllables, and that it is a phonetic constraint. Indeed, there are many cases of phonological lapses, but these tend to be resolved through phonetic processes.

6. Conclusions

After discussing the definition of secondary stress adopted in this paper, I have reviewed the claims which have been made in the literature about secondary stress placement in English. As previous research often lacks quantitative analyses, I have used dictionary data to provide a more detailed picture of this phenomenon. Although this type of data is far from

perfect, I have argued that it can still be used to provide useful insights on English phonology. The results presented in this paper overall confirm what was known about secondary stress placement but offers a more fine-grained picture.

It has been found that the three general constraints on stress patterns, */00-/, *CLASH and *LAPSE, are quite generally respected, although we have noted isolated exceptions of */00-/ violations in words with transparent prefixes and a few cases of violations of *CLASH in non-derived words and in derived words showing exceptional stress preservation. *CLASH applies within the domain of the phonological word as stress clashes are frequently attested across phonological word boundaries in prefixed words with compositional semantics. *LAPSE has been argued to be a phonetic constraint targeting sequences of reduced vowels and, with this definition, has been found to have only one exception.

Morphology has been confirmed to be a strong determiner of secondary stress placement, as was seen through the effects of prefixation and stress preservation. Monosyllabic semantically interpretable prefixes are often assigned a secondary stress, especially in compositional constructions. It was also found that, in prefixed antonymic pairs, the least frequent member of the pair tends to receive secondary stress on its prefix, while this is not true of the most frequent member of the pair. However, the results do not confirm a general stress-repelling effect of semantically opaque prefixes, as proposed by Fudge (1984). The only effect which has been found for these prefixes is that they favour pen-initial stress preservation in stress-shifted derivatives with more than two pretonic syllables. Stress preservation has been found to be a major force in secondary stress assignment in stress-shifted derivatives. The most striking results can be summed up as follows:

- Stress preservation is generally dominated by *CLASH, although a few exceptions do preserve the stress of their base (exceptional stress preservation). This type of exception is more likely to occur if the base is more frequent than its derivative (as predicted by the segmentability hypothesis), if the first syllable is open and if the second syllable is closed.
- Stress preservation failure is quite rare and never concerns initial stress (i.e. initial stresses are always preserved). Failure to preserve stress on the second syllable has been found to be favoured by the absence of a monosyllabic opaque prefix and by a first syllable that is heavier than the second syllable. No effects of relative frequency have been found, unlike what is reported by Collie (2007, 2008) and predicted by the segmentability hypothesis.
- Stress variation in the base is generally preserved in the derivative.
- The role of remote bases is marginal, although exceptional stress preservation is better predicted if the frequencies of remote bases are taken into consideration.

Finally, it was found that syllable structure does have an effect, but this effect is quite different from what is reported in the literature. Indeed, no effects of absolute weight have been found: the only weight effects that have been found are those of syllable closedness (which impacts secondary stress placement in non-derived words and favours exceptional stress preservation), and relative weight (which impacts stress preservation failure). As for the effects of onsetlessness, these have only been found to be significant in non-derived words, as onsetless words are more likely to receive pen-initial secondary stress than words with an initial onset.

To conclude, I have sought to provide a clear overview of the issues regarding secondary stress, a review of the literature on that issue and a summary of the empirical results I have brought forward over the last eight years. All the results have been illustrated with numerous examples, which I hope will prove useful for researchers and for teachers. However, the issue of secondary stress placement in English is far from being resolved. Certain classes of words that have been left aside will need to be studied in more detail and

may provide new interesting insights (e.g. neoclassical compounds). Obviously, the results based on dictionary data presented in this paper will have to be compared with other types of data to see whether the results hold, for example in spontaneous speech or judgement tasks.

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[1] My dissertation also included analyses of the pronunciation of vowels bearing secondary stress. These have been further developed in Dabouis (2018).

[2] Excepted for the chanted vocative discussed above.

[3] There is one notable exception: in words with an initial dactyl and where the third syllable begins with /t/ (e.g. *Mèditerránean*, *Nàvratilóva*), that /t/ may not be flapped and is realised with aspiration, like other voiceless stops in that same position (e.g. *Mèdi*[tʰ]*erránean*, *Lòla*[pʰ]*alóoza*, *Nèbu*[kʰ]*adnézzar*; Davis & Cho 2003; Jensen 2000; Withgott 1982).

[4] Some have claimed that this is due to the fact that such prefixes must satisfy foot or word minimality and be bimoraic (McCarthy & Prince 1994; Pater 2000; Raffelsiefen 1999).

[5] This should be extended to bound stems which are attached to semantically transparent prefixes such as *-flate* in *inflate* or *deflate*.

[6] One more could be added but will not be discussed further because the previous literature has cast serious doubts on its efficiency. This is the *H(constraint put forward by Burzio (1994) which states that initial heavy syllables may not be unstressed. Wenszky (2004: 120) notes that this constraint is rather weak and "should be rephrased as "#H(is dispreferred" but even this less severe constraint should be ranked relatively low, since a large number of words violate it". It is possible that, in approaches which assume that full vowels always carry some degree of stress, this constraint actually refers to the tendency of initial pretonic closed syllables to resist vowel reduction. This generalisation is found as such (Burzio 1994: 113; Fudge 1984; Halle and Keyser 1971) or as a related constraint, i.e. initial pretonic light syllables undergo vowel reduction (or "destressing"; Halle & Vergnaud 1987: 239; Hayes 1982; Selkirk 1980, 1984: 119). This generalisation is supported by recent empirical work by Dabouis & Fournier (2019) but, as noted by Wenszky (2004) and Pater (2000), there are exceptions, either words with initial heavy unstressed syllables or initial light stressed syllables.

The dataset used in Dabouis (2016a) did not allow for a proper test of the validity of *H(, but it was found that initial open syllables, if receiving secondary stressed, usually contain long vowels. This is what I call the "Rule of the Initial Pretonic" (see Dabouis (2018)).

[7] Note that Bolinger notes primary and secondary stress in the same way (with an acute accent) because he assumes that using a different symbol is not necessary as, in his analysis, secondary stress always precedes primary stress.

[8] As mentioned in §3.2, there are reported exception to *CLASH for words with a single pretonic syllable. However, no such exceptions are reported for non-derived words with two pretonic syllables.

[9] We could call that assertion into question as many Greek words have specific spelling-to-sound correspondences (e.g. <ph> - /f/, <eu> - /juː/), may contain certain specific suffixes (e.g. *-itis*, *-osis*), often are neoclassical compounds, which have specific morphological and phonological properties (see Dabouis & Fournier to appear).

[10] Collie points out that, in classical cyclic models, leap-frogging preservation should not be possible but that it is perfectly possible in a model using what she calls "fake" cyclicity such as Stratal Phonology (Bermúdez-Otero 2012, 2018b) in which the access to the base of complex words is probabilistic and based on factors such as relative frequency. In this model, it is perfectly possible for the more deeply embedded base to be accessed rather than the local base, especially if the former is more frequent than the latter.

[11] For example, some have studied spontaneous speech (Tokar 2018; Videau 2013), have conducted nonce-word reading tasks (Domahs et al. 2014; Turcsan & Herment 2015) or nonce-word judgement tasks (Steriade & Stanton 2020).

[12] Tokar (2018) reports anecdotal evidence regarding the phrase *acceleration and deceleration*, which would often be stressed *accéleration and déceleration*, as opposed to the expected *áccceleration and décceleration* if the semantic transparency of the prefix does not make a difference. I conducted a Youglish search (https://youglish.com) on 13/08/2020 and found that, out of 16 relevant occurrences, *deceleration* receives initial stress while *acceleration* receives pen-initial stress in 15 instances. In the only remaining occurrence, both words have initial stress.

[13] To my knowledge, no specific study of secondary stress placement in these words has been conducted and so their exclusion should be seen as a precaution here, but these words should be investigated in more detail. There is anecdotal evidence that they may behave differently from other words: *larỳngológical* is derived from *làryngólogy* and therefore violates stress preservation. One possible explanation is that the neoclassical root *laryngo-* normally receives stress on its second syllable (e.g. *larýngograph*, *larýngoscope* cp. *rádiograph*, *cínemascope*, *láparoscope*, *stéreoscope*) and that this stress pattern will be adopted whenever possible, even if that violates stress preservation.

[14] Note that these counts do not include prefixed words, which are discussed in the next section.

[15] However, this inventory also includes six words in *-ate*, *dictate*, *lactate*, *mandate*, *migrate*, *ornate* and *stagnate*, for which the change is going in the opposite direction. Indeed, these words used to have initial stress and are undergoing a stress shift towards final stress, in British English at least. Therefore, the initial secondary stress in these words could be interpreted as a remnant of the historical primary stress. It is possible that other words in (14) are going the same change, and a detailed diachronic study of these words could shed light on this issue.

[16] The full dataset and list of exclusions can be found in Dabouis *et al.* (2017), along *divertimento* which had not been excluded but has now been included along with the words in (16a). As argued by Dabouis (in preparation), it is possible that long words are almost systematically parsed into word-like constituent and therefore are never completely free of a form of what could be called "crypto-morphology".

[17] The relationship with *restaurant* is supported by the alternative pronunciation /ˌrestə**ɒn**ˈtɜː/.

[18] Note that Dabouis (2016a) reported a distinct behaviour for words with monosyllabic opaque prefixes, which were found to be more likely to have pen-initial stress than non-prefixed words. However, this result was not confirmed in the expanded dataset and when all the possible determining variables are taken into consideration.

[19] This observation holds true if one adopts a different definition of stress and considers that all full vowels bear a degree of stress. Dabouis & Fournier (2019) report that, among words containing a monosyllabic prefix in the initial pretonic position listed in Jones (2006) as bearing no secondary stress, the proportions of words which have a main pronunciation that contains a full vowel are 7% for opaque prefixed words, 20% for words with a transparent prefix and non-compositional semantics and 96% for prefixed words with compositional semantics.

[20] See Myers & Li (2009) for references on this issue.

[21] Dabouis (2016a) studied them separately and concluded that they should be treated alongside derivatives formed by juxtaposition.

[22] For obvious reasons, this figure is a simplification of the results, which does not include a number of specific cases implying, for example, the appearance of a stress in the derivative or derivatives with several possible bases (which do not themselves stand in a relationship of containment).

[23] Frequencies were collected from SUBTLEX-UK (Van Heuven et al. 2014).

[24] In order to use a replicable criterion, semantic transparency was assessed based on a general online dictionary, Dictionary.com (https://www.dictionary.com). The relationship between the base and derivative was coded as transparent if the base appeared in the definitions of the derivative given by the dictionary and as opaque if it did not. This variable was introduced as a complement to relative frequency to indirectly measure segmentability, as has been done in previous work (Ben Hedia & Plag 2017; Plag & Ben Hedia 2018).

[25] As suggested by an anonymous reviewer, a study on spoken corpora could bring enlightenment on this point.