The binary branching nature of syllable constituents: the English onset

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Abstract: The conventional composition of the English syllable is captured in the template: C_0^3 $V_1^2 C_0^4$. This means that the onset accommodates a minimum of zero and a maximum of three consonants, the coda a minimum of zero and a maximum of four, whilst the nucleus takes a minimum of one and a maximum of two vowels. This article focuses on the onset constituent, and argues that the English onset branches twice instead of three times. It argues that the conventional three position onsets are derived from word initial consonant clusters, and that these onsets do not appear to hold word medially where only onsets with two positions appear to be attested. Motivating evidence is drawn from other languages, specifically Italian, Spanish and Portuguese, because it is believed that, except for the coda, the binary branching nature of syllable constituents is universally imposed in the world's languages. Also, no one language or dialect can exhaustively account for all linguistic phenomena — evidence to demonstrate an otherwise systematic behaviour of a phonological unit may have to be drawn from other languages or dialects. A brief overview of the Optimality Theory account of syllable onset is given, and areas of overlap are noted.

Introduction

Consonant patterning in syllable constituency in the world's languages appears to adhere to certain linguistic principles which seem to be universally imposed. Two such principles which are relevant to the present paper, are that of *sonority* and *onset maximisation*. These principles have been investigated within the syllable onset in various languages by various scholars (for example, Giegerich, 1992; Harris, 1994; Blevins, 1995; Spencer, 1996; Gierut, 1999; Gierut & Champion, 2001; Barlow, 2005).

The sonority theory

According to the sonority principle, speech sounds may be arranged in a hierarchical scale according to their prominence[1], with the least sonorous sounds occupying the bottom rank and the most sonorous the top one. The sonority scale may be outlined as follows, where the numbering starts with 1, representing the least sonorous sounds, up to 6, which indicates the most sonorous sounds. In this paper, the numbering is assigned to sounds arbitrarily (but see also Giegerich, 1992). Also, within the obstruents band, voiceless sounds are less sonorous than their voiced cognates.

sonorants	6. Vowels
	5. Glides
	4. Liquids
	3. Nasals
obstruents	2. Fricatives/Affricates
	1. Plosives

The role of the principle of sonority in governing the co-occurrence of sounds in the structuring of syllables, and for our purposes, the English syllable, is two-fold. One aspect relates to the issue of *sonority sequencing*, and another to *minimum sonority distancing*. According to sonority sequencing, on the one hand, the vocalic nucleus constitutes the peak of sonority, and is (optionally) flanked by consonants on either side which display a decreasing sonority profile the further away from the nucleus they get (cf. Harris, 1994; Blevins, 1995; Spencer, 1996). Thus, consonants occupying the onset position construct an ascending sonority scale towards the peak of the syllable, or a descending sonority scale away from the nucleus of the syllable. Minimum sonority distancing, on the other hand, concerns the distance in sonority that is imposed between segments occupying the (first and second) slots in the syllable onset. The minimum distance may be determined by reference to the sonority rank occupied by the consonant types in the onset. In English, it appears that the minimum sonority distance to be observed by segments in the onset position should be greater than one degree, hence the barring of sequences such as /*κσ, *φν,*μλ, etc/.

The principle of sonority on its own is however not adequate to account for constraints that occur in the syllable onset. Licensing is another crucial factor that has to be taken into consideration, but this will not be addressed in this paper.

Onset maximisation

The principle of onset maximisation is based on the premise that languages tend to give priority to the formation of onsets rather than to codas. This also seems to be supported by languages with syllable structure (C)V, where only open syllables are permitted. This template, CV, has thus become the core syllable template. Onset maximisation therefore gives priority to onsets, because although some languages appear to disallow the coda, all appear to allow onsets. According to this principle, intervocalic consonants are syllabified in the onset of the following syllable as long as they form an onset which observes the phonotactic constraints operating in the syllable structure of that language (cf. Harris, 1994; Gussmann, 2002). Thus in the CVCV sequence, as in 'better' /ˈβετə/ the consonant /τ/ would be syllabified with /ə/ in the following syllable rather than with /ε/ as the coda of the preceding syllable. In the VCCV sequence found in words such as 'lucrative' /ˈλuːκɹəτɪʊ/, both the /k/ and /p/ would be syllabified with the vowel /ə/ as a well-formed obstruent-liquid onset. If the two consonants concerned do not constitute a well-formed onset, the first consonant would be incorporated in the previous syllable as the coda, and the second in the following as an onset. For example, in the word, 'sector' /ˈσεκτə/, the consonant /k/ would be syllabified with /ε/ as the coda of the preceding syllable, whilst /τ/ would be included with /ə/ in the following syllable as an onset. /kτ/ clearly contravenes the constraints operating within an English onset and the consonants therefore are syllabified as different syllabic constituents.

Types of the English onset
Zero position onsets

It is possible for the onset of the English syllable to be unoccupied by any consonant. This is illustrated below:

(1)   'all' /ɔː.l/

```
        σ
       / \
      O   R
         / \
        N   C
        |   |
        x   x
        |   |
       /ɔ:  l/
```

Single position onsets

Distribution of consonants in single position onsets

With the exception of /N/ and marginally /Z/[2], the entire inventory of consonant contrast can occur in a single position onset. This is illustrated below.

(2)   'call' /Oːλ/

```
                        σ
                       / \
                      O   R
                      |  / \
                      | N   C
                      | |   |
                      x x   x
                      | |   |
                     /κ Oː  λ/
```

Two position onsets

A restriction applies in the patterning of consonants in two position onsets. In this onset type, the first slot is always occupied by an obstruent and the second by a liquid or glide. This is summarised in the Table 1(a).[3]

In Table 1(a), two types of barring are evident: Homorganic consonants may not pattern together, hence the forbidden / *τλ, *δλ *πω, *βω, *τλ and *Tλ [5]/ combinations. Also, as it was just mentioned, whereas C₁ maybe any obstruent in the language, C₂ may only be either a liquid or a glide: /λ,ρ,φ,ω/. This patterning can be accounted for in terms of the sonority theory (sequencing and distancing) outlined on above.

Using the (1–6) numbers assigned to sounds above, the sonority profile of the obstruent-liquid/glide sequence is plotted on Figure 1 (a) and (b), using /πλ, πφ/ sequences as examples (cf. Giegerich, 1992). These are found in words such as 'play' and 'pure' /πλεɪ/ and /πφɪY/.

As expected, an ascending scale of sonority may be observed from the onset towards the peak. This profile may be said to reflect a well-formed (English) syllable onset.

Other types of two-slot positions have been proposed where the first consonant would be the coronal /s/ plus a liquid or glide, or /s/ plus some other consonant, e.g./t, w, m etc./ (cf. Roach, 2000: 71–71, for instance). These so-called 'onsets' occur in words like:

(3)   'slide' /σλαɪδ/,   'swell' /σωελ/,   'Sewell' /Nσφυːελ/,   'syringe'[6] /σρɪνδZ/

The entire combination is summarised in Table 1(b).[7]

Significant differences can be observed in the co-occurrence of consonant contrasts in Table 1(b) as compared to Table 1(a). In Table 1(b) there is no restriction whatsoever in the co-occurrence of segments in the onset. In fact, after the voiceless coronal fricative /s/, consonants behave as if they are occupying a single-position onset in that, apart from the exceptions mentioned above, /N/ and

Table1(a): Phonotactic relations between consonant contrasts in the syllable onset (Harris, 1994; Roach, 2000)

C₂	λ	ω	φ	ρ	π	τ	κ	μ	υ
C₁									
π	+	—	+	+	—	—	—	—	—
τ	—	+	(+)[4]	+	—	—	—	—	—
κ	+	+	+	+	—	—	—	—	—
b	+	—	+	+	—	—	—	—	—
d	—	+	+	+	—	—	—	—	—
γ	+	+	(+)	+	—	—	—	—	—
φ	+	+	+	+	—	—	—	—	—
T	—	—	(+)	+	—	—	—	—	—

pl	1	4	6
pj	1	5	6

OBSTRUENT PLUS LIQUID-GLIDE PATTERNING AND THE VOCALIC PEAK
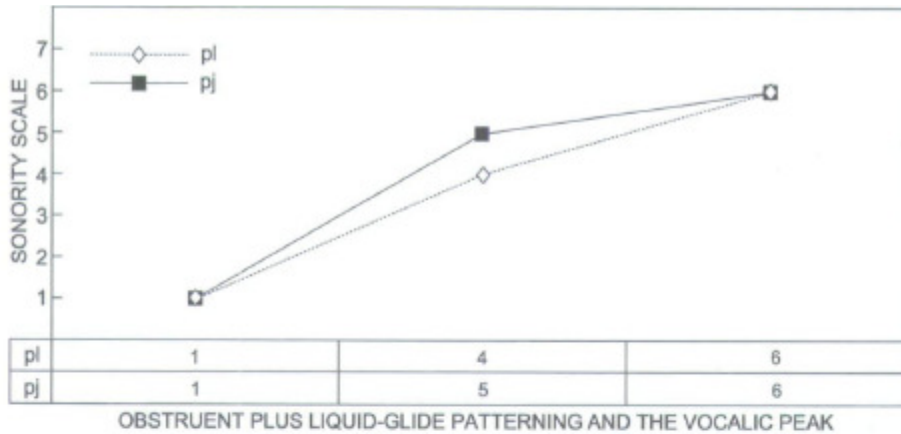
Figure 1(a): The sonority profile of the obstruent plus liquid-glide sequences

sj (i)	2	5	6
sp (ii)	2	1	6
sm (iii)	2	3	6
sf	2	2	6

/S/ PLUS CONSONANT PATTERNING AND THE VOCALIC PEAK
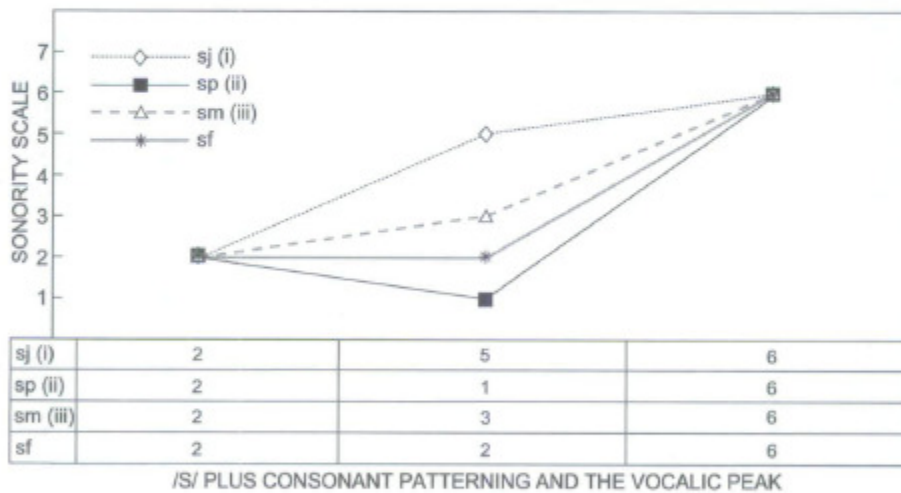
Figure 1(b): The sonority profile of the /s/ plus consonant sequences

marginally /Z/, any consonant type freely occurs. Thus both the barring on the co-occurrence of homorganic sounds and the restriction imposed by the sonority principle are flaunted, allowing the occurrence of combinations as, for instance, {σν/σμ, σκ/στ, σλ/σω}[8]. The sonority profiles of the various (i)–(iii) sC clusters are plotted below, using /σφ, σπ, σμ, σφ/ sequences found in, for instance, 'splash' /σπλ{Σ/, 'suitable' /σφυːτ≡β□λ/, 'smoke' /σμ≡Υκ/ and 'sphere' /σφΙε/.

Figure 1(b) shows that, for the /σπ/ sequence, an upward sonority slope towards the peak of the syllable is not obtained. In fact, a downfall in sonority, from 2 to 1, is what is obtained. Also, for the /σφ/ sequence, no minimum sonority distance is kept between neighbouring segments, since both segments in the sequence score 2 on the sonority scale. Only the sequences /σφ, σμ/ in the figure observe the sonority principle.

Table1(b): Phonotactic relations between the coronal fricative /s/ and other consonant contrasts (Roach, 2000).

	(i)				(ii)			(iii)	
C_2	λ	ω	φ	ρ	π	τ	κ	μ	υ
C_1 s	+	+	(+)	(+}	+	+	+	+	+

The sC clusters thus present inconsistencies in the patterning behaviour of onset segments. The phonotactic restrictions which operate on the structuring of the onset in Table 1(a) sequences are not observed in Table 1 (b) sequences. There does not appear to be any consistent relationship between the fricative /s/ and the consonants that occur after it. This situation could be quite revealing as to whether these sC clusters actually constitute syllable onsets.

The position adopted in this paper is that these clusters do not constitute onsets, the problem hinging on the syllabification of the fricative /σ/. And, below, the syllabification of this fricative into the onset of the so-called three position 'onsets' will be rejected on these grounds and others. For now, this position is reached for reasons of the contravention of the sonority principle discussed above, and because of the principle of onset maximisation.

The syllabification of sC clusters word-internally

As pointed out above, according to the principle of onset maximisation, consonants may be maximally syllabified into the onset if they constitute a well-formed onset in the syllable structure of the relevant language. If the sC cluster constitutes a well-formed onset on the edge of a word, this syllabification could be expected to hold word-internally too. However, certain stress patterns in English as well as the syllabification of /σ/ in sC clusters in other languages appear to favour the confinement of the fricative in the coda position, rather than the onset position, word-medially. If this distribution could be established, it could be the second indication (the first having been offered by the sonority contour above) that the pairing could be bogus (Harris, 1994).

Some stress patterns in English

Some words in English which contain the sC cluster appear to favour the syllabification of /s/ in the coda position rather than making it an onset sister with the following consonant. This is communicated by way of stress, where syllables attract stress by being heavy, and this 'heaviness' is indicated by a (branching) rhyme dominating at least two occupied slots. These slots may both be in the nucleus, in both the nucleus and the coda where each constituent contains only one segment, or in both the nucleus and the coda where the nucleus contains two segments and the coda only one.[9] Consider the following illustration for the word 'booster' /ˈβuːστə/ (and such words as 'listerine' /ˈλιστəριːν/). This word manifests a super heavy rhyme where the fricative /σ/ must be syllabified into the coda constituent.

(4) 'booster' /ˈβuːστə/
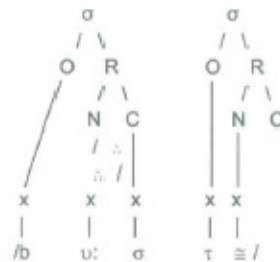
The syllable /ˈvʌlɪst/ in [ˈvʌlɪstərːv] manifests a heavy rhyme where, with only a short vowel in the nucleus, the coda position has to be occupied, in this case by /s/, for the syllable to attract stress. More examples of such words include 'basket' /ˈvβɑːskɪt/, 'coaster' /ˈvkɛʏɑtɛ/, and 'master' /ˈvμʌːstɛ/. If the sC cluster constituted a well-formed onset, it would automatically be syllabified into the onset position in the above words, in observance of the onset maximisation principle. The fact that it could be stripped from the following consonant by some other phenomenon could be taken as an indication that it cannot be taken for granted as a cluster partner with that consonant.

But the general stress pattern in English is very inconsistent, and may not provide a reliable cue for the syllabification of the sC clusters word-internally. For instance, in the word, 'industry' /ˈvɪndɛstrɪ/ it is the antepenultimate syllable that is stressed and not the one containing the sC string. However, if the coronal fricative can be shown not to belong to the onset in word internal environments, then the fluctuating stress pattern in English would also have been demonstrated to be independent of syllabification.

The English palatal glide [φ]

In some dialects of English, the palatal glide, also known as yod, can occur after any single consonant in stressed syllables in the language (thus forming the Cj combination). The syllabification of this consonant provides insight into how consonant clusters at the beginning of a word could be integrated into syllable constituents (Harris, 1994). Consider the following examples:

(5) (a) puree [ˈvπφʏɛpɛɪ]   (b) dual [ˈvδφuːɛλ]   (c) lieu [ˈvλφu]
     beauty [ˈvβφuːtɪ]   neutron [ˈvvφuːtρΘv]   luminary [ˈvλφuːμɪvɛpɪ]

The natural assumption to make from the examples above is that the two consonants at the beginning of the words are onset sisters, with the sonorant [φ] being parsed into the second slot of the onset. This could be illustrated as follows.

(6) lieu [λφυ]   O   R
                          / ·   / ·
                         x   x   x   x
                         ρ   ρ   · /
                         λ   φ   υ /

A different scenario is observed when the yod is confronted with a genuinely branching onset (in this case one involving a plosive and a lateral). Consider the following examples.

(7) blue *[βλφυː]   clue *[κλφυː]   glue *[γλφυː]   plural *[vπλφʏɛpɛλ]

The glide simply becomes stranded. This situation could plausibly be attributed to the fact that both slots in the onset are already occupied, leaving the yod, which otherwise occurred with lone plosives as part of a legitimate, branching onset, stranded. This is illustrated as follows.

(8) clue *[κλφυ]   O   R
                          / ·   / ·
                         x   x   x   x
                         ρ   ρ   · /
                        /κ   λ   φ   υ /

The significance of the syllabification of the palatal glide is that it provides a test to determine whether the elements in the sC cluster constitute a well-formed onset. If they do, then they should never be followed by the yod, just like the well-formed onsets in (7) above. Consider the following examples.[10]

(9)   scute [¹¹] [σκφυːτ], skewer [∀σκφυːε], sputum [∀σπφυːτεμ], spurious [∀σπφΥερΙεσ]
        stupor [∀στφυːπε], Stewart [∀στφυːωετ]

The reoccurrence of the palatal glide in the examples above indicates that there is an empty slot in the onset that it can occupy. Clearly, the plosives occupy the first slot of the onset by virtue of their sonority indices, and the sonorous yod occupies the second slot, observing the sonority principle. The /s/, therefore, is just not part of the onset. Thus the data, as it stands, points to the fact that the spirant in the *s*C clusters and the following consonant are in effect heterosyllabic segments: they do not belong to the same syllable constituent.

The issue to be addressed now is where the coronal fricative is syllabified. Various proposals have been put forth to the effect that this consonant may be parsed at the level of a word, or directly linked to the syllable. Other proposals parse this coronal fricative into the coda constituent of the preceding syllable; motivating evidence for this comes from other languages with the same cluster, such as, for instance, Italian, and from languages like Spanish and Portuguese.

The syllabification of the coronal fricative in sC clusters in other languages
### Some stress patterns in Italian

Certain facts about some stress patterns in Standard Italian words are very revealing as to the syllabic status of the coronal fricative /s/ in *s*C clusters. In this language, stressed vowels are long when they are not followed by a rhymal complement (i.e. the coda). But when the syllable is closed, these vowels are short (Harris, 1994: 55). This is illustrated below, with examples adapted from Gussmann (2002: 109).

(10)   a.   b.
        Stressed long vowels   *Stressed short vowels*
        casa [∀καːζα] 'house'   *bocca* [∀βοκκα] 'mouth'
        muro [∀μυːρο] 'wall'   *campo*[∀καμπο] 'field'
        Feroce [φε∀ροːτΣε] 'savage'   *centre* [∀τΣΕντρο] 'centre'

As is evident from the examples above, stressed vowels are long when they occur in an open syllable (cf. 10a). In the examples in (10b), the stressed vowels are not long, suggesting that one of the medial consonants is syllabified in the preceding syllable as a coda. This means that the consonant following the long vowel (cf. 10a) is not syllabified in the coda but in the onset of the following syllable. Thus, in a stressed syllable, the rhyme must dominate two occupied positions, where the segments may both be vocalic, and therefore in the nucleus as a long vowel. Or, in addition to a vocalic segment in the nucleus, there may be a rhymal complement, the coda, in which case the vocalic element remains short.

Examples in *casa* in (10a) and *bocca* in (10b) may therefore be syllabified as follows:

(11)   *casa* [∀καːζα] 'house'
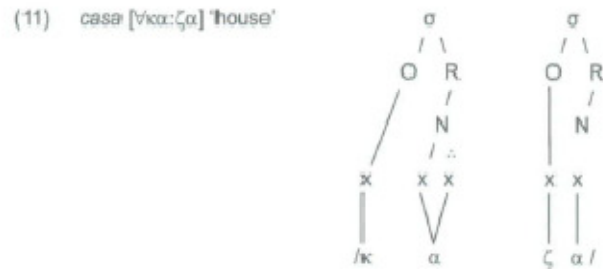
(12)   *bocca* [˅βοκκα] 'mouth'
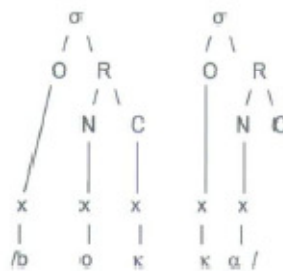
This state of affairs is handy in dealing with the syllabification of internal consonant sequences in Italian. Consonants immediately following long vowels are syllabified in the onset of the following syllable, and those following short vowels belong to the coda of the preceding syllable. Consider the following examples, adapted from Harris (1994: 55) and Gussmann (2002: 111–112).

(13)   a.

pietra [˅πφE:τρα] 'stone' (CCVV.CCV)

zebra [˅δζE:βρα] 'zebra' (CVV.CCV)

quadro [˅κωα:δρο] 'square' (CCVV.CCV)

b.

basta [˅βαστα] 'enough' (CVC.CCV)

vista [˅ωιστα] 'sight' (CVC.CV)

pesca [˅πEσκα] 'peach' (CVC.CV)

The internal obstruent plus liquid-glide sequences in (13a) obviously syllabify into the second syllable as a well-formed onset. This is evidenced by the fact that the preceding stressed vowel is long. These therefore pattern with the (10a) set discussed above. Syllabification of segments containing *s*C clusters as in (13b) presents a completely different picture. The stressed vowel in the first syllable is short, clearly indicating that the coronal fricative /s/ is being consistently syllabified as the coda, a rhymal complement closing the syllable accordingly. In fact, the syllabification of internal consonant sequences in (13b) is on the same pattern as that of (10b) above, since the /s/ splits with the following segment to belong to the coda. Thus the medial *s*C cluster does not appear to constitute a well-formed onset in Italian. The syllabification of these *s*C clusters may be illustrated as follows.

(14)   *basta* [˅βαστα] 'enough'
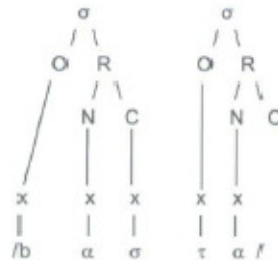
This distribution of the coronal fricative in the *s*C cluster word-medially in Standard Italian further supports the claim that the consonant is not an onset consonant, but rather belongs to the coda.

*s*C cluster word-initially

*s*C clusters also occur in word-initial position in Italian, as in the following words:

(15)(a) *specifico* [σπε˅τΣι:φικο] 'specific' (b) *scatola* [˅σκα:τολα] 'box' (Gussmann, 2002)

These examples pose an interesting problem: if one accepts the claim that the coronal

fricative is a coda consonant, there does not seem to be any nucleus with which it would be syllabified, since the nucleus is the compulsory constituent of the syllable. Of course, one could adopt a different parsing strategy in word-initial contexts, that of incorporating the /s/ into the onset for lack of a preceding rhyme to attach it to. This strategy would however result in an inconsistency: if the /s/ in the sC belongs to the coda word-internally, this syllabification should hold word-initially too.

Evidence for the syllabification of /s/ in the coda position in word-initial contexts could be obtained from alternations regarding the masculine definite article in Standard Italian. This article has a singular and a plural form, as illustrated below.

(16)   *Singular*   *Plural*
        il [ɪλ]   *l*[ɪ]
        lo [λo·]   *gli*[ʌɪ]
        (*l'* [λ])   (*gl'*[ʌ])

Consider the following description of these articles, adapted from Harris (1994: 63) and Gussmann (2002: 111):

(i) *The choice of the masculine **plural** definite article before nouns starting with consonants.*
In the singular form, the definite article is *il*, and in the plural it is *i*.

(17)   *Singular*   *Plural*
        il doni 'the gift'   *i* [ɪ] *doni* 'the gifts'
        il soldato 'the soldier'   *i* [ɪ] *soldati* 'the soldiers'
        il plico 'the file'   *i* [ɪ] *plichi* 'the files'

What is worth noting is how the different consonants select the masculine *plural* definite article, and, in particular, the fact that /s/, occurring as a single consonant selects the same article as the other consonants, *i*, whether they are single consonants or a branching onset cluster. This confirms the status of the /s/ in this case as an onset consonant as it selects the article that other consonants in the onset position select.

(ii) *The choice of the masculine **singular** definite article before nouns starting with vowels.*
In the singular form, the definite article is *lo*, which becomes *l'* when the vowel in this article is elided in fast speech. In the plural form, the variant for the definite article is *gli*, sometimes just simplified as *gl'*.

(18)   *Singular* [12]   *Plural*
        l' amico 'the friend'   *gli amici*
        l' anno 'the year'   *gli anni*
        l' italiano 'an Italian'   *gli – gl'italiani*

(iii) *The choice of the masculine **plural** definite article before sC clusters.*

(19)   *Singular*   *Plural*
        lo studente 'the student'   *gli studenti*
        lo scalo 'the port'   *gli scali*
        lo albero 'the tree'   *gli alberi*

The form of the article adopted by the plural forms of the sC clusters are of interest for purposes of contrast with the plural form of the article adopted by the solitary /s/ in nouns commencing with consonants in (17) and those commencing with vowels in (18). That the sC clusters do not adopt the form of the article adopted by the solitary /s/, which is obviously in the

onset position, is very revealing as to the syllabification of the coronal fricative element: this fricative is clearly not in the onset position.

Having divorced the /s/ from the onset, the most natural thing, it appears, would be to accept the claim that, even in word initial environment, the /s/ fricative is a coda consonant, except, this time, the problem is that the preceding vowel with which this /s/ is syllabified appears to be absent. The presence of the vowel, however, is made evident by analysis of the sC clusters in a related Romance language, Spanish.

sC clusters in Spanish

It is interesting to observe that sC clusters simply do not exist in Spanish. This is precisely because the fricative in sequences that would otherwise be sC clusters are always preceded by a vocalic element, in particular the element /e/. Consider the following examples (*Spanish-English. English-Spanish Dictionary*, Gonzalez, 1989).[13]

(20) *estudiante* [εστυ∀Δφαντε] 'student'
      estudio [εσ∀τυδΔφο] 'studio'
      estupor [εστυ∀κορ] 'stupor'
      Espan~a [εσ∀παθα] 'Spain'
      espa~tula [εσ∀πατυλα] 'spatula'
      escuela [εσ∀κωελα] 'school'
      esculpir [εσκυλ∀πιρ] 'sculpt'

Clearly, it would be impossible to regard the two s and C (in this case st, sk and sp) consonants as homosyllabic elements in Spanish, since the language clearly specifies the syllabic statuses of the consonants. Thus /s/ is a rhymal complement of a vowel which has melodic content; and the following consonant makes the onset of the following syllable.

Perhaps this state of affairs could be extrapolated onto the Italian situation. Plausibly, unlike Spanish, Italian chooses not to fill up the melodic content of the nucleus for the rhymal complement; it is nevertheless clear from the Italian data that the spirant is not an onset. The syllabification patterns of these two languages may be represented as follows:

(21) Spanish
      Espan~a [εσ∀παθα] 'Spain'

```
          R     O     R     O     R
         / ·    |     |     |     |
         N C    |     N     |     N
         | |    |     |     |     |
         x x    x     x     x     x
         | |    |     |     |     |
         /ε σ    π     α     θ    α/
```

(22) Italian
      scatola [∀σκα:τολα] 'box'

```
          R     O     R     O     R     O     R
         / ·    |     |     |     |     |     |
         N C    |     N     |     N     |     N
         | |    |    / ·    |     |     |     |
         x x    x   x  x    x     x     x     x
         | |    |    · /    |     |     |     |
         / σ    κ    α      τ     ο     λ    α /
```

Against this background, it seems reasonable to conclude that the spirant /s/ in English sC clusters belongs to the coda of the preceding syllable. In this regard then, English patterns up with Italian in that it does not express the melodic content of the preceding nuclei element with which the /s/ in the sC clusters is syllabified. The English language nevertheless adequately demonstrates the fact that this consonant, in this cluster, is not accommodated in the onset position.

Word initial three consonant clusters

Given the above findings, the so-called three position 'onsets'[14] can now be addressed. Specifically, it is claimed that these 'onsets' can be reduced to legitimate two-slots onsets: the obstruent plus liquid-glide sequence, observing the sonority and onset maximisation principles which govern the construction of syllable constituents. In short, then, it is concluded that the only legitimate onset in English is the one summarised in Table 1(a), an onset which branches twice maximally, the first slot less sonorous than the second towards the peak. And this 'conforms to the general requirement that within onsets two obstruents are not permissible' (Gussmann, 2002: 110).

Cross linguistic analysis and language Di-oxyribo-Nucleic Acid (DNA)

Phonology describes language specific characteristic of linguistic units. This paper has argued for the binary branching nature of syllable constituents, focusing on the English onset, and has provided motivating evidence from other languages for the conclusions arrived at. The question is whether in doing so, the paper has not perhaps adulterated onset characteristics unique to the English onset, resulting in 'heretical' and misleading conclusions. Also, is this not opening a situation where 'anything can happen' in language analysis? That is, to account for a linguistic phenomenon in one language, one would freely extrapolate characteristics of that phenomenon from a different language onto the language under investigation, since there would not be any evidence in the language concerned.

Perhaps in addressing these questions consideration needs to be given to what syllabification is about. Two possible scenarios exist. Syllabification could be viewed as a process where melodic units are exhaustively attached to syllable constituents, ensuring that no unit is left 'stranded' or unattached. This approach could be viewed as operating from the bottom, essentially from the level of the melodic tier, up, towards syllable constituents (Onset, Rhyme: nucleus, coda). Syllabification could also be seen as an exercise operating from the top downwards. Here, it is the syllable constituents (the Onset and the Rhyme: nucleus and coda) that govern the patterning of melodic units occurring as their content, and not the other way round. In this way, syllable constituents control what is allowed and what is disallowed within their slots. This paper adopts the view that the latter approach to syllabification supports and upholds the retention of language DNA, but the former actually overrides and violates it.

Thus, whereas one view would exhaustively incorporate the voiceless coronal fricative /s/ in the onset as a melodic unit needing to be syllabified, the other would reject it as a language-specific pattern dictated by the onset itself. Standing divorced from the onset, the language characteristically chooses not to express the nucleus of the coda with which this fricative is syllabified.[15] This paper maintains that this is also a language specific behaviour of English which is lost in the other approach to syllabification.

Motivation for the syllabification of /s/ in the coda is drawn from other languages not in a haphazard way. As pointed out above, and for the purposes of this discussion, the syllable (onset) is envisaged as a linguistic unit exhibiting consistent behaviour in the languages of the world (cf. Introduction), and is governed by the two principles presented above, which are assumed to be universally imposed. It is for this reason that evidence for what happens to /s/ could be provided by other languages.

Optimality Theory (OT): summary of syllable representation

It was argued above that the English onset and its constituents, consists of a maximum of two segments instead of the conventional three. It was also argued that what appear to be three position onsets are actually derived from an aggregation of consonants at word edges; furthermore, and that such onsets do not occur in word-internal environments, where only two slots in the onset appear to be allowed. This finding could be significant regarding the composition of the onset at the beginning of a word – as a two-position constituent in English, and perhaps also in all languages of the world.

This section provides a brief Optimality Theoretic analysis of the English syllable.[16]

Optimality Theory accounts for syllable representation by means of constraints. Regarding syllable margins, of which onsets are part, the constraints are as follows (Bernhardt & Stemberger, 1998: 214).

Co-occuring (σ – Margin $\rightarrow$ + consonantal)
Co-occuring (σ – Margin $\rightarrow$ -sonorant)
Co-occuring (σ – Margin $\rightarrow$ -continuant)
Co-occuring (σ – Margin $\rightarrow$ C-place)
NotCo-occuring (σ – Margin, V-place)

These constraints articulate a restriction against the occurrence of vowels in the syllable margins. Thus only consonants are may occur in the onset (and the coda). Furthermore, two general constraints are generated: ONS, which stipulates that syllables must have onsets, and NO-CODA, which stipulates that codas are disallowed in syllables. Regarding the onset, the theory first seeks to establish the existence of the onset by way of the rule: σ ►ONSET, which also indicates that the onset is directly dominated by the syllable. The actual existence of the onset is achieved by means of placing a high rank on the rule: σ ►ONSET, to indicate the fact that the onset must be present, since onsets, like codas may be optional in the syllable,[17] as opposed to the nucleus, which is the compulsory element of the syllable. Any consonant in the language may occur in the one position onset. By means of the faithfulness constraints, PARSE and FILL, the onset is parsed onto the phonological unit, syllable, and its phonetic content expressed.

The syllabification of consonants in the onset position is realised by means of the following two constraints: (σ, L, {low-sonority – features},L), and NoSequence$_{onset}$ (Bernhardt & Stemberger, 1998: 228). These constraints stipulate that, in parsing consonants in the onset slot, the least sonorous consonant may occupy the first slot and the more sonorous one may occupy the second slot. This constraint allows the realisation of onsets like the ones mapped out on Table 1(a), as 'the Universal Margin Hierarchy says that less sonorous segments make more harmonic onsets" (Prince & Smolensky, 2002: 152).

As shown in the discussion the English syllable; the maximum segment load of two in the syllable also shows that it can only be optimally bimoraic and not trimoraic. This means that anything that is parsed for the third segment will violate the Hayes principles as presented above. The prosody-morphology is the standard as a source of restriction (Prince & Smolensky, 2002: 49). According to this account a syllable is a foot (FTBIN) and it can only contain at least two moras. Under this assumption it is important to state that the ranking of constraints that specify violations of well-formed-ness in Optimality Theory constitutes the basis for the determination of the syllabic constituents. Under this account any attempt to give a syllable three segments violates the morphological and the phonological features of a syllable.

Conclusion

The paper has shown that segments in the syllable also pattern themselves according to certain constraints which should not be ignored in preference to determining syllable structure on the basis

of gross consonant clusters at word edges. In this way, the syllable distinguishes itself as a phonological unit with its own unique characteristics which operate quite independently of the word, and these must be considered in determining syllable structure. OT provides for constraints that will parse the phonological constituent — onset, by means of the high ranking constraint σ ►ONSET, and through the high ranking constraint FILL, realise it. It is thought that the constraint based theory should also take into consideration other factors such as presented here; the sonority principle and onset maximisation, and factors of cross-linguistic analysis presented in the article to reject the conventional view of the three-times maximality of the syllabic segments.

Notes

1. Sonority may be determined in three different ways. In articulatory terms, it refers to the relative constriction of the vocal tract during the articulation of the sounds. Acoustically, it could be determined on the basis of output energy on certain frequency bands for the sounds, and perceptually, sonority maybe manifested in the relative loudness of speech sounds when they are produced (*cf.* Harris, 1994).

2. /N/ is altogether barred from occurring in the onset position (and for that matter at the beginning of words). Also, this sound only occurs in English in the context of /v/ plus a velar stop: /k/ or /y/. /Z/ occurs very marginally in English words, particularly in word initial contexts. But the sound can occur in the onset position of a syllable, e.g. in 'measure' /με.Zə/.

3. There are several gaps in this picture: e.g. combinations such as the following are prohibited from occurring: /τλ, δλ, ϖλ, ϖρ, Τλ, Δλ, Δρ, ζλ, ζρ, Σλ, Ζλ, Ζρ, ηλ, ηρ, πϖ, βϖ, φϖ, Δφ, Δϖ, ζφ, ζϖ, Ζφ, Ζϖ, Σϖ, Σφ, ηϖ/ . Rarely, the first position in a two-slot onset can be occupied by a nasal, where only two combinations are noted: /μφ, νφ/ as in 'mute' /μφΥτ/ and 'nuclear' /νφΥκλιə/

4. ( ) indicates that the combination is very marginal. Examples: 'turing' /Ντφ‍Υ≡ρΙΝ/, 'gewgaw' /ΝγϕΟ:/, 'Thule' /ΤϕΟ:λ/. Others examples are: 'Beulah' /ΝβϕΟ:λə/, 'dew' /ΝδϕΟ:/

5. /*τλ, *δλ ,*ελ and *Τλ/ share the tip/blade of the tongue, and /*πϖ, *βϖ/ are both articulated with the lips and an additional contact between the tongue and the velum.

6. Possibly in some accents of English. Otherwise pronounced /σΙ\ρΙνδΖ/

7. *s/* combination, not included here, is also possible. For example: 'sphere'

8. The sounds /β,δ,γ/ do not appear for C_2 in Table 1(b) because of voicing assimilation between the coronal fricative /s/ and the next segment. These essentially therefore become indistinguishable from /π,τ,κ/ sounds. This relationship, however, does not appear to have any bearing on the *s*C clusters as onsets.

9. Such rhymes are referred to as super heavy rhymes and occur only under specific conditions (Harris, 1994: 65)

10. It should be mentioned that such forms are very few in number. But their very occurrence is crucial at least for purposes of deciding the status of /s/ in *s*C clusters in syllable constituency.

11. A thickened horny or bony plate on a turtle's shell or on the back of a crocodile, stegosaurus, etc. *The New Oxford Dictionary of English* (Pearsall & Hanks, 2001).

12. From the examples, it appears that the choice of the variants for the articles in the singular form is sensitive to whether the onset of the following syllable in the noun is occupied or not. If it is not, as is the case since the nouns begin with vowels, then the selected forms are those that would occupy the onset position.

13. Portuguese, which is closely related to Spanish, has similar forms as, for instance, *esqueleto* 'skeleton', *esqui* 'sky', *espectra* 'spectra', *espirito* 'spirit', *estuque* 'stucco', *estudante* 'student', *estudo* 'study'. (*Portuguese – English. English – Portuguese Dictionary*, Lamb, 1982).

14. The conventional template for a three-position onset in English is usually represented as follows:

$$C_1 \quad C_2 \quad C_3$$
$$s + \{\pi,\tau,\kappa\} + [\lambda,\omega,\rho,\phi]$$

Tabulated as follows:

Table 2: The phonotactics of three consonant clusters

	πλ	πω	πρ	πφ	τλ	τω'	τρ	τφ	κλ	κω	κρ	κφ
σ	+		+	+	-	-	+	+	-	+	+	+

As is apparent, the distribution of C_2-C_3 consonants in this three consonant cluster is exactly the same one that was observed above in Table 1(a), where the C_2 slot is occupied an obstruent and the C_3 slot by a liquid or glide, observing the sonority principle.

[15] To attempt to prove the existence of this nucleus is beyond the scope of this paper. Evidence for this could be found in, for instance, Harris (1994).

[16] This theoretical account is based on two specific assumptions. First, the following syllabic properties presented by Hayes (1995: 57), are assumed. (a) Constituency: Only constituents such as segment, mora, syllable foot, phonological word may be marked as extrametrical. Syllabic sequences that can be forced out of the constituent are -COD and need not be interpreted as unitary constituents. (b) Peripherality: the left-right edges of a syllabic domain designate its edge and extrametrical status of EDGEMOST — prominences, feet, tones, affixes if they cannot be separated binary. (c) Edge markedness: the right edge is unmarked for extrametricality. Stress will be the only candidate, not tone or affixation. (d) Uniqueness: Only one constituent may be extrametrical. The unparsed sequence will be constituent. The second assumption is that underlyingly the English onset is C and that where CC occurs it dominated by the PRT (persistent rule theory) which bars binarity of CC. This phonotatic feature then allows syllabification of CC onset.

[17] Although onsets may be optional in the structure of the syllable, they are, nevertheless, preferred to codas. Languages do not lack onsets, but they may lack or even disallow codas.

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