A Typology of English Consonant Clusters

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Abstract: This paper concentrates on the classification of English biconsonantal clusters and makes an attempt at giving a principled answer to the question of why specific types of consonant clusters may occur only in a restricted set of phonological positions. Besides the distribution of cluster types, a brief discussion is also devoted to formal configurations that underlie the distributional facts.

Keywords: phonology**,** consonant clusters, onset, coda, bogus

1. Introduction

This paper discusses different approaches to the treatment of consonant clusters and aims at introducing a new typology for English biconsonantal clusters (CCs). The question of triconsonantal clusters (CCCs) will be completely disregarded due to space limitations. Three different approaches to the classification of consonant clusters will be distinguished: (a) the classical generative approach, (b) the standard Government Phonology (GP) approach and (c) the Strict CV approach. The latter framework, in fact, denies the existence of consonant clusters in the traditional sense altogether and different types of consonant clusters can be expressed in terms of syntagmatic structural configurations in this model. Note that clusters of the *sCC* format will also be disregarded in the present paper. The interested reader is invited to consult Kaye (1996), Harris (1994), Csides (2008).

2. Types of classification. The classical generative approach

There are 24 consonant phonemes in English. This means that in principle we can create 24x24 biconsonantal clusters if all logical possibilities are exhausted, and this gives us 576 CC clusters. Yet only a handful of them occur both word-initially and word-finally. The reason why this is so is that phonotactic constraints exist in all languages that severely reduce the distributional capacity of certain consonants in the vicinity of other consonants along the phonological string.

In the standard generative phonology tradition two criteria for defining phonotactic constraints were usually accepted and these constraints are defined on the basis of syllabic constituents (onset, rhyme, nucleus, coda).

The first approach may be referred to as the *substantive approach* in that the inherent properties of the consonants forming a CC cluster are derived from feature matrices. The feature

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constellations in these matrices serve as backdrop against which the relative sonority of consonants is gauged. The general end product of this methodology is a sonority scale which deploys the major classes of speech sounds in general and consonant in particular on a scale which proceeds from the least sonorous segments (voiceless stops) towards the most sonorous ones (vowels) on a continuum. The general observation is that sonority tends to increase from the margins of the syllable towards the centre. In other words, the least sonorous segments are found at the margins of the syllable and the most sonorous ones in the centre.[2] Proceeding from left to right, segments constituting the syllable show an upward sonority slope from the onset towards the nucleus and a downward sonority slope from the nucleus towards the coda. Sonority then is a derivative category, which follows from the constellation of feature values.

According to what is generally referred to as the Sonority Sequencing Generalization (SSG) there are two different types of consonant clusters. Rising sonority clusters generally occur at the beginning of words and syllables, and they are usually referred to as *onset clusters*, where in a #C_1C_2 sequence C_2 is more sonorous than C_1, e.g., ***tr**y*, ***dr**ink*, ***fr**ame*, ***fl**ow*, ***pr**ay*, *be.**tr**ay*, *a.**pr**on*, ***tw**ist* etc.

On the other hand, falling sonority clusters are typically found at the end of words and syllables and they have come to be known as *coda cluster*, where in a C_1C_2# string C_2 is typically less sonorous than C_1, e.g., *be**lt***, *wi**nd***, *bu**rn***, *he**nc**e*, *cu**lt***, ***apt***, *ju**mb**o*, *hi**nd**er*, *a**lt**ar*, *tu**rn**er* etc.

The major problem with this dichotomy is that word-medially both rising and falling sonority clusters are attested. Moreover, not all word-final clusters uniformly display a falling sonority profile, cf., for example, the case of *axe* [ks], [pt], *axe, apt*.[3]

The second approach to the categorization of consonant clusters is based on the distribution of clusters. According to the distributional approach, onset clusters never occur at the end of words. Apparent final onset clusters contain a syllabic consonant, e.g., *apple, circle*. Furthermore, typical (falling sonority) coda clusters are never found word-initially. Word-medially, however, both rising and falling sonority clusters are attested, i.e. the word-medial site enjoys greater distributional freedom than the margins. What is even more interesting is that there are clusters that may occur only word-medially, e.g., *me**dl**ey*, *mo**tl**ey*, *a**thl**ete*, *o**nl**y*, some of them occur as a result of syncope *fa**m**[i]**l**y*. These entities resemble onset clusters in as much as they display a rising sonority profile. Even those clusters that result from syncope almost all display a rising sonority profile and thus formally resemble clusters that occur only word-initially and word-medially.

We may conclude that the simple onset cluster vs. coda cluster dichotomy is untenable.

3. Standard Government Phonology and Consonant Clusters

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[2] Obviously, word initial *sC* and word-final *Cs* and *Ct* clusters upset this pattern but this problem will not be tackled in this paper.

[3] As mentioned above in footnote 1., the discussion of this problem would take us far beyond the scope of the present paper.

In the framework of standard Government Phonology (GP) advocated among others e.g., by Kaye, Lowenstamm and Vergnaud (1990), Charette (1991), Harris (1994), (1997), there are three types of clusters: onset clusters, coda-onset[4] clusters and bogus clusters. The latter type of cluster is in fact a non-cluster: two consecutive onset consonants flanking an empty nucleus, hence the term ‘bogus’. In this theoretical framework there are there are empty categories, especially empty nuclei that are sandwiched between two consecutive onsets. These structural entities are referred to as bogus clusters, and it is a distinctive property of these non-clusters that they can occur only word-medially.

Another distinctive feature of bogus clusters is that there is no phonotactic interaction between the parties of such clusters. Phonotactic interaction is said to exist between the parties of onset clusters and coda-onset clusters: these phonotactic restrictions (interactions) are expressed in terms of elements and segmental complexity instead of the traditional sonority scale For an extensive discussion of phonotactic interactions between the members of onset clusters and coda-onset clusters the reader is invited to consult Harris (1994).

Standard GP goes a step further by recognizing a third type of cluster. Besides onset clusters and coda clusters it distinguishers a third type of cluster whose existence is mainly justified on phonotactic grounds and distributional facts. Bogus clusters occur word-medially but never word-initially or word-finally. Interestingly, the theory fails to notice that there is a formal parallel between onset clusters and bogus clusters in that the latter also display a rising sonority profile. Furthermore, standard GP fails to account for the distribution of different types of clusters using a unitary mechanism.

1. Strict CV phonology

Strict CV-Phonology (Lowenstamm (1996), Ségéral,& Scheer (1999), Scheer (2004), Szigetvári (1999), Csides (2002), (2004), (2008)) takes the findings of standard GP to their logical conclusion. The theory is a radical offspring of standard GP, and it dispenses with syllabic constituents altogether and thus all consonant clusters are viewed as CvC sequences, where the lowercase *v* indicates an empty vocalic position. The difference between traditional light and heavy syllables in the theory of Strict CV-Phonology is given in (1) below.

(1)HEAVY AND LIGHT SYLLABLES IN CV

a. light syllable | b. heavy syllable type I | c. heavy syllable type II

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      C     V           C   V   C   V            C   V   C   V
      |     |           |   |       |        |   |    |
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[4] In fact, coda-onset clusters are roughly the same as coda clusters. This terminological difference will not be treated here.

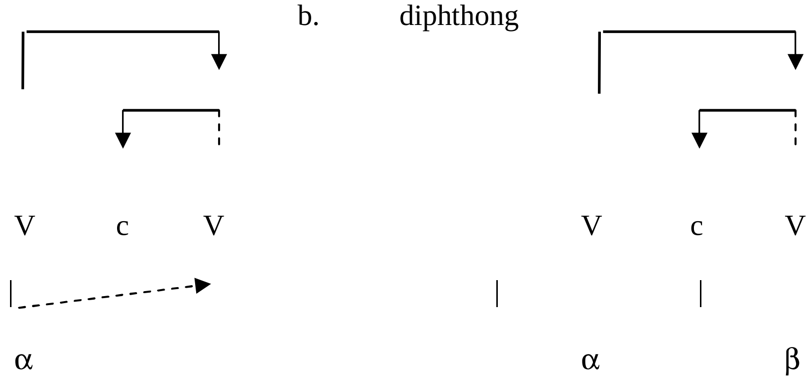
α β α β γ α β γ

While in classical generative Phonology the difference between a heavy syllable and a light syllable could be expressed only by making reference to a disjunction, in strict CV the same distinction can be made by reference to the number of CV pairs the given type contains. A light syllable consists of a single CV pair while a heavy syllable consists of two consecutive CV pairs.

A skeletal position without melody attached to it is an empty skeletal position. There are strict restrictions on the occurrence of empty categories in Strict CV Phonology to be discussed below. It is also worthy of note that in Strict CV a direct parallel can be drawn between a long vowels and diphthongs.

(2) LONG VOWELS, DIPHTHONGS AND BINARY TROCHAIC FEET[5]

a. long vowel b. diphthong



The consonantal position flanked by the vocalic positions is empty in the case of long vowels and diphthongs. As the above representations illustrate, Strict CV Phonology recognises a strictly alternating CVCV skeleton, where empty consonantal and vocalic positions may be represented with lowercase letters for visual exposition.

Notice however, that empty skeletal positions may not randomly be deployed along the phonological skeleton but there are strict constraints on the occurrence of empty categories. It is not difficult to see why we must place stringent restrictions on the use of empty categories. Empty categories should not become an omnipotent, ubiquitous device that the theoretician may freely use whenever the need arises because this would lead to an unfalsifiable and hence uninteresting theory.

4.1. The distribution of empty vocalic positions:

[5] The arrows indicate governing relations: the governor, the governee and the direction of government. The broken line indicates that government proceeds in both directions above the skeleton. Below the skeleton the broken line indicates spreading of melodic material from one skeletal position into another.

Since all CC clusters are CvC strings we have to define the conditions under which these complex categories may appear. Since there is no recourse to an arboreal structure, the deployment of empty categories can only be constrained by syntagmatic structural relations.

Before we make an attempt at defining these lateral structural relationships, we must understand the nature of the phonological skeleton in general and the inherent properties of consonantal and vocalic positions in particular. Szigetvári (1999) proposes the following definitions of vocalicness versus consonantalness.

(3) INTERPRETATION OF C-NESS AND V-NESS IN CV Szigetvári (1999)

Vocalicness is loud: V slots of the skeleton aim at being pronounced.

Consonantalness is mute: if nothing intervenes a C position will remain silent.

It has become a phonological commonplace amongst phonologists that government regulates the interpretation of skeletal positions in the phonological string. Government then counts as an 'intervention' into the default interpretation of relevant skeletal positions. This observation is roughly formulated in the following manner.

(4) THE FUNCTION OF PROPER GOVERNMENT Ségéral and Scheer (1999)

Proper Government inhibits segmental expression of its target.

The term 'proper government' comes from standard GP into strict CV and expresses a unidirectional (right-to-left) governing relation between a contentful governor vocalic position and an empty governee vocalic position. Government is claimed to be a destructive force that ruins the inherent properties of its target. This observation is formulated in the following manner by Szigetvári (1999).

(5) DEFINITION OF GOVERNMENT Szigetvári (1999)

Government spoils the inherent properties of its target. A governed C position loses its inherent muteness, it loses its stricture properties and becomes louder, that is more vowellike, more sonorous, it undergoes vocalic lenition[6]*. A governed V position loses its inherent loudness and becomes silent.*

According to the definition above the phonological skeleton consists of strictly alternating C and V positions whose respective muteness and loudness can be relatively or absolutely ruined by the

[6] The question of governed consonantal positions and lenition phenomena will not be discussed in the present paper.

establishment of syntagmatic governing relations. Note that there is no recourse to an arboreal structure in this theory and there are no syllables or syllabic constituents.

4.2 A typology of English consonant clusters

What is interesting from the point of view of our topic – the distribution of biconsonantal clusters in English – is the status of empty vocalic positions. More precisely the question is whether the silencing of empty vocalic positions tells us anything about the distribution of English biconsonantal clusters. Ségéral & Scheer (1999) and Szigetvári (1999) did not recognise governing relations between two contentful vocalic positions. Csides (2008), however, takes their findings a step further by proposing the algorithm in (6) below.

(6) GOVERNMENT IN PHONOLOGY (CSIDES 2008)

Government directly affecting melodic complexity takes place at the level of the foot. In a trochaic stress system:

a. *The stressed vowel governs the farthest contentful vocalic position to its right within the foot silencing it relatively in the form of vowel reduction and thereby providing it with governing licence.*
b. *The government licensed contentful vocalic position then governs the farthest contentful vocalic position to the opposite direction within the foot.*
c. *This process lasts until all contentful vocalic positions are gathered into the metrical hierarchy.*
d. *If no further contentful vocalic positions are available, government targets empty vocalic positions in either direction keeping them absolutely silent in the form of syncope, or static emptiness.*
e. *If no empty vocalic positions are available, government by the unstressed contentful vocalic position targets empty or contentful consonantal positions by default.*

The theoretical machinery proposed in (6) above opens the way towards giving a principled answer to the question of the distribution of English biconsonantal clusters. Traditional onset clusters will occur in positions where the empty vocalic position sandwiched between the consonantal parties of such clusters is governed by a following vocalic position having melodic content. This is why onset clusters may occur only word-initially and word-medially. Consider the representations in (7) below.

(7) THE DISTRIBUTION OF CC CLUSTERS IN CV-PHONOLOGY (CSIDES 2004, 2008)

(a) Onset clusters

trip

C v C V C v
| | | |
t r I p

metro

C V C v C V C V
| | | | |
m e t r ↔Y

According to the representations in (7) above, the empty vocalic position flanked by the consonants forming an onset cluster must be silenced by government initiated by a following contentful vocalic position. The reason why onset clusters never occur word-finally is that there is no available contentful vocalic position at the end of the word that could serve as a governor of the empty vocalic position inside the cluster.

Turning now to coda clusters, we may conclude that this type of cluster may occur only within a V-toV or V-to-v governing domain and the empty vocalic position occurring inside this cluster need not be silenced by government because of the strong phonotactic dependencies holding between the members of this cluster. This strong phonotactic interaction, whose exact details will not be discussed in the present paper, is formally represented by square brackets. The reason why coda clusters may not occur word-initially is that this type of structural configuration may not fall within a V-to-V or V-to-v governing domain in this position. Consider now the representations in (7b) below.

(b) Coda clusters

. *mint*

C V [C v C] v
| | | |
m I [n t]

. *jumper*

C V [C v C] V
| | | | |
dZ ℘ [m p] ↔

Turning finally to bogus clusters, we can immediately see the reason why bogus clusters are unable to occur at the margins of the word. Consider the representation in (7c) below.

(c) Bogus clusters

butler

bakery

C V C v C V   C V c V C v C V | |
| | | | | | | | b ℘ t
l ↔ b eI k r i

By examining the representations in (7c) above, it becomes obvious that there are two separate conditions on the occurrence of bogus clusters. One the one hand, they must occur within a V-to-V or V-to-v governing domain, and therefore they cannot occur word-initially. On the other hand, the empty vocalic position sandwiched between the consonants must be governed by a following contentful vocalic position, and as a result bogus clusters cannot occur word-finally. These two conditions together ensure that bogus clusters are restricted to the word-medial position. In this sense bogus clusters are the most marked entities of all types of clusters.

5. Summary

There are at least three different types of biconsonant clusters in English and their distribution is regulated by a very simple algorithm proposed in (6) above. Onset clusters occur word-initially and word-medially because they must be followed by a contentful vocalic position, which can govern and hence silence the empty vocalic position inside the cluster. Coda clusters are found word-medially and word-finally since these are the positions in which they can occur within a V-to-V governing domain (word-medially) or V-to-v governing domain (word-finally). Note that in Strict CV-Phonology all words end in a vocalic position. Even consonant final words end in an empty vocalic position.

And finally, there are two requirements on the occurrence of bogus clusters. First, they must occur inside a governing domain like coda clusters and hence they never occur word-initially. Second, the empty vocalic position inside a bogus cluster must be governed and hence silenced by a following contentful vocalic position. This latter is the reason why they never occur word-finally. These two conditions together ensure that bogus cluster will appear only word-medially and even in that position never before a consonant.

The final conclusion is that there are at least three different types of biconsonantal clusters in English whose distribution is regulated by a single algorithm of governing relations proposed in (6) above.

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