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Abstract: This paper deals with English vowel reduction and focuses on what is generally referred to as the Arab Rule (Ross 1972 i.a.). Vowels tend to reduce if the preceding syllable is light, whereas they do not reduce if the preceding syllable is heavy. Our purpose is twofold: first, based on the scrutiny of Wells (2008), we evaluate the efficiency of the Arab Rule and show that is empirically verified. Second, we propose an analysis of blocking contexts couched within CVCV phonology (Lowenstamm 1996). We use two central notions such as Government and Licensing, and show that vowel reduction only applies to "governing-and-governable" vowels.

Keywords: English vowel reduction; Arab Rule; Strict CV; Element Theory; stress

1. Introduction

Since SPE, there is broad consensus about the claim that, in English, unstressed vowels tend to reduce. Although it is a strong tendency, vowel reduction is not systematic in unstressed syllables: it is indeed blocked in some contexts. In this paper, we focus on the so-called "Arab Rule", which accounts for the two American idiolectal pronunciations of the word *Arab* ([ærəb] vs. [eɪræb]). Contrary to classic approaches assuming that English words project prosodic units, namely syllables and feet, we propose an analysis of Arab rule couched within Strict CV Phonology. Our purpose is twofold: (a) to evaluate the efficiency of the Arab Rule; and (b) to propose an analysis without metrics consisting in the unification of English blocking contexts. After a brief introduction to the facts (section 2.1), we show the

results of our careful corpus-based study: we conclude that the existence of the Arab rule is empirically verified. Section 3 is devoted to highlighting the main lines of Strict CV Phonology with special attention to the "weak" vs. "strong" distinction without the prosodic hierarchy. This proves crucial in defining our analysis, which we lay out in section 4.

2. Vowel reduction in English and the Arab Rule

2.1. In the literature

In English, many unstressed vowels reduce to schwa, as shown by the examples in (1).[1]

(1) a. *atom* [ˈ**æ**təm] vs. *atomic* [**ə**ˈtɒmɪk]
b. *fatal* [ˈf**eɪ**təl] vs. *fatality* [f**ə**ˈtælɪti]
c. *province* [ˈpr**ɒ**vɪns] vs. *provincial* [pr**ə**ˈvɪnʃəl]

In these examples, it can be seen that the quality of the first vowel is different when it is stressed (first column) and when it is not (second column). Following Wells (2008), we also treat cases such as (2) as reduced.[2]

(2) a. *fiesta* [f**i**ˈestə]
b. *tuition* [tj**u**ˈɪʃən]
c. *eponymous* [**ɪ**ˈpɒnɪməs] (cf. *eponym* [ˈepənɪm])

However, vowel reduction is not systematic in unstressed syllables and has been claimed to depend on a number of factors. It has been claimed that vowels in open syllables are more likely to reduce than vowels in closed syllables (Burzio 1994, 113; Fudge 1984; Halle & Keyser 1971), but vowels in syllables closed by obstruents are less likely to reduce than vowels closed by sonorants (Pater 2000). Also, vowels in syllables closed by non-coronals are less likely to reduce than vowels closed by coronals (Burzio 1994; Dahak 2011; Fudge 1984; Ross 1972). It has also been claimed that vowels in a syllable closed by a non-coronal obstruent and preceded by a heavy syllable

[1] The transcriptions given in this paper are taken from Wells (2008).

[2] We take reduced vowels (/ə/, /i/, /ɪ/, /ʊ/ or /u/) to be defined as in Cruttenden (2014, 158): "these are the short vowels with a central or centralised quality (apart from final /i/) and are the least prominent syllables".

should not reduce (e.g., *Àl*[ə]*xánder* vs. *Tìmb*[ʌ]*któo*; see the discussion on the Arab Rule below). It has been noted that initial pretonic closed syllables normally do not reduce except if that syllable is a prefix (Chomsky & Halle 1968: 118; Guierre 1979, 253; Liberman & Prince 1977; Pater 2000; Selkirk 1980). Spelling effects have been observed: vowels spelled with a digraph reduce less than monographs, especially in the initial pretonic position (Dahak 2011; Deschamps et al. 2004, 217; e.g., ***au****gment* [ɔːgˈment] vs. *p****a****rental* [pəˈrentəl]). More frequent words show more reduction than less frequent words (Fidelholtz 1975) and, finally, the existence of a morphological base in which the vowel is stressed can diminish its chances to reduce (Chomsky & Halle 1968, 112, e.g., *reláx* → *rèlaxátion, expréss* → *èxpressívity*), even more so if that base is more frequent than the derivative (Bermúdez-Otero 2012: 32, after Kraska-Szlenk 2007, §8.1.2).

All of these factors probably interact and a lot of empirical work is still required to evaluate the relative importance of each of them and how they interact. In this paper, we are interested in one particular interaction between two parameters which has been observed in the case of what is often called the Arab Rule (Fidelholtz 1966; Hayes 1982; Pater 1995; 2000; Ross 1972), with reference to the two idiolectal pronunciations of the word *Arab*, [ˈærəb] and [ˈeɪræb], which illustrate this rule. As mentioned previously, it has been claimed that vowels found in syllables closed by non-coronal obstruents should reduce less than vowels found in syllables closed by coronal obstruents. However, if the preceding syllable is stressed and light, the vowel should reduce, regardless of the place of articulation of the coda consonant.

Beside Fidelholtz (1966) and Ross's (1972) rule-based analyses, more recently, the only formal analysis of the Arab Rule which we are aware of is that of Pater (2000). Pater's analysis is developed in Optimality Theory (Prince & Smolensky 1993) and Prosodic Phonology (Selkirk 1980 and related work). Crucially, it makes use of well-formedness requirements on feet, which should be bimoraic trochees. In this analysis, [ˈærəb] would be parsed as a single foot and [ˈeɪræb] as two feet.

2.2. Empirical evaluation

In order to study the Arab Rule, all the words with the following properties were collected from Wells (2008): disyllabic, main stress on the first syllable, one single non-coronal coda in the second syllable and no identifiable morphological structure. Only British pronunciations were consid-

ered.[3] Then, we coded whether the first syllable was heavy or light (assuming that only words with C_0VCVC have a light first syllable). Four words for which the weight of the first syllable varies have been left out (e.g., *rebec* ['ri:bek] ~ ['rebek]). The final dataset contains 202 words (e.g., *Derek, Murdoch, stomach, Joseph, Barack, scallop*). In order to control for potential frequency effects, token frequencies were collected from SUBTLEX-UK (van Heuven et al. 2014) and log-transformed so as to resemble the way "humans process frequency information" (Hay & Baayen 2002). Following Hammond (2003), vowel reduction in the second syllable was coded as a four-point scale: when the dictionary only shows a full pronunciation with no variant, it was coded as 0, when it shows a full pronunciation and a reduced variant,[4] it was coded as 1, when it shows a reduced pronunciation and a full variant, it was coded as 2 and when it shows only a reduced pronunciation, it was coded as 3.

An ordinal logistic regression analysis was performed and a significant correlation was found between vowel reduction in the second syllable and both the weight of the first syllable ($p < .01$) and log-frequency ($p < .01$). There are more words with a reduced second vowel if the first syllable is light than when it is heavy, as predicted by the Arab Rule (Figure 1).

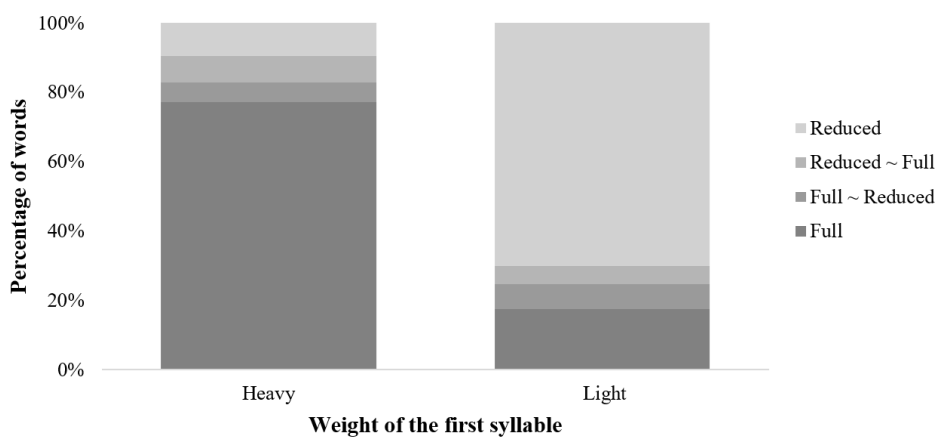


Figure 1: Weight of the first syllable and vowel reduction in the second syllable

[3] As noted by one of the reviewers, the Arab Rule has been so far described for American English only so one might wonder whether it should be expected in British English too. Foot-based analyses suppose that both varieties of English have moraic trochees so, according to these analyses, the Arab Rule should be expected in both varieties of English as it is seen as a consequence of foot well-formedness conditions.

[4] Reduction was defined as in §2,1.

The relationship between frequency and vowel reduction also goes in the expected direction: more frequent words are more likely to have a reduced second vowel than less frequent words, as shown in Figure 2.

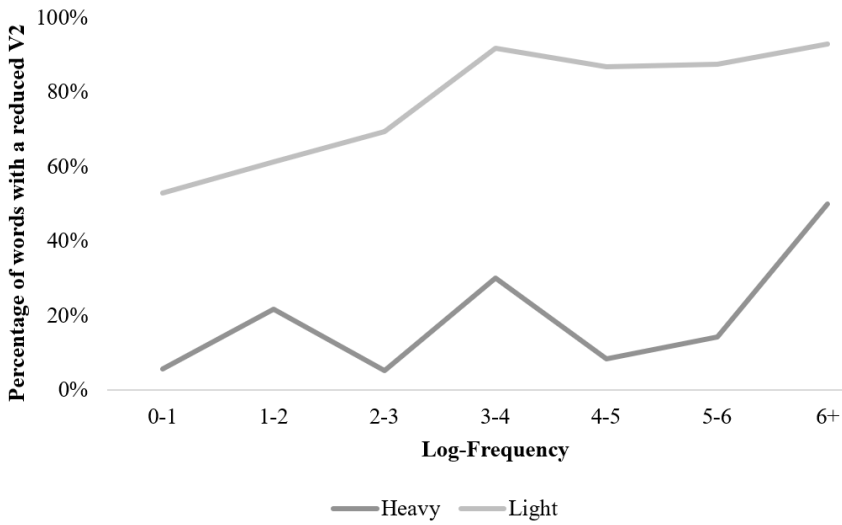


Figure 2: Vowel reduction of the second syllable, log-frequency and weight of the first syllable[5]

Therefore, the existence of the Arab Rule is empirically verified. We have also found that frequency interacts with the Arab Rule. Although the frequency effect goes in the expected direction, its interaction with the Arab Rule had never been measured before.

3. Lateral relations

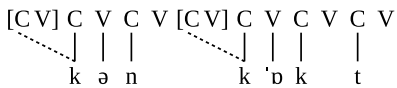
3.1. "Weak" and "strong" without dependency

In Strict CV Phonology (Lowenstamm 1996), stress is not represented by a dependency between a strong and a weak position. Instead, it is materialized by an empty CV slot at the periphery of the syllable surfacing as stressed (Larsen 1994; 1995; Scheer 2000). Provided that the left edge

[5] To make the representation more convenient, only the main pronunciation was taken into consideration for the computation of the percentage of vowel reduction per frequency group.

of the word is also represented by an empty CV (Lowenstamm 1999), the model predicts identical realizations in stressed and initial positions. As a concrete example, English obstruents are aspirated in both initial position (irrespective of stress) and pretonic position (3).[6]

(3) 'concoct' [kʰənˈkʰɒkt]



In order to derive complex syllables, Strict CV Phonology uses the lateral relations of Kaye et al. (1990): Government and Licensing. These relations determine the realization of skeletal positions according to the three fundamental principles in (4).

(4) a. Governing or licensing nuclei are necessarily ungoverned
b. Non-final empty nuclei are necessarily governed
c. Long vowels are necessarily licensed (Kaye 1990)

Since empty nuclei are necessarily governed, Harris (1990) suggests that Government has an inhibitory effect on the segmental content of segments whereas licensing has a strengthening effect. Based on this idea, Coda Mirror Theory (Ségéral & Scheer 2001b) proposes the following derivation of consonant lenition: ungoverned consonants are not inhibited (5a), and governed consonants are inhibited (5b).[7]

(5) a. 'buster' b. 'butter'

Provided that Government has an inhibitory effect, Harris (1990) shows that vowel reduction can be represented with lateral relations. In the two following subsections, we look at the contexts where the inhibition of vowels is expected and where it is not.

[6] Concerning the preservation of an ungoverned empty nucleus before the stress CV, Enguehard (2016a;b) argues that this sort of nuclei behave like Final Empty Nuclei in several languages: they do not need to be governed.

[7] American English flapping is a typical surface manifestation of inhibited onsets.

3.2. Governing and non-governing vowels

Vowels preceded by an empty nucleus are forced to govern. We call them "governing vowels". The inhibition of governing vowels is limited because these cannot be governed. Inversely, vowels preceded by a non-empty nucleus do not need to govern, and thus they can be governed. We call these vowels "non-governing vowels".

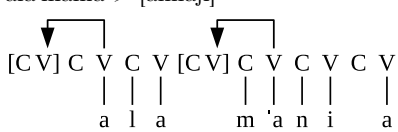
The contrast between governing and non-governing vowels with respect to vowel reduction is illustrated by the evolution of Old French in Scheer (2000). This evolution shows that only stressed vowels (6a) and unstressed vowels in initial syllables (6b) avoid vowel reduction (i.e., reduction to schwa or zero depending on dialects).

(6)

	Latin	French	Gloss
a.	ala'm**a**nia	[al'm**a**ɲ]	'Germany'
	libe'r**a**re	[li'vʁ**e**]	'deliver'
	sil'v**a**ticus	[so'v**a**ʒ]	'wild'
b.	m**a**'ritus	[m**a**'ʁi]	'husband'
	v**a**'lere	[v**a**'lwaʁ]	'worth'
	l**a**'vare	[l**a**'ve]	'wash'

As mentioned in the previous subsection, both the stress and the left edge of the word are represented by an empty CV. Assuming that the stress CV is located on the left of the stressed syllable, Scheer (2000) proposes to unify the two blocking contexts with the following generalization: governing vowels can avoid reduction, as shown in (7).

(7) ala'mania > [almaɲ]



3.3. Governable and ungovernable vowels

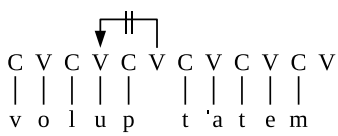
Vowels followed by a governed nucleus cannot be governed. Consequently, the inhibition of these "ungovernable" nuclei is limited, that is they tend not to reduce nor disappear. Inversely, vowels followed by an ungoverned nucleus can be governed. Thus, the inhibition of these "governable" vowels is free.

The contrast between ungovernable and governable vowels with respect to vowel reduction can be illustrated by additional exceptions to Old French vowel reduction. Although unstressed vowels are supposed to be reduced in non-initial syllables (8a), Jacobs (1989) mentions that some of them avoid vowel reduction when they occur in a closed syllable (8b).

(8)		Latin	French	Gloss
	a.	civ**i**ˈtatem	[siˈte]	‘city’
		bon**i**ˈtatem	[bɔ̃ˈte]	‘kindness’
		comp**u**ˈtare	[kɔ̃ˈte]	‘count’
	b.	pap**i**lˈionem	[pav**i**ˈjɔ̃]	‘pavilion’
		tab**e**rˈnarium	[tav**ɛ**ʁˈɲe]	‘innkeeper’
		vol**u**pˈtatem	[vol**y**pˈte]	‘lust’

In Strict CV Phonology, vowels in closed syllables are generally ungovernable (except word-finally because the final empty nucleus is ungoverned). Hence the following generalization, illustrated in (9): ungovernable vowels avoid vowel reduction.

(9) volupˈtatem > [volypte]



This categorical representation of vowel reduction does not mean that this model is unable to account for the variation effects introduced in Section 2. Theoretically, a governing and/or ungovernable vowel can also be reduced as long as this reduction does not lead to zero. However, such a reduction in a non-inhibited context is less likely to occur. In this sense, we say that it is limited.

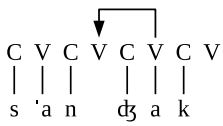
4. Analysis

4.1. Left context

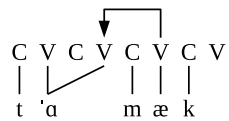
In Section 2, we mentioned that the blocking of vowel reduction described by the Arab Rule occurs after a heavy syllable. The case of CVC and CVV syllables is simple. If a vowel is preceded by a closed syllable, it must govern the empty nucleus on its left (10a). If it is preceded by a syllable

ending with a long vowel, it must license the long vowel on its left (10b).[8] In both cases, the vowel following a heavy syllable needs to be a potential governor and its inhibition is limited.[9]

(10) a. 'sanjak'

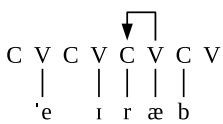


b. 'tarmac'

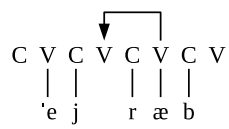


The case of heavy syllables ending with a diphthong is more complex because diphthongs can be represented with two consecutive nuclei or with a nucleus followed by a glide. In the first case, diphthongs do not need to be governed or licensed (11a). In the second case, they need to be governed in the same manner as closed syllables (11b). We adopt the second option.

(11) a. /'eɪræb/ 'Arab'



b. /'ejræb/ 'Arab'



Although English diphthongs are commonly represented with two nuclei (Harris 1994; Hammond 1999), Szigetvári (2016) argues that these behave like closed syllables. First, diphthongs followed by a final sonorant (except /n/ and /ŋ/) can trigger the insertion of an epenthetic vowel (e.g., [faj(ə)l] 'file'), in the same way as coda sonorants (e.g., [fil(ə)m] 'film'). Second, in some varieties of English, /t/ is flapped in intervocalic position but not after a consonant or a diphthong/long vowel (Bye & de Lacy 2008). If diphthongs end with a glide, each heavy syllable involved in the Arab Rule needs to be taken in charge by the following vowel through Government or Licensing (see (10a–b), (11b)). As a consequence, we expect the inhibition of the governing vowel to be limited. To complete our discussion, we should mention two additional phenomena: (i) most varieties of English show a flapping of /t/ after diphthongs, and (ii) diphthongs can also be realized as long vowels in some English dialects. These phenomena do not contradict the representation we have adopted: coda glides can spread to a licensed nucleus, or they can fall and trigger the lengthening of the preceding vowel.

[8] In the last example, the arrow represents Licensing.

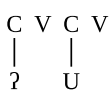
[9] Following Cyran (2010, 98), we assume that unreduced vowels are better governors/licensers than reduced vowels like schwa.

4.2. Right context

Unstressed vowels preceded by a heavy syllable avoid vowel reduction only if they occur in a syllable closed by a non-coronal consonant. We propose that non-coronal consonants are more complex than coronal consonants. Some varieties of English show a free alternation between [t] and [ʔ] in some positions of the word, but not between [p], [k] and [ʔ] (Brulard & Carr 2015 253-254; Ward 1929, §250e; Wells 1982, 410). Most variants of Element Theory (Kaye et al. 1985) assume that [ʔ] is the realization of a primitive element |ʔ| which can combine with other elements (e.g., |ʔU| = [p], |ʔU| = [k]). In an approach with privative features, there is no reason to add a place element to |ʔ| in order to distinguish it from [p] and [k]. Thus English [t] can be the realization of a single |ʔ| with coronality as a default feature. In case of flapping, |ʔ| drops and only the coronal feature introduced by a redundancy rule is maintained.

In the past decades, a significant amount of studies have argued that "vertical" complexity (i.e., the amount of features) and "horizontal" complexity (i.e., the amount of positions) can be interrelated (Lowenstamm 1991; Ségéral & Scheer 2001a; Luo & Enguehard 2019, among others). Accordingly, we propose a representation where the complexity of non-coronal consonants is manifested by bipositionality (12).[10]

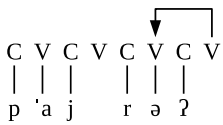
(12)



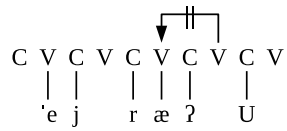
This representation accounts for the contrast between coronal and non-coronal consonants in the context of the Arab Rule. In (13a), the final empty nucleus is able to govern the unstressed vowel because it is ungoverned. But in (13b), the unstressed vowel is ungovernable because it is followed by a governed nucleus.

[10] This approach can be compared to GP 2.0 (Pöchtrager 2006), in which less sonorous consonants are represented with a more complex structure than more sonorous consonants. However, in contrast to Pöchtrager (2006), the core of our analysis is based on the presence of an empty nucleus between two consonantal positions. For this reason, our representation is closer to the concept of virtual gemination in Strict CV Phonology (Ségéral & Scheer 2001a) than to the expressive structure defended in GP 2.0.

(13) a. 'pirate'



b. 'Arab'



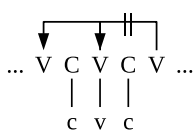
One could ask how we can account for final consonant clusters like in [bʌlb] 'bulb' if the nucleus between |ʔ| and |U| cannot govern. We assume that |U| can spread onto the embedded nucleus when it is absolutely necessary for it to govern the empty nucleus on its left. When it is not necessary (like in 13b), |U| may remain inactive.

In sum, the blocking of vowel reduction only applies to "governing-and-ungovernable" vowels. Provided that the inhibition of both governing and ungoverned vowels is limited, we expect them to escape reduction more frequently than other unstressed vowels.

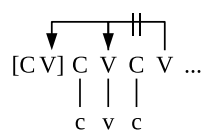
4.3. Prediction

As in former descriptions of the Arab Rule, governing and ungovernable vowels are typically found in a closed syllable preceded by a heavy syllable (14a). However, this is not the only context where the same configuration of lateral relations is expected. Provided that the left edge of the word is represented by an empty CV, vowels occurring in a closed first syllable are also governing and ungovernable (14b). Accordingly, we expect them not to be reduced.

(14) a. Post-coda closed syllable



b. Initial closed syllable



As discussed in §2.1, it is a widely shared observation that initial pretonic closed syllables normally do not reduce (with the exception of semantically opaque prefixes). The present analysis independently predicts this observation. However, this observation still has to be empirically verified. We leave this to future research.

5. Conclusion

In this paper, we showed that the derivation of vowel reduction using lateral relations does not only account for the Arab Rule, but it also predicts other exceptional patterns. We proposed the unification of two different contexts where the blocking of vowel reduction applies. This unification lies in a simple generalization, i.e., governing and ungovernable vowels cannot be reduced because their inhibition is blocked by lateral relations. As the reader can see, this generalization does not result from metrical notions. Nevertheless, we do not claim that metrical structure is useless. Rather, we claim that the absence of metrical structure in a model like Strict CV Phonology can prove useful because it enforces the unification of unrelated phenomena into abstract configurations.

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