An Alternative Representation of Schwa in English

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Abstract

The main objective of this paper is to investigate the behaviour and the element structure of the English reduced vowel schwa from the perspective of Element Theory. It will be postulated that although [ə] and [ʌ] have two dissimilar phonetic identities, phonologically they share one representation, i.e. [ʌ] is a stronger version of [ə] and the former surfaces phonetically only when the latter is too weak to appear before or after some clusters, or in words with secondary stress. Therefore, the element structure of [ə] should be considered as identical to that of [ʌ].

Keywords: *English schwa, Element Theory, Government Phonology, English wedge*

1. Introduction

The aim of this article is to demonstrate that two English vowels, namely [ə] and [ʌ] behave phonologically in a similar manner and one can be easily replaced in certain environments by the other, with no ambiguity whatsoever, especially when unstressed and in affixes. Therefore, when it comes to their melodic representation, it will be claimed that they both share one element representation and the way to differentiate between them is to specify either the stressed or unstressed positions they may or may not appear in. The paper is organised in the following way: in section 2 I introduce some basic assumptions of Element Theory, which is part of Government Phonology (GP henceforth). Sections 3 and 4 consist of two well-established element analyses of the English vocalic system, one proposed by Harris (1994) and the other described by Backley (2009, 2011). In section 5 I introduce a new element analysis of the two vowels in question and I provide some arguments for my proposal.

2. Element Theory – its tools and application

Element Theory (henceforth ET) has its roots in Government Phonology (Kaye, Lowenstamm and Vergnaud 1985, 1990). ET aims at demonstrating that phonological expressions are comprised of elements which are the smallest and privative units of subsegmental representation and which can be pronounced in isolation. The table in (1) below (reproduced after Cyran 2010) enlists eight elements (employed in both vowel and consonant description) along with their acoustic patterns and articulatory execution:

(1)

	Acoustic pattern	Articulatory execution
A	*Mass*: central spectral energy mass (convergence of F1 and F2)	Maximal expansion of oral tube; maximal constriction of pharyngeal tube
I	*Dip*: low F1 coupled with high spectral peak (convergence of F2 and F3)	Maximal constriction of oral tube; maximal expansion of pharyngeal tube
U	*Rump*: low spectra peak (convergence of F1 and F2)	Trade-off between expansion of oral and pharyngeal tubes
ʔ	*Edge*: abrupt and sustained drop in overall amplitude	Occlusion in oral cavity
h	*Noise*: aperiodic energy	Narrowed stricture producing turbulent airflow
N	*Nasal*: low frequency of first resonance	Lowered velum; air flow through the nasal passage
H	*High tone*: raised pitch on vowels; VOT lag (aspiration) in obstruents	Stiff vocal cords
L	*Low tone*: lowered pitch on vowels; VOT lead (full voicing) in obstruents	Slack vocal cords

In Standard GP assumptions it is commonly believed that the interpretations of elements should be universal for all languages. In the next subsection we are going to focus on the types of expressions employed by ET.

2.1. Simplex vs. complex expressions

Segments within the GP framework can be twofold: either they are simplex expressions, which means that they have only one element ascribed, or they are complex, which is synonymous to two or more elements being fused to create a representation of a particular segment. In simplex or complex expressions one of the elements (or the sole element when it comes to simplex phonological expressions) can be the head, while the other one plays the role of an operator (there may be more than one operator within an expression), or the whole expression may be headless, which refers to having two equal operators within this phonological entity. There cannot be, however, a situation in which there are two or more heads within one expression – this is the fundamental assumption of the standard version of ET (cf. Kaye 2001 for details).

Element Theory distinguishes three elements, these being {A U I}, which may be employed in both vowel and consonant description. There are also some additional elements which ET employs, but since only these three are used in vowel representation (in consonants they describe the place of articulation), we are not going to go into further detail. These primes may be mixed together in order to build other segments save for three corner vowels, which are described exactly as the three elements {A U I}. Thus, if we aim at describing a typical [e], all we need to do is compose two elements {I} and {A} which fuse into {I A}. Exactly the same pattern may be applied to a characteristic [o], which consists of {U} and {A} fusing into {U A}. These are possible segmental representations of vowels. However, there is also a very specific tool – the so-called headedness, which makes segments even more contrastive (this, of course, depends on their acoustic features). Its application is explained in the next subsection.

2.2. Headedness and its application

A tool which deserves special attention is headedness. This is a mechanism which refers to a situation in which one element within an expression is more prominent or, in other words, it contributes more to the perception of an expression. If, for instance, a system shares two front mid sounds, namely [ɛ] and [e], they have to be told apart elementally. It should be borne in mind that since these are two different sounds, it is impossible to employ exactly the same element description for both of them, e.g. simply {A I}, because then we would never be able to differentiate one from the other. Therefore, by heading e.g. {I} in {A I}, a tense [e] is received, while by applying headedness to {A} in {A I}, a lax [ɛ] sound is described (a whole expression can also be headless, i.e. {A I} – as a matter of fact, this fully depends on a given sound system). Thus, in this respect headedness means distinguishing between three sounds (represented as either {A I}, {A I}, or {A I}) which share some similar qualities but are phonetically and phonologically distinctive, i.e. the distinction between tense/lax vowels. This is, of course, language-specific.

2.3. Permutations of elements and constraining system

As stated by Kaye (2001), twenty divergent permutations of elements are available to be used, both headed and headless, which allow us to characterise the most complex system in any language. These are depicted in (2):

(2)

Headed			**Headless**	
{I}	{A I}	{A I U}	{A}	{A I U}
{U}	{A U}	{A U I}	{I}	{_}
{A}	{I A}	{I U A}	{U}	
	{I U}		{A I}	
	{U A}		{A U}	
	{U I}		{I U}	

However, there is also a universal tool which restricts such combinatorial possibilities of the elements – this is called Licensing Constraints (LC). Due to the fact that it is almost impossible to use all twenty potential descriptions of vowels in any language, licensing constraints are there to exclude unnecessary expressions which do not fit a particular language. One sound can be described in a few diverse ways by means of the elements, although the choice and argumentation for the chosen representation lie in the quality of a particular sound. That is to say, if a given sound system consists of tense vowels (e.g. English), then headedness should be used to portray this feature and, thus, all headless representations can account for lax vowels.

3. Harris' proposal (1994)

Harris' analysis of the whole system of English vowels dates back to 1994 and is, most probably, the first piece of profound research of such a type carried out in the framework of Element Theory. Since the aim of this paper is to focus only on two vowels, i.e. [ə] and [ʌ], we are going to omit element descriptions of the remaining English vowels. The element representations of [ə] and [ʌ] (Harris 1994: 114-117) are provided in (3):

(3) [ə]{@}
[ʌ]{@}

According to Harris, {@} stands for a neutral position of the vocal tract (Harris 1994: 108). He also points out that "most researchers within the A-I-U tradition accord this neutral quality some special status, either by treating it as a segment devoid of any active elementary content or by taking it to be the independent manifestation of a fourth element" (Harris 1994: 109).

We can infer from the above descriptions in (3) that [ə] and [ʌ] are elementally the same, i.e. {@} and, in Harris' approach, the only way we can differentiate between them is by the accented or unaccented position they occur in within words. However, even before analysing the stressed and unstressed environments, let us first examine the nature of the element {@} and headedness.

As far as the neutral element used by Harris is concerned, the first thing that should be mentioned is that in theoretical/phonological frameworks such as Government Phonology or Dependency Phonology (Anderson and Ewen 2009) this {@} element is treated as an expression deficient in any active content and remaining headless, it is a recessive realisation of some other melody-filled expressions (e.g. when full vowels are reduced to [ə], [ɪ], and [ʊ]). In reduction processes full vowels are decomposed into schwa-like vowels causing at the same time a loss of phonological information. Harris (1994: 109) metaphorically calls {@} a blank canvas to which different colours {A I U} are added, creating at the same time a broader spectrum of tints providing some acoustic signal and making the expression fully audible and phonologically relevant. He assumes that {@} is a kind of a baseline on which other elements can be superimposed. All schwa-like vowels have the neutral element, even [ʌ], which appears in strong positions. Harris (1994: 110) claims that "other centralized categories that are potentially distinct from this baseline can then be thought of as displaced versions of a neutral quality, expressed as the fusion of {@} with some other element."

When it comes to headedness, Harris (1994: 111) assumes that {@} may be a fully autonomous and phonetically significant element when it plays the role of the head of an expression. In other cases, i.e. when it is a dependent, it is phonetically inaudible, thus carrying no phonological or phonetic information. Therefore, if the element structure is an unheaded {@}, then we hear nothing and this is exactly the case in Harris' proposal of [ɜː], which is beyond the scope of this article. However it needs to be mentioned in order to show the discrepancies between the complexity of these two sounds. Harris' long schwa is simply {@} linked to two nuclear slots (Harris 1994: 297). The problem is, however, that the long schwa is perfectly audible. Additionally, unlike [ə], it may occur in accented positions. So, a headed version of {@} is a very strange entity, because it gives the impression that a reduced

vowel (schwa) is structurally richer than a full vowel (long schwa) and it should be the other way round, because [ɜː], unlike [ə], can occur in both stressed and unstressed environments, i.e. *expert*, *universe* (Cruttenden 2008: 147).

Harris also makes one prediction which is thought provoking. If {@} is treated as the fourth element (collaterally with {A I U}), then it may be the head as well as a dependent within an expression. Logically, this makes sense to some extent because all the three remaining elements also have such competence: they can be either a head or a complement of this head. Phonetically, this is irrelevant because {@}, standing alone in Harris' approach, i.e. headless, is either silent (as in final empty nuclei) or it makes a small contribution to the making of other sounds. What Harris says is that only when headed is it significant and meaningful. Such a claim, as already mentioned, poses a problem if we consider his element representation of the long schwa, which is simply {@}. Besides, he proposes that the headed {@} is a reduced vowel and this holds true for [ə] but not necessarily for its short stressed equivalent [ʌ], since this vowel may appear in both stressed and non-stressed contexts. And here a real obstacle appears, because in words such as *subjectivity*, there is an unstressed [ʌ] in the first syllable and it cannot be replaced by [ə] – so here the structural description causes nothing but ambiguity. Phonologically, it is applicable only when {@} is a head (its headless version implies silence), because then it carries some information and makes the expression audible. Another important question which is open to discussion is the understanding of the application of headedness in an element which is phonologically inactive. Consequently, whether {@} is headed or not, it does not contribute to the making of a sound to a large extent[1], except for centralising or neutralising corner articulations.

Additionally, a basic view of ET assumes (Kaye, Lowenstamm and Vergnaud 1985) that every element {A I U} has a separate tier (of course they can fuse together in order to create more complex sounds), and only {@} does not have one but, instead, it is tied to the {A I U} segmental lines. Maybe, if it can be either headed or non-headed as with the other three elements, and if it is treated as the fourth element, it should also be represented independently on a segmental line. This is a theoretical question which requires more in-depth studies.

4. Backley's analysis (2009, 2011)

Backley's description of the English vocalic system differs considerably from the one proposed by Harris. As in the earlier section, we are going to consider only the two vowels in question. Let us then see Backley's element descriptions,[2] which are presented in (4) below:

(4) [ə]{A}
[ʌ]{A}

What can be inferred from the above representations is that Backley makes a clear-cut distinction between the always unstressed schwa and its stressed equivalent. What he proposes

[1] The extent is of course always debatable.

[2] In Backley's analysis the vowel [æ] contains the elements {A I}.

is heading the element {A} in [ʌ], which in his description is {A}, and leaving [ə] headless, i.e. {A}, in order to account for its reduction ability. Therefore, in reduction processes full vowels, which in his analysis are all headed (except for the long schwa), are deprived of headedness. Backley proposes that the schwa vowel and two short full vowels [ɪ] and [ʊ] are headless when reduced. Reduction in Backley's (2009: 62) approach means "the loss of structural material from a segment representation". In the case of unstressed vowels it is simply depriving them of headedness.

Backley's proposal seems to be very logical, especially if we want to neatly account for the reduction ability of certain sounds. On the other hand, if it is either the stressed or unstressed environment which makes [ə] and [ʌ] different and they are claimed to be phonologically identical, why should they have distinct element descriptions? It may not be necessary if [ʌ] really is a stronger version of [ə] and it appears whenever [ə] is too weak.

5. An alternative proposal

In this section I would like to propose a different element representation of English [ʌ] and [ə]. Let us first consider the element descriptions of these two vowels, which may be found in (5)[3]:

(5) [ə]{_}
[ʌ]{_}

In (5) we can see that [ʌ] and [ə] are expressed in the same manner, i.e. they are both headless, with no active vocalic elements ascribed. This looks as if there is neither a segmental nor a prosodic difference between them. However, such an assumption would be fallacious. They both, as already mentioned, share different stress assignments, i.e. schwa is never stressed, but wedge, on the other hand, freely appears in stressed, unstressed or secondarily stressed syllables as in *sulphuric* or *subglacial*.[4]

If a wedge is the stressed opposite of a schwa, these two should not appear within the same context. However, there are a few words which suggest that this is not always true. Relevant examples (based on Cruttenden 2001: 147) are provided in (6):

(6) s<u>u</u>lphuric [sʌlˈfjʊərɪk]
s<u>u</u>bjectivity [ˌsʌbdʒəkˈtɪvəti][5]
prod<u>u</u>ct [ˈprɒdʌkt]
aqued<u>u</u>ct [ˈækwɪdʌkt]

In these examples, both a wedge and schwa appear in unaccented positions and such a state of affairs dramatically worsens the issue of their element representation, which is the same, and

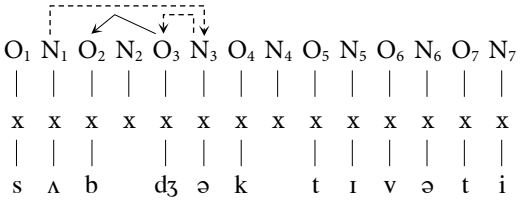
[3] The difference between the descriptions in (3) and (5) is that in (5) there is already no {@} element, which in Harris' analysis was additionally headed or unheaded.

[4] Schwa and wedge are similar phonetically and differences between them are not always easy to perceive. I thank the reviewer for this observation.

[5] *Subjectivity* could potentially be interpreted as a compound. This issue is, however, debatable.

their phonetic interpretation, which becomes ambiguous. Nonetheless, in some words presented in (6), i.e. ['ækwɪdəkt], ['prɒdəkt], [səl'fjʊərɪk][6], schwa appears interchangeably with wedge, so such words have double pronunciations, which indicates free variation. But there are also words such as [ˌsʌbdʒək'tɪvəti] where it is impossible to swap [ʌ] with [ə] and, therefore, the assumption that these two vowels are structurally the same may be disputable. However, there are two possibilities when [ə] cannot surface interchangeably with [ʌ] in words such as *subjectivity*. For one thing, there is a consonant cluster following the vowel, which, most probably, needs a stronger licenser (as proposed in Cyran 2003). Thus, the double licensing of the leftward interonset relation (LIO) may be at work in certain words. Double licensing of LIO means that a vowel preceding a consonant cluster licenses to the right a vowel following this cluster, so that this rightmost nucleus responsible for a governing relation could successfully license a cluster at hand. An example is presented below in (7):

(7)



In the case of *subjectivity*, the reduced vowel [ə] in N_3 following [bdʒ] may be too weak to license this consonant cluster by itself, so it needs support from the leftmost nucleus N_1, which is a full vowel [ʌ]. Thus, the weakly stressed N_1 licenses N_3 (dashed line)[7]. This nuclear position government-licenses (another dashed line) the preceding O_3 to govern O_2 via LIO (solid line). Consonant clusters may be responsible for the type of vocalic sound, since some clusters prefer the presence of stronger licensers.[8] As mentioned in Cyran (2003: 280), [ə] cannot appear before some RT clusters such as [mp], [ŋk], [lp], [lb], [lk] (especially at the right edges of words). Another environment precluding the appearance of [ə] in certain situations is secondary stress, which is obligatory in longer words like *subjectivity*.

Let us now make the following prediction: if schwa is claimed to be an unstressed equivalent of wedge, then an unstressed wedge should have the potential to be easily replaced by schwa in an unaccented position (in some favourable environments). To find out whether this prediction holds true, let us also consider the prefix *sub*, which may be realised as either [sʌb] or [səb][9] in the examples below (based on the *Oxford English Reference Dictionary* 2003 and the *Cambridge English Pronouncing Dictionary* 2003):

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[6] Based on the online source: *Merriam Webster Dictionary*: http://www.merriamwebster.com/dictionary and Wells (2000).

[7] Both the schwa and the empty nuclei will share the same element description, i.e. {_}. However, the difference between them will be expressed in the arboreal structure, that is to say, schwa is always linked to the skeleton, while empty nuclei never have any association lines.

[8] As the reviewer suggests, 'the definition of "stronger licensers" cannot rely on sound interpretation only'. Strong licensers and the definition may require further investigation.

[9] The prefix *sub* may create a domain on its own, which is of importance to some extent. However, we are not going to focus on it in this article, because the behaviour of this prefix needs further investigation.

(8)

Cluster	[ʌ]		[ə]	
[bp]	[sʌbˈpəʊst]	*subpost*	*	
[bk]	[sʌbˈkɒmpækt]	*subcompact*	*	
[bg]	[sʌbˈgleɪʃəl]	*subglacial*	*	
[bt]	[ˌsʌbˈtend]	*subtend*	[səbˈtend]	*subtend*
[bd]	[ˌsʌbˈdɪvaɪd]	*subdivide*	[səbˈdʌkʃən]	*subduction*
[bm]	[ˌsʌbˈmɜːʃən]	*submersion*	[səbˈmɜːʃən]	*submersion*
[bn]	[ˌsʌbˈnɔːməl]	*subnormal*	*	
[bl]	[ˌsʌbleˈtenənt]	*sublieutenant*	[səbˈlaɪm]	*sublime*
[br]	[ˌsʌbrəˈgeɪʃən]	*subrogation*	[səbˈrepʃən]	*subreption*
[bdʒ]	[ˌsʌbˈdʒuːdɪsi]	*sub judice*	[səbˈdʒekʃən]	*subjection*
[bv]	[sʌbˈvɜːt]	*subvert*	[səbˈvɜːt]	*subvert*
[bs]	[ˌsʌbˈsɜːv]	*subserve*	[səbˈsɜːv]	*subserve*

What can be seen in the table in (8) is the following: both [ə] and [ʌ] can appear before the majority of consonant clusters of different sonority, e.g. TT such as [bt], [bd] (sonority plateau), TR such as [bm], [bs] (shallow sonority slope) and [br] (steep sonority slope). However, the difference in all these words lies in the secondary stress: all words where both schwa and wedge are possible have secondary stress before [ʌ] and this may be the reason why there cannot be [ə] in such words. In the above examples, there are also clusters which demand either schwa or wedge. There are no words in which [ʌ] cannot appear before a cluster. [ə], on the other hand, cannot be found before the cluster of a bilabial stop + a velar stop, i.e. [bk], [bg], or a bilabial stop + a nasal, i.e. [bn]. Furthermore, in (8) there are clusters such as a bilabial stop + an alveolar stop [bt], an alveolar fricative [bs], a bilabial nasal [bm] and a labio-dental fricative [bv], respectively, where [ʌ] and [ə] appear interchangeably. Even though there are some restrictions on the occurrence of these two vowels, like secondary stress, no minimal pairs occur and we are most probably dealing with free variation here.

6. Conclusion

This article presents the two English central vowels [ʌ] and [ə] with their divergent element analyses. Three different approaches were shown and explained in detail. In the third proposal [ʌ] and [ə] are described by means of the same structure {_}. The distinction between the two, as already mentioned, is being realised in either stressed or unstressed syllables. Thus, it can be stated that [ʌ] and [ə] are two phonetic objects (and this is stress-dependent), but phonologically they behave as one object, i.e. [ʌ] is a slightly stronger version of [ə] and sometimes has to replace it (in words bearing secondary stress). This exchange may also be, at least to some extent, speaker-dependent,[10] i.e. if speakers know that the vowel is truly unstressed, then they immediately utilise schwa. However, if secondary stress appears, schwa is impossible and a phonetically stronger version, that is [ʌ], appears in this position.

[10] These are not purely linguistic categories but rather pragmatic.

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