

WELSH VOWEL MUTATION - AN OPTIMALITY ANALYSIS

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Abstract

Welsh vowel mutation is a purely positional vowel alternation, the effects of which serve to obscure phonemic contrasts between three vowels in the system, namely barred-i [ɨ], schwa [ə] and [u]. In this paper I propose an optimality theoretic account of vowel mutation differing from previous derivational analyses (e.g. Thomas 1979, 1984, Williams 1983) in various ways, including in the underlying values of some of the vowels involved. The correct results emerge primarily through the interaction of a high-ranking structural constraint prohibiting schwa in a final syllable, an input-output faithfulness constraint on vowel features, and a constraint prohibiting a high central rounded vowel, [ɨ̞].

1. Preliminaries – vowel mutation

Vowel mutation is a positional vowel alternation affecting the diphthongs [aɪ] [aɨ] [aʊ] and [ɨʊ] as well as the monophthongs [u] and [ɨ]¹. The traditional characterisation of vowel mutation is that these vowels appear in word-final syllables (including monosyllables), but in non-final position these vowels alternate systematically with another set of vowels, as below. (NB although the other changes are consistently encoded in the orthography, the [ɨ] ~ [ə] alternation is not represented orthographically; y in a final syllable standardly represents [ɨ], while y in a non-final syllable represents [ə].)

(1) ²	orthography		phonetic value	
	<i>final syllable</i>	<i>non-final</i>	<i>final syllable</i>	<i>non-final</i>
	ai	~ ei	[aɪ] ~	[əɪ]
	au	~ eu	[aɨ] ~	[əɨ]
	aw	~ o	[aʊ] ~	[ɔ]
	uw	~ u	[ɨʊ] ~	[ɨ]
	w	~ y	[u] ~	[ə]
	y	~ y	[ɨ] ~	[ə]

¹ Note that the vowel barred-i, [ɨ], is characteristic of northern varieties of Welsh, which are the focus of this paper. Vowel mutation also occurs in dialects without [ɨ]; the analysis in those varieties will necessarily differ in detail. Note, however, that not all dialects exhibit vowel mutation, particularly those dialects lacking central vowels (including schwa) such as parts of Pembrokeshire, see Awbery (1984: 79, 1986: 59).

² In these examples orthography is followed by broad transcription in square brackets; northern pronunciation is assumed here. Predictable phonetic variation is not shown. Note, too, that although vowel length may be contrastive in Welsh, length is ignored here as irrelevant to mutation: both long [ɨ:] and short [ɨ] alternate with [ə]. On the phonemic values for Welsh orthographic symbols see Ball & Williams (2001).

In lexical context, these alternations appear as in (2):

(2) a. ai [aɪ] ~ ei [ɛɪ]	<u>t</u> aith ‘journey’	<u>t</u> eithio ‘to journey, travel’
	<u>g</u> air ‘word’	<u>g</u> eirwir ‘truthful’
au [aʊ] ~ eu [ɛʊ]	<u>h</u> aul ‘sun’	<u>h</u> eulog ‘sunny’
	<u>a</u> ur ‘gold’	<u>e</u> uriad ‘golden’
aw [aʊ] ~ o [ɔ]	<u>t</u> lawd ‘poor’	<u>t</u> lodion ‘the poor’
	<u>b</u> awd ‘thumb’	<u>b</u> odiau ‘thumbs’
uw [ɨʊ] ~ u [ɨ]	<u>b</u> uwch ‘cow’	<u>b</u> uchod ‘cows’
	<u>u</u> wch ‘higher’	<u>u</u> chel ‘high’
b. y [ɨ] ~ y [ə]	<u>by</u> r ‘short’	<u>by</u> rion ‘short PL’
	<u>bry</u> n ‘hill’	<u>bry</u> niau ‘hills’
w [ʊ] ~ y [ə]	<u>tr</u> wm ‘heavy’	<u>try</u> mion ‘heavy PL’
	<u>cw</u> ch ‘boat’	<u>c</u> ychod ‘boats’
	<u>cw</u> m ‘valley’	<u>c</u> ymoedd ‘valleys’

Although this is the typical characterisation in the descriptive literature (e.g. Morris Jones 1913, 1921, Thomas 1979, Thorne 1993), note that the mutations listed in (2a) are arguably marginal in the synchronic language. For example, although *ai* and *au* do appear as *ei* and *eu* in the penultimate syllable, there are also instances of *ei* and *eu* appearing in final syllables. The [aʊ] ~ [ɔ] alternation is not generally applicable as there are instances of [aʊ] in the penult, e.g. *hawsaf* ‘easiest’, as well as instances of [ɔ] in the final syllable, e.g. *pechod* ‘sin’. Finally, the [ɨʊ] ~ [ɨ] alternation is restricted to occurring only before [χ], as in the examples given. In light of the exceptional status and essentially diachronic interest of the alternations in (2a), the rest of the paper will focus on the alternations in (2b). Although these are not without exceptions, they are of more general regularity and, at least as regards aspects of the [u] ~ [ə] alternation, an interesting subset of exceptions behave in a principled fashion.

As further evidence for the claim that vowel mutation involves a purely phonological positional sensitivity, note that a suffix containing a mutable vowel will also mutate if it, in turn, is followed by a suffix, i.e. by another syllable. The suffix in (3b) shows a mutable vowel in a final syllable; this vowel is shown mutated in a non-final syllable in (3c).

(3) a. melin [mɛlɪn] ‘mill’	b. melin-ydd ‘miller’	c. melin - ydd - ion ‘millers’
	[ɨð]	[əð]

Observe that in these examples the rôle of morphology is restricted to adding phonological structure through suffixation. Morphological complexity *per se* is not relevant, nor is morphological content. The important point is that the vowel in question appears in a non-final syllable. The syllable in question has been made non-final through the addition of a suffix.

One other fact involving morphology should be noted at this point. In Welsh,

compounding distinctions are made between ‘proper’ and ‘improper’, as well as between ‘strict’ and ‘loose’ compounds, see e.g. Morris-Jones (1913, 1921), Williams (1989), Thorne (1993). Without going into the details and complexities here, note that some mutable vowels in apparent non-final position do not mutate if they are in the final syllable of the first element of a compound. For example, the *y* in *llyndref* ‘lake village’ is [ɨ], not [ə]: *llyn+dref* [ɨɨn-drɛv] < *llyn* ‘lake’ + *tref* ‘town’, cf. *llyn* [ɨɨn] ‘lake’ ~ *llynoedd* [ɨən-ɔɨð] ‘lakes’. In other words, vowels in this position –the final syllable of the first element of such compounds –behave as they do in an unambiguously final syllable. This suggests that the domain of vowel mutation is the phonological word and that in such compounds each element is a separate phonological word.

We saw in (2b) that *y* [ɨ] and *w* [u] are alike in mutating to [ə] in non-final position in polymorphemic words. For *y*, however, this mutation also occurs in monomorphemes, as in (4)³.

- (4) *mynydd* /mɨnɨð/ [mənɨð] ‘mountain’

With the addition of a suffix to *mynydd*, the second *y*, now in non-final position, also mutates:

- (5) *mynyddoedd* [mənəðɔɨð] ‘mountains’

Turning to the other monophthong affected by vowel mutation, the facts surrounding the [u] ~ [ə] alternation have a further twist compared with those of the [ɨ] ~ [ə] alternation.

Despite the parallel between *w* and the other mutating vowels shown in (2), we see in (6) that, unlike [ɨ], [u] may appear in non-final position in monomorphemes in a specific context: the /u/ in the penultimate syllable doesn’t lower to [ə] when followed in the final syllable by a further [u].

- (6) *cwmwl* /kumul/ [kumul] ‘cloud’
*[kəmul]

However, when BOTH underlying /u/ vowels are in non-final position then both mutate to schwa, again parallel to the behaviour of [ɨ] seen in (5). (This mutation of *w* [u] is indicated in Welsh orthography by means of a *y* in a non-final syllable.)

- (7) *cymylau* [kəməla] ‘clouds’

Although specific to the vowel [u] amongst the mutating vowels, this behaviour is entirely systematic for that vowel, as shown by the further data in (8), where all instances of orthographic *y* in the righthand column represent [ə]⁴.

³ The assumption here of underlying /ɨ/ in the first syllable, following Thomas (1984: 110f.), is based on the standard value of unmutated orthographic *y*. Thomas’ argument extends to other monomorphemic words with *y* representing pre-final schwa in their surface form, e.g. *cybydd* [kəbɨð] ‘miser’, *cyfarth* [kəvəθ] ‘to bark’, *sydyn* [sədɨn] ‘sudden’. Another possibility is, of course, available: that the underlying phonemic value of orthographic *y* is /ə/.

⁴ For the sake of completeness, there are, in fact, words with *w* [u] in the penultimate syllable and a vowel other than *w* [u] in the final syllable which do not mutate. This typically involves words borrowed from English, e.g. *bwllo*

(8)	cwpwrdd	‘cupboard’	cypyrddau	‘pl.’
	Cwcoll	‘cowl’	cycyllau	‘pl.’
	mwnwgl	‘neck’	mynyglau	‘pl.’
	mwrthwl	‘hammer’	myrthylau	‘pl.’
	bwgwl	‘menace’	bygyllau	‘threats’
	bwrlwm	‘gurgling’	byrlymu	‘bubble over’
	swmbwl	‘goad’	symbyllau	‘pl.’

More will be said below about the behaviour of *w* [u]. At this point, however, there is one more relevant fact about the phonological system of Welsh vowels that needs to be noted.

In addition to the [ɨ] represented by orthographic *y*, there is another [ɨ] vowel, represented by orthographic *u*. This barred-*i*, however, does not alternate with schwa. Thus, the two [ɨ] vowels must be distinguished within the Welsh vowel system, given their differing behaviour with respect to alternation with schwa.

2. Distinguishing between alternating *y* [ɨ] and stable *u* [ɨ]

Apart from accounting for the alternations seen so far, note that there is a further difficulty surrounding the analysis of barred-*i*, namely also accounting for those cases in which barred-*i* does not alternate with schwa. As we have already seen, in words written with orthographic *y*, barred-*i* alternates with schwa, as in (9).

(9)	syn [sɨn]	~	syndod [sən-dɔd]	‘amazed’ ~ ‘wonder’
	llyn [ɨɨn]	~	llynoedd [ɨən-ɔɨð]	‘lake’ ~ ‘lakes’
	bryn [brɨn]	~	bryniau [brən-ja]	‘hill’ ~ ‘hills’

As noted above, however, Welsh also represents barred-*i* with orthographic *u*. The barred-*i* in these words shows no alternation, as in (10).

(10)	budd [bɨð]	~	buddion [bɨð-jɔn]	‘benefit’ ~ ‘benefits’
	llun [ɨɨn]	~	lluniau [ɨɨn-ja]	‘picture’ ~ ‘pictures’
	sudd [sɨð]	~	suddion [sɨð-jɔn]	‘juice’ ~ ‘juices’

In pre-OT generative phonology several derivational analyses distinguish between *y* and *u* by means of an underlying featural distinction and rules targeting relevant features. The most important of these analyses are Thomas (1979, 1984) and Williams (1983)⁵, to which we now turn.

Thomas (1979, 1984)⁶ deals with vowel mutation by means of a vowel lowering rule

[buljo] ‘tease, annoy’, *bwlffyn* [bulɨn] ‘bullfinch’, *cwsmer* [kusmar] ‘customer’, *cwmni* [kumni] ‘company’, *swper* [supar] ‘supper’ and many more besides. Conversely, there are a few words in which pre-final *w* mutates despite being followed by *w* in the final syllable, e.g. *bygwth* [bəguθ] ‘threaten’ (a variant of *bwgwith* [buguθ]). See also Fynes-Clinton (1913) and Thomas (2000).

⁵ Another often-cited analysis is that of Allen (1975). Given the serious flaws in that paper (cf. Cartmill 1976), I will mention it no further here.

⁶ The 1984 paper appeared previously as Thomas (1979). In the following I refer only to the 1984 version.

applying in a pre-final syllable. In the context of the present discussion, the important point is how he allows the lowering rule to affect y [ɨ] without also affecting u [ɯ], bearing in mind that the phonological analysis is entirely independent of orthography and that at the surface y and u are phonetically identical in final syllables. Thomas contends that:

the internal structure ... can be clarified once we cease to concentrate on the phonetic units which are the surface structure of the phonology and, instead, build an analysis on the structural relationships which underlie them (Thomas 1984: 105).

Thus, perfectly consistently with the assumptions of generative phonology, Thomas argues that despite the surface identity of y and u in final syllables, they can still be distinguished within the phonological system by appealing to differing abstract underlying representations. Referring to y as /ɨ₁/ and to u as /ɨ₂/, Thomas notes that the distinction between the two ‘is purely abstract: it is reflected in the surface phonetics only in the participation or otherwise of the segment [ɨ] in the lowering alternations’ (1984: 109). For the sake of clarity and ease of discussion, Thomas symbolizes /ɨ₁/ as front rounded /y/ and /ɨ₂/ as back unrounded /u/, although neither of these segments occurs in the phonetic inventory of modern Welsh.

Featurally, Thomas assigns /y/ (=ɨ₁/) the features [+high, -back, +round], while assigning the features [+high, +back, -round] to /u/ (=ɨ₂/). The lowering rule is written to affect [+high, +round], thus forcing /y/ to surface as schwa. The /u/ remains unaffected by the lowering rule, ultimately surfacing as [ɨ].

One further point to note about Thomas’ analysis, particularly in the light of current phonological assumptions about the absence of intermediate structures⁷, is the iterative application of the lowering rule. As indicated above in (3), (4) and (5), the lowering of /ɨ₁/ to [ə] occurs in any pre-final syllable, regardless of whether that syllable is in a stem or a suffix. Thomas achieves this by assuming the iterative application of the lowering rule, with a disjunction of morpheme boundary (+) and word boundary (##) in the rule, so that the rule applies first in the pre-final syllable before a morpheme boundary, then again in the pre-final syllable before a word boundary.

Williams (1983) revises Thomas’ analysis in several ways. Accepting his basic approach and reasoning, Williams rejects Thomas’ reliance on the feature [round] for distinguishing the vowels in question. Instead, she proposes using the feature [length], arguing that ‘the feature reflects the fact that [+length] vowels are the only monophthongs descended from originally long vowels, and are long in a wider range of environments in the modern language’ (p. 246).

Williams explores the diachronic origins of the two sources of [ɨ] and why there are two sets of monophthongs, ‘/i/ and /u/ which never reduce to schwa or become lowered to [e] or [o]⁸, and /y/ and /u/, which take part in the reduction and lowering processes’ (p. 241). In an elegant analysis of the facts, Williams proposes an underlying vowel system for Modern Welsh which reflects the surface vowel system in stressed syllables in Primitive Welsh (ca. 6th Century). Thus,

⁷ The ‘absence of intermediate structures’ assumes a non-stratal approach to OT. Stratal OT would allow certain intermediate levels of representation; see Kiparsky (2000), Bermúdez-Otero (forthcoming). As regards vowel mutation, however, the kinds of morphological criteria motivating strata appear not to be involved.

⁸ This refers to the results of another vocalic alternation, so-called ‘a-affection’.

Williams' analysis of vowel mutation encapsulates a synchronic analysis which in certain respects recapitulates the historical development of the Welsh vowel system.

While these analyses work within the context of derivational phonology, they rely on essentially ad hoc extrinsically ordered phonological rules and iterative rule application. In contrast, the analysis proposed below has the advantage of obviating certain ad hoc aspects of previous analyses, including iterative, extrinsically ordered rules. Moreover, it underscores the role of schwa in the system and allows a simpler analysis of vowel mutation in monomorphemes.

3. Analysis

Within the framework of Optimality theory, the following analysis models the relevant distinctions by means of interacting structural constraints together with constraints on input/output faithfulness.

Let us initially assume that the surface values for *y* and *u* in final syllable position reflect their input values (cf. *Lexicon Optimization*, Prince & Smolensky 2002: 191ff), in other words assume the input {*ɨ*}. Starting with the *br[ɨ]n ~ br[ə]niau* alternation, we clearly need a constraint banning the occurrence of schwa in a final syllable.

- (11) * $\text{ə-FINAL}\sigma$: Schwa does not occur in a final syllable

Assuming the input {*brɨn*} and comparing the output candidates [*brɨn*] and [*brən*], the * $\text{ə-FINAL}\sigma$ constraint distinguishes correctly between them.

(12) *bryn* [brɨn] 'hill'

Input	* $\text{ə-FINAL}\sigma$
a. $\text{br}\mathfrak{h}\mathfrak{n}$	
b. brən	*!

Note that this raises a question about the unit of evaluation of the constraint. As observed in Section 2 with respect to compounding, the phonological word is relevant here as well. There are a number of proclitics in Welsh that would appear to have final schwa. These include the definite article *y* [ə], *yr* [ər], the preposition *yn* [ən] 'in', the first person singular possessive *fy* [və], among others (see also Hannahs & Tallerman 2006). Given the status of these items as proclitics and the fact that they therefore cannot occur in final syllables (since they do not occur in isolation without hosts), they do not present any counterevidence to the constraint, provided that the unit of evaluation is the phonological word (understood to include a clitic and its host). Given the complete absence of truly word-final schwa in the language, the constraint against final schwa must be highly ranked within the constraint hierarchy.

Turning to *bryniau* [brənja] 'hills', we presumably need a constraint prohibiting the occurrence of non-final [ɨ]. Compelling barred-i in the input to surface as schwa will also entail the violation of a faithfulness constraint on input-output identity in vowels, although this constraint will be ranked lower than the constraint prohibiting non-final barred-i.

- (13) * $\text{ɨ-NON-FINAL}\sigma$: Barred-i occurs only in final syllables

- (14) IDENT-IO (vowel): Input vowels match output vowels

bryn-iau [brɛnja] ‘hills’

(15)	Input {brɛn-ja}	* ə-FINALσ	*ɨ- NON-FINALσ	IDENT-IO (vowel)
a.	☞ brɛnja			*
b.	bɨnja		*!	

If we then consider the monosyllabic *pur* [pɨr] ‘pure’, it would appear to be accounted for in the same way as *bryn*, assuming underlying /pɨr/. In the following tableau the candidate [pɨr] is correctly selected as more harmonic than the competitor candidate *[pɛr].

pur [pɨr] ‘pure’

(16)	Input {pɨr}	* ə-FINALσ	*ɨ- NON-FINALσ	IDENT-IO (vowel)
a.	☞ pɨr			*
b.	pɛr		*!	

However, the parallel does not extend to multisyllabic *puro* [pɨro] ‘purify’, since *u* does not undergo mutation it must surface as [ɨ], even in non-final syllables. The constraint hierarchy established, however, does not allow the selection of *puro* [pɨro] as optimal:

puro [pɨro] ‘purify’

(17)	Input {pɨr-o}	* ə-FINALσ	*ɨ- NON-FINALσ	IDENT-IO (vowel)
a.	pɨro		*!	
b.	☹ pɛro			*

One way of avoiding this problem is by distinguishing underlyingly between the [ɨ] that alternates with [ə] and the [ɨ] that is stable in all positions. Therefore, following Thomas or Williams, *y* and *u* must be given separate phonemic identities. In Williams’ (1983) analysis *u* = /ɯ/ and *y* = /ɨ/; these choices reflect the diachronic development of the Welsh vowel system. By adopting these underlying representations, /ɨ/ will surface as [ɨ] in final position and as [ə] elsewhere, as we have just seen in the tableaux in (12) and (15). The input /ɯ/ needs to surface consistently as [ɨ].

In order to achieve the desired result, consider the surface vowel system of Welsh. The central vowels of Welsh are high central [ɨ] and mid central [ə]. Neither of these vowels is rounded. A constraint prohibiting central rounded vowels will prevent the occurrence of barred-*u*.

Moreover, given that /ʉ/ is high, central and rounded, the mid vowel schwa as an output for /ʉ/ would violate *two* IO faithfulness features, [height] and [round], whereas barred-i at the surface, being high and central, would violate only one input feature, [round]. Thus, the IO faithfulness constraint needs to be revised to refer to vowel features, rather than to vowel segments. Each featural difference between input and output form will incur a separate violation.

(18) *CENTRAL-ROUND: central vowels are unround

(19) IDENT-IO (vowel feature): Input vowel features match output vowel features

pur [pʉr] ‘pure’

(20) Input {pʉr}	* ə-FINAL σ	*CENTRAL-ROUND	*i- NON-FINAL σ	IDENT-IO (vowel feature)
a. pʉr		*!		
b. p̄r				*
c. p̄r	*!		*	**

Although the constraints and the hierarchy established now allow us to correctly select among the competing candidates for *bryn*, *bryniau* and *pur*, note that the wrong output candidate for *puro*, *[p̄ro], is again selected as most harmonic. In the following tableau, candidate (c) is incorrectly selected over candidate (b).

puro [p̄ro] ‘purify’

(21) Input {p̄ro}	* ə-FINAL σ	*CENTRAL-ROUND	*i- NON-FINAL σ	IDENT-IO (vowel feature)
a. p̄ro		*!		
b. p̄ro			*!	*
c. p̄ro				**

While *CENTRAL-ROUND correctly prevents barred-u from surfacing, it doesn’t by itself allow the necessary distinction to be drawn between alternating *y* and non-alternating *u*. A way is needed to prevent schwa from surfacing when it is associated with underlying /ʉ/, while at the same time allowing/forcing it to surface when it is associated with underlying /i/.

At least two assumptions need to be examined here. In the first place, although there is ample evidence for the general validity of a constraint against word-final schwa, there is no general evidence for a prohibition against [i] in a non-final syllable. It is true that the [i] associated with orthographic *y* does not occur in non-final syllables, but that is not the only source

of [ɨ]. This suggests that the *ɨ-NON FINALσ constraint is not appropriate. Secondly, apart from diachronic considerations, why should the underlying representation of orthographic y be /ɨ/ rather than schwa? In fact, the assumption of underlying /ə/ is justified on several grounds. Empirically, it is the case that y represents [ə] throughout the language far more frequently than it represents [ɨ]. Frequency therefore supports underlying [ə]. On a related theoretical point, Lexicon Optimization (see Prince & Smolensky 2002: 191ff., Kager 1999: 32ff) suggests that underlying forms should, as far as possible, match surface forms. Here there are two surface forms, [ə] and [ɨ], associated with a single input form; the surface form with the greatest occurrence is [ə], making it a reasonable choice for representing the input segment, as the output form most often matches /ə/. A further advantage to the assumption of underlying /ə/ for the present analysis is that it allows us to abandon one of the constraints proposed above, *ɨ-NON FINALσ. The effects of that constraint emerge simply through the ranking of *ə-FINALσ >> IDENT-IO (vowel feature), provided the appropriate underlying vowels are posited. Moreover, the absence of the *ɨ-NON FINALσ constraint means that barred-i in words like *puro* will no longer be incorrectly ruled out, and a more highly ranked constraint will not be required to rule it in.

To test these assumptions and the ensuing constraint ranking, consider the following tableaux, showing the evaluation of potential candidates for *bryn*, *bryniau*, *pur* and *puro*. In the tableau in (22), the underlying schwa is properly marked as violating the highest constraint in the hierarchy. The (b) candidate [brɨn], despite incurring an I-O faithfulness violation, correctly surfaces.

bryn [brɨn] ‘hill’

(22)

Input {brən}	*ə-FINALσ	*CENTRAL-ROUND	IDENT-IO (vowel feature)
a. brən	*!		
b.  brɨn			*

In tableau (23), the underlying schwa is correctly allowed to surface while the faithfulness violation of candidate (b), *[brɨnja], in this case prevents it from surfacing. Note that any other vowel in the first syllable would have fared even worse: schwa and barred-i differ featurally only with respect to height, they share (lack of) rounding and centrality. Assuming one violation for each different feature, any other vowel in the system would have incurred at least two violations of IDENT-IO (vowel feature), compared with the single violation of [ɨ] here.

bryn-iau [brənja] ‘hills’

(23)

Input {brən-ja}	*ə-FINALσ	*CENTRAL-ROUND	IDENT-IO (vowel feature)
a.  brənja			
b. brɨnja			*!

In tableau (24), candidate (c) is correctly ruled out by the constraint against the occurrence of schwa in a final syllable. The underlying central round vowel of candidate (a) falls foul of the *CENTRAL-ROUND constraint, correctly allowing candidate (b) [pɪr] to surface, in spite of the violation of the IDENT-IO faithfulness constraint.

(24) *pur* [pɪr] ‘pure’

Input {pɪr}	*ə-FINALσ	*CENTRAL-ROUND	IDENT-IO (vowel feature)
a. pɪr		*!	
b. \curvearrowright pɪr			*
c. pɛr	*!		**

Finally, the tableau in (25) shows the surfacing of barred-i, provided that vowel is associated with orthographic *u* (underlying /ɨ/) rather than with orthographic *y* (underlying /ə/).

(25) *pur-o* [pɪro] ‘purify’

Input {pɪr-o}	*ə-FINALσ	*CENTRAL-ROUND	IDENT-IO (vowel feature)
a. pɪro		*!	
b. \curvearrowright pɪro			*
c. pɛro			**!

Under these assumptions with this constraint hierarchy we can correctly distinguish between alternating [ɨ] ~ [ə] and stable [ɨ], as shown.

Earlier it was pointed out relative to examples (4) *mynydd* [mənɨð] and (5) *mynyddoedd* [mənəðɨð], along with numerous other monomorphemic examples such as *cybydd* [kəbɨð] ‘miser’, *cyfarth* [kəvərθ] ‘to bark’, *sydyn* [sədɨn] ‘sudden’ (see note 4), that the traditional assumption has been that the non-final vowels in these words are derived from /ɨ/. Adopting the present analysis brings with it the further simplification to the grammatical system that schwa in monomorphemes is simply a reflection of the underlying value of the vowel in question.

(26) *mynydd* [mənɨð] ‘mountain’

Input {mənəð}	*ə-FINALσ	*CENTRAL-ROUND	IDENT-IO (vowel feature)
a. \curvearrowright mənɨð			*
b. mənəð	*!		

(27) *mynyddoedd* [mənəð-ɔ̃ð] ‘mountains’

Input { mənəð-ɔ̃ð }	*ə-FINAL σ	*CENTRAL-ROUND	IDENT-IO (vowel feature)
a. mənɪðɔ̃ð			*
b. ☞ mənəðɔ̃ð			

(28) *cybydd* [kəbið] ‘miser’

Input { kəbəð }	*ə-FINAL σ	*CENTRAL-ROUND	IDENT-IO (vowel feature)
a. ☞ kəbið			*
b. kəbəð	*!		

Consider one more piece of the puzzle, namely the behaviour of orthographic *w* [u] which alternates with [ə] in a non-final syllable – except when followed by another [u] in the final syllable. First consider the related pair *cwm* [kum] ‘valley’ ~ *cymoedd* [kəmɔ̃ð] ‘valleys’. *Cwm* [kum] correctly surfaces under the assumptions made to this point, and assuming that the surface [u] reflects the input vowel /u/.

(29) *cwm* [kum] ‘valley’

Input { kum }	*ə-FINAL σ	*Central-round	IDENT-IO (vowel feature)
a. ☞ kum			
b. kəm	*!		*

As for *cymoedd* [kəmɔ̃ð] ‘valleys’, we need a way of preventing [u] from appearing in non-final position. It was argued above with respect to alternating [ɪ] that its behaviour was unlikely to be the result of a constraint prohibiting barred-i, since this would produce the wrong result for stable [ɪ]. One might therefore question the likelihood of a constraint against non-final [u], e.g. *u-NON FINAL σ . Note, though, that there is a fundamental difference between the behaviour of [ɪ] and that of [u]: because of the association of [ɪ] with two different phonemes, a constraint prohibiting [ɪ] incorrectly affects the output of both the alternating and the non-alternating phoneme. As concerns [u], though, it is not the case that there is another source for [u]. Rather, the exceptional behaviour involves the occurrence of non-final [u] when [u] also appears in a final syllable. Thus, we can posit a constraint against the occurrence of [u] in non-final position to account for words like *cymoedd* [kəmɔ̃ð]:

(30) * u-NON FINAL σ : [u] appears only in final syllables

(31) *cwmoedd* [kəm-ɔ̃ð] ‘valleys’

Input { kumɔ̃ð }	*ə-FINAL σ	*CENTRAL-ROUND	*u-NON FINAL σ	IDENT-IO (vowel feature)
a. ɸ kəmɔ̃ð				*
b. kumɔ̃ð			*!	

In addition, given the non-mutating behaviour when the [u] in question is followed by another [u] in the final syllable, the constraint needs to scan not only the position of the [u], but also to determine whether an [u] in non-final position is linked to an [u] in final position. Non-final [u] is prohibited *unless* it is linked to [u] in final position. This is reminiscent of Itô’s coda condition (1986: 50ff.), by means of which a doubly linked coda escapes a filter designed to prohibit a singly linked coda. In the case of *cwmwl* [kumul] ‘cloud’, for example, both instances of [u] are linked and so the mutation does not occur. In some sense, the ‘non-final’ [u] in such a form is not completely non-final, given its association with the following, final [u].

(32) k u m u l

So, *cwmwl* [kumul] surfaces with both [u] vowels intact.

(33) *cwmwl* [kumul] ‘cloud’

Input { kumul }	*ə-FINAL σ	*CENTRAL-ROUND	*u-NON FINAL σ	IDENT-IO (vowel feature)
a. kəmul				*
b. ɸ kumul				

Only when *both* /u/ vowels are non-final do they mutate to schwa.

(34) *cmymlau* [kəməl-a] ‘clouds’

Input { kumul-a }	*ə-FINAL σ	*CENTRAL-ROUND	*u-NON FINAL σ	IDENT-IO (vowel feature)
a. ɸ kəməla				**
b. kumula			*!*	

In this way, the mutating behaviour of [u], together with its peculiarity of not mutating when followed by [u] in a final syllable, are brought into the analysis.

4. Conclusion

The present paper has revisited the problem of accounting for the vowel mutation alternations of [ɨ] ~ [ə] and [u] ~ [ə] together with addressing the alternation of [ɨ] with [ə] in one set of cases and the absence of alternation in a different set of cases. As has been shown, a straightforward optimality theoretic account is available. In this account, I have assumed different underlying vowels from those posited by Thomas and Williams, i.e. /ə/ for alternating y, and /ʉ/ for the stable segment. The account rests on the interactions of a high-ranking structural constraint prohibiting schwa in final syllable (*ə-FINALσ), a constraint prohibiting high central [ɨ] (*CENTRAL-ROUND), an I-O Faithfulness constraint on vowel features (IDENT-IO (vowel feature)), and a constraint prohibiting the occurrence of (singly linked) [u] in a final syllable (*u-NON FINALσ). The assumption of underlying /ə/ for the alternating vowel is supported empirically by frequency of occurrence: Welsh orthographic y most often represents [ə]. Theoretically, this accords with lexicon optimization (Prince & Smolensky 2002: 191ff.), whereby an output segment should ideally mirror its input correspondent. Under these assumptions alternating y and non-alternating u can be correctly distinguished in both final and non-final syllables. The [u] ~ [ə] alternation, while requiring a further constraint, is also consistent with this analysis.

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