Quantity-quality interactions in Welsh

Phonologization across dialects

Pavel Iosad
University of Edinburgh
pavel.iosad@ed.ac.uk

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1 Quantity and quality in Welsh

1.1 A contrastivist conundrum

The Contrastivist Hypothesis
The phonological component of a language $L$ operates only on those features which are necessary to distinguish the phonemes of $L$ from one another (D. C. Hall 2007, p. 20)

• Question here: how do you decide the set of phonemes to be distinguished by features?

• A well-known problem for phonemic theory: mutually predictable distributions
  • North Germanic, e. g. Norwegian: [taːk] ‘roof’ $\neq$ [takː] ‘thanks’

  • If vowel length is phonemic, then consonant length is allophonic
  • If consonant length is phonemic, then vowel length is allophonic


  • English key: /ki/ or /ki/?
  • English kit: /kit/ or /kɪt/?
  • Or even syllable cuts?

The problem
Any contrastivist approach appears forced to make a choice, even when purely empirical adjudication is difficult

• See, for example, and among many others:
1.2 Quantity and quality in Welsh

The received view

- Descriptions of Welsh argue it to be essentially like English
- Mutually predictable distribution of length and quality
  - Long vowels are tense [iː uː eː oː]
  - Short vowels are lax [aɪʊɛɔ]
  - Disagreement about [a]/[ɔː]


The evidence: quality is phonemic

- English borrowings like [ˈbrɔːn] brawn: length does not predictably lead to tenseness
  - Unclear status in the grammar
  - Not empirically shown that borrowed [ɛːɔː] qualitatively identical to native [ɛɔ]
  - Unclear whether [a]/[aː] are distinct qualitatively
- Difficult to account for patterning

The evidence: quantity is phonemic

For the details of this analysis, see Iosad (2012b)

- Distribution within ‘short-long’ or ‘lax-tense’ pairs is largely predictable
  - Long before [b d ɡ ʃ ʊ ʋ ɭ]
  - Short before (most) clusters (but always predictable in any case)
  - Short before [p t k s ʃ ɬ ɾ ɱ]
  - [ə] is always short
  - Lexical contrast before [n l r]

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<td>a</td>
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<td>tonau</td>
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<tr>
<td>b</td>
<td>[ˈtʰɔnˑɛ]</td>
<td>tonnau</td>
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- Partially predictable distribution of quantity driven by quality of surrounding vowels: mix of coerced and distinctive weight (Morén 2001)
- Analysis: general bimoraicity requirement moderated by lexical moraicity and constraints on what can and can’t acquire a mora
  - Metropolitan New York English (Morén 2001)
  - Latvian (Bye & de Lacy 2008)
  - Friulian (Iosad 2012a, Torres-Tamarit forthcoming[a],[b])
Dialect variation in length

- All dialects: long and short vowels in stressed monosyllables
  - ton ‘wave’ [tʰɔ̃n̩] ≠ tôn [tʰoːn̩] ‘tune’
- South Welsh: long and short vowels in stressed penults
  - tonnau ‘waves’ ≠ tənau ‘tunes’
- North Welsh: only short vowels in penults
  - tonnau = tənau
- Mid Welsh and NE (Awbery 1984): ‘free variation’ in penults

1.3 South-West Welsh

A different pattern

- Description: mid long vowels are lax before a high vowel

(2) a. [ɛːdɛ] edau ‘thread’
   b. [ɔːɡɔv] ogof ‘cave’

(3) a. [tʰɛːbɪɡ] tebyg ‘similar’
   b. [kʰɔːdi] codi ‘rise’

(4) Alternations [kʰoːdɔð] cododd ‘(s)he rose’

- This could be construed along the same lines as the borrowing argument
- But the distribution is still predictable!

Outline of argument

- Are there criteria we can use beyond surface predictability?
  - Yes: modularity
  - If a distinction participates in a pattern that involves proprietary phonological information, it should be phonological
  - ‘Tenseness’ is likely phonologized both in SW Welsh and other varieties
  - Predictable distribution of distinct categories is an expected result of the life cycle, not a problem for the Contrastivist Hypothesis
  - Contrastivity is defined as non-redundancy in feature assignment along the lines of the contrastive hierarchy
2 Dialect variation

2.1 South-West Welsh

Acoustic study

- 8 speakers in study: 6 show the system described for the south-west
- Carmarthen, rural W Carmarthenshire, Pembrokeshire
- 149 items × 3 repetitions, controlled for consonantal context, vowel length, height of following vowel
- Carrier phrase Glywes i'r gair ___ ddoe 'I heard the word ___ yesterday'
- Basically: descriptions are correct

- Figure 2a: robust durational distinction, as expected for South Welsh
- Figure 2b: clearly bimodal pattern in the mid long vowels but not in high vowels
- 'Lax' long vowels seem fairly similar to short vowels
- Quantitative results: generalized additive hierarchical models using R package mgcv (Wood 2006), speaker and word as random effects
- Improved fit with three-way interaction between vowel quality, vowel length and height of following vowel
- In this model, the height of the following vowel has a significant effect (95% CI excludes zero) only on long /eːoː/, again as expected from descriptions
Analysis

- The ‘tense-lax’ distinction in mid vowels is sensitive to the ‘high-nonhigh’ distinction among all vowels
- The height specification of vowels is a proprietary phonological feature
- Hence, the ‘tense-lax’ distinction in mid vowels is phonological
- Emergent/substance-free feature theory (e.g. Mielke 2007, Morén 2007): these two distinctions pattern together, so they are encoded by the same feature
- Important fact: patterning of vowels in unstressed (post-tonic) syllables
  - [i u] in open syllables, [i o] in closed syllables
  - Only [ɛ ɔ] for mid vowels

- Parallel Structures Model of feature geometry (e.g. Morén 2003, 2006, 2007, Youssef 2010)
- Different implementation of ‘tenseness’ in high and mid vowels
  - High vowels: ‘lax’ [i o] are more marked, pattern with [ə] in that this is the class of vowels that can never be long
  - Mid vowels: ‘tense’ [e o] are more marked
    * Only [ɛ ɔ] in post-tonic syllables
    * Tense [e o] phonologically active: targeted by dissimilation process
    * The feature V-manner[closed] covers both high vowels and tense mid vowels
    * Dissimilation within the final disyllabic domain responsible for alternations
Quantity-quality interactions in Welsh

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Table 1: Featural specifications for vowels: South-West Welsh

Phonologization in South-West Welsh

- The ‘tenseness’ distinction shows signs of *phonologization* (Hyman 1976, 2013) or *stabilization* (Bermúdez-Otero & Trousdale 2012, Bermúdez-Otero 2014, Ramsammy 2015): reference to phonological information
  - Distribution in high vowels is sensitive to the presence of a coda
    - Modelling shows this is not a durational effect
  - Distribution in mid vowels is sensitive to contrastive phonological specification
    - We return to possible continuous effects below
- Most speakers consistently show unexpected [ɛː] in ‘fenestr’ [ˈfɛːnɛst] ‘window’
- *Phonemicization*: contrastive by any criterion

2.2 Standard system

- This system is exemplified in the data by a single speaker
- Figure 6a: robust distinction in duration
- Figure 6b: ‘tense’ when long and ‘lax’ when short
- Similar to findings for monosyllables in Mayr & Davies (2011)
- Post-tonic syllables
  - Lax [ɪ o] when closed, tense [ɪ u] when open
  - Lax [ɛ ɔ] in all contexts
- Overall distribution:
  - High vowels: lax in closed syllables (unstressed or short before moraic coda), tense in open syllables
  - Mid vowels: lax when monomoraic, tense when bimoraic
Summary on standard system

- ‘Tenseness’ probably phonologized: sensitive to phonological information
  - High vowels: presence of codas
  - Mid vowels: moraic structure
    - Not a duration effect
- The features used for the ‘tenseness’ distinction do not interact with anything else or with each other
- No evidence this is the same feature

2.3 The non-enhanced system

- Again, just a single speaker: notably, this speaker is from Aberystwyth in the Mid Wales area
- Figure 8a: small but robust difference in duration by vowel category
  - This contradicts the descriptions claiming ‘free variation between “short” and “long” vowels’
- Figure 8b: no difference in formant values by length category: all stressed vowels are ‘lax’
- Figure 10: longer duration does lead to some gradient tensing in stressed vowels
- Same post-tonic system as elsewhere
Figure 7: Contrastive hierarchy for the standard system

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Table 2: Featural representations for the standard system
Figure 8: Duration and vowel quality for Sp8

Figure 10: Effect of vowel duration on F1, Sp8
Summary for non-enhanced system

- No evidence for a phonological ‘tenseness’ distinction in mid vowels
- Some evidence for a distinction in high vowels sensitive to codas, but only apparent word-finally
  - Note the broader domain of the requirement compared to the standard system
- No analysis here due to lack of data from stressed monosyllables
- Potentially: ‘free variation’ in quantity really means ‘(some) continuous variation in quality’
- Some descriptive literature can be interpreted to agree with this (Wmffre 2003, Rees 2013)

3 Phonologization across dialects

3.1 Diachronic interpretation

- Suggested diachronic interpretation for stressed vowels
  - No difference in quality within vowel categories
    - Length is enhanced by (continuous) tensing (Stevens & Keyser 1989, 2010, Keyser & Stevens 2006) \(\approx\) non-enhanced system
  - All short-long pairs are interpreted as featurally distinct, but the features are inert otherwise \(\approx\) standard system
  - Features used for the tenseness distinction participate in alternations involving other segments \(\approx\) south-western system
  - Tenseness becomes phonemicized (see also Iosad 2014 for another scenario)

Where does contrast come from?

- If features are emergent, they must be extracted from categorical distributions in the data
- Categorical distributions arise from phonetic processes with predictable outcomes via the life cycle
- At early stages of the life cycle, the categories will be in predictable (‘complementary’) distribution
- Some learning models are biased to collapse such distinctions (e.g. Peperkamp et al. 2006, Dillon, Dunbar & Idsardi 2012)
- But the distribution may also be interpreted to be driven by the grammar (K. C. Hall 2013, Kiparsky 2014)

3.2 Rule scattering in South-West Welsh

The origin of height dissimilation
Figure 11: Effect of post-tonic vowel duration on V1/V2 duration ratio, by stressed vowel, south-western speakers

- Height dissimilation: phonologization of a trade-off in inherent length
- Irish: synchronically (Munster, Ó Sé 1989) and diachronically (Connacht, Ó Sé 1984) ⇒ categorical (?)
- East Slavic: categorical (Crosswhite 2000) or continuous (Kasatkina & Ščigel’ 1996, Kniazev & Shaulskiy 2007), potentially coexisting
- Kera: continuous? (Pearce 2007)

- The following model was used to estimate the effect of post-tonic vowel duration on the ratio between the duration of the stressed and post-tonic vowel

```
fit <- gam(v1h.v2h.ratio ~ s(v2h.dur, by=v1, k=5) + v1 + v1.is.long + s(speaker, bs='re') + s(word, bs='re'), data=sw.data)
```

- Figure 11 shows that the relationship is consistent with the existence of a trade-off
- The coexistence of a continuous pattern and its categorical congener in the grammar is major prediction of the theory of the life cycle: rule scattering
- South-West Welsh is an interesting example of rule scattering, since the cognate processes are rather different in nature (unlike t/d-deletion, [l]-darkening etc.)

3.3 Emergent features and phonologization

Phonologization and labelling
Emergent/substance-free feature theory is compatible with theories of the life cycle
- Entities to be labelled emerge from categorical distributions in the data
- Categorical distributions in behaviour may be generated by underlyingly non-categorical pro-
  cesses (cf. Ladd 2006)
- Phonologized distinctions participate in ‘narrowly phonological’ patterns even when the evidence for their exact nature is weak

Emergent features and contrast
- Phonologization in this sense is an alternative to surface contrast as a criterion for ‘redund-
  ancy’
- Features like ‘tenseness’ in systems like Welsh are not ‘redundant’ even if they may be predict-
  able on the surface from the context
- The Contrastivist Hypothesis is worth pursuing with a revised definition of ‘redundancy’
- Consistency with the Successive Division Algorithm (Dresher 2009) is a good candidate cri-
  terion (cf. Dresher 2014)

References


Iosad, Pavel. 2014. The ATR/Laryngeal connection and emergent features. MS., University of Edinbrgh. in preparation.


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*A* outside the confidence interval

Table 3: Models for normalized F1, south-western speakers