Disentangling the effects of long-term language contact and individual bilingualism: the case of monophthongs in Welsh and English

Authors: Robert Mayr, Jonathan Morris, Ineke Mennen, Daniel Williams

To cite this article:

Mayr, R., Morris, J., Mennen, I. & Williams, D. (2015). Disentangling the effects of long-term language contact and individual bilingualism: The case of monophthongs in Welsh and English. *International Journal of Bilingualism*, DOI: 10.1177/1367006915614921, first published online 26 November 2015.

Link to article:
http://ijb.sagepub.com/content/early/2015/11/25/1367006915614921.abstract

This research was funded by a British Academy/Leverhulme Small Research Grant (SG111947), awarded to Robert Mayr and Ineke Mennen.

Abstract

Aims and Objectives:
This study investigates the effects of individual bilingualism and long-term language contact on monophthongal vowel productions in English and Welsh.

Design:
To this end, we recorded the Welsh and English vowel productions of two sets of Welsh-English bilinguals differing in home language use, as well as the English vowel productions of English monolinguals.

Data and analysis:
The data were analysed acoustically, with a focus on spectral and temporal properties. Comparisons were then made within each language and cross-linguistically.

Findings:
The results of a cross-linguistic acoustic comparison revealed a high degree of convergence in the monophthong systems of Welsh and English, but also some language-specific categories. Interestingly, at the individual level we found no effect of linguistic experience on vowel production: the two sets of bilinguals and the English monolinguals did not differ in their realisation of English vowels, and the two sets of bilinguals did not differ in their realisation of Welsh vowels.

Originality:
This is one of few studies to examine the effect of linguistic background on variation in Welsh and English bilingual speech, and the first to compare the speech of Welsh-English bilinguals and English monolinguals. More specifically, it investigates the extent to which a speaker's home language can affect phonetic variation in a close-knit community of speakers and in a situation characterised by long-term language contact.

Implications:
The findings demonstrate pervasive phonetic convergence in a language contact situation with a historical substrate. They also indicate that a homogeneous peer group with shared values can override the effects of individual linguistic experience.

Keywords
vowel productions; acoustic analysis; language contact; phonetic convergence; linguistic experience; Welsh-English bilingualism

1. Introduction

Research has shown that bilinguals have separate, but non-autonomous systems, exhibiting cross-linguistic interactions (Mennen, 2004; Paradis, 2001). In bilingual communities, such interactions may give rise to systemic convergence, resulting in the emergence of contact varieties (Bullock & Gerfen, 2004; Heselwood & McChrystal, 1999). A particularly interesting sociolinguistic context exists in Wales where monolingual speakers of Welsh English, a contact variety that shares many accentual features with Welsh, live alongside bilingual speakers. While the English accents of the largely monolingual areas in South-East Wales are well documented (Collins & Mees, 1990; Mees & Collins, 1999; Mayr, 2010; Walters, 1999, 2001), little is known about the varieties of English spoken in bilingual areas and their relation to local varieties of Welsh. Are they characterised by particularly extensive Welsh-language influence? If so, what is the extent of cross-linguistic convergence between Welsh and English in these communities? With respect to English, do monolinguals and bilinguals from the same community have different accents? And with respect to Welsh, what is the role of linguistic experience in the accents of bilingual speakers?

In this paper, we seek to answer these questions on the basis of a systematic acoustic analysis of the vowels produced by three groups of adolescent males from a bilingual school in West Wales: (1) Welsh-English bilinguals from Welsh-speaking homes, (2) Welsh-English bilinguals from English-speaking homes and (3) English monolinguals. In so doing, we aim to disentangle the effects of individual linguistic experience and long-term language contact in this community.

2. Background

2.1. Long-term language contact

It is widely known that structural similarities between languages may develop in cases of language contact (Bullock & Gerfen, 2004; Campbell & Muntzel, 1989; Chang, 2009). Contact-induced language change may occur as the result of long-term synchronic code-switching or phonological transfer, which ultimately arise from social factors, such as prestige and dominance (Backus, 2004). This, in turn, can result in STRUCTURAL CONVERGENCE which, according to Thomason (2001, p. 262), describes "a process through which two or more languages in contact become more similar to each other […] when both or all of the languages change".

A number of studies have examined contact situations where one or both languages are undergoing, or have undergone, phonological convergence (Bullock & Gerfen, 2004; Campbell & Muntzel, 1989; Chang, 2009; Colantoni & Gurlekian, 2004; Heselwood & McChrystal, 1999; Louden & Page, 2005). Bullock and Gerfen (2004), for instance, have shown convergence *towards* English in the vowel system of French spoken in Frenchville, Pennsylvania. Similarly, Louden and Page (2005) found patterns of both convergence towards and divergence away from American English in the phonology of Pennsylvania German. Finally, Colantoni and Gurlekian (2004) found that the intonation patterns of Buenos Aires Spanish differed from those of the rest of the Spanish-speaking world as a result of mass inward migration from Italy at the turn of the twentieth century.

The result of convergence can be contact-induced language change. Thomason and Kaufman (1988) distinguish between two types of interference, a type of contact-induced language change. The first, BORROWING, describes a change in which a feature present in the system of one of the languages becomes incorporated into the system of

the other. SHIFT-INDUCED INTERFERENCE, in contrast, occurs due to the mass acquisition of a second language. This influence may be present in bilingual settings or in situations where language shift has already taken place as a SUBSTRATE.

Such substrate effects are noted in many established global varieties of English (Schneider, 2011, p.201 see also Sankoff, 2001 for a review) and in the contemporary speech of monolingual descendants of immigrant communities (e.g. Holmes, 1996; Fought, 1999; Sharma & Sankaran, 2011; Kirkham, 2013). The presence of a Welsh substrate effect on varieties of Welsh English is well attested, both at the level of phonology (Wells, 1982, p. 377; Thomas, 1997, p. 67; Penhallurick, 2004) and morphosyntax (e.g. Paulasto, 2006; Filppula, Klemola & Paulasto, 2009). For example, Penhallurick (2004, p. 102) notes that "in STRUT there is a marked tendency to a vowel raised and centralised compared with English RP /ʌ/, even to the extent that [ə] is a common variant". This is often attributed to the influence of Welsh where /ʌ/ is absent and /ə/ can appear in stressed or unstressed syllables (Ball & Williams, 2001).

2.2. The role of linguistic experience in speech production

A large number of studies have highlighted phonetic differences between monolingual and bilingual speakers (e.g., Guion, 2003; Kehoe, Lléo & Rakow, 2004; Elordieta & Calleja, 2005; Fowler, Sramko, Ostry, Rowland & Halle, 2008). They support the view that a bilingual speaker's two languages constitute separate, but non-autonomous systems that mutually influence each other (Paradis, 2001).

A number of different extra-linguistic factors have been shown to influence variation among bilingual speakers, particularly in migrant contexts (e.g. Adamson & Regan, 1991; Drummond, 2010; McCarthy, Evans & Mahon, 2013) and among those who have acquired a second language later in life (see Piske, MacKay & Flege, 2001 for

a review). In particular, age of acquisition has been shown to have an important influence on bilingual and second language speech, either because of maturational constraints (a decrease in neuroplasticity which inhibits language acquisition, cf. Højen & Flege, 2006), or because there is a correlation between age of acquisition and other factors such as language use (cf. Flege, 2007).

Fewer studies have examined the role of linguistic background on *bilingual* speech production and in situations of long-standing societal or regional bilingualism. Guion (2003), for instance, examined the vowel systems of 20 Quichua-Spanish bilinguals. The vowels of the two languages differ according to descriptive accounts, and most speakers who had acquired Spanish before the age of seven, and half of those who had acquired the language before the age of 14 maintained a cross-linguistic difference. Not only was the production of bilinguals' L2 found to correlate with age of acquisition, Guion (2003) also found that those early acquirers who distinguished their vowel productions in the two languages, also produced their L1 Quichua vowels differently to those who had acquired Spanish later.

Simonet (2010) examined the production of /l/ in the speech of Catalan-Spanish early bilinguals who differed in their home language and language dominance. He found differences between dominant and non-dominant speakers' productions in each language, although most early bilinguals did differentiate between the two languages. Those speakers who did have a merged /l/ category for both languages tended to be Spanish-dominant females which, Simonet (2010: 676) suggests, may be due to socio-indexical reasons in that "these speakers may intend to distance themselves from what they may perceive as Catalan-accented Spanish" (see also Simonet, 2011).

2.3. The role of the peer group

There is a large body of literature devoted to language variation in adolescents' speech, and in particular to the role of adolescents in language change (see, for instance, Kirkham & Moore (2013) and references therein). Adolescence marks an important period in linguistic development and speakers turn away from caregivers as their models of acquisition and inevitably turn to their peer group (Kerswill & Williams, 2000). Work, such as Eckert (1989; 2000) has shown, however, that language variation is likely to occur *within* the wider peer group as smaller 'Communities of Practice' (CofPs; Eckert & McConnell-Ginet, 1992) construct different social identities. The construction and performance of these identities may result in different linguistic behaviour between CofPs and may furthermore be inherently linked to other factors, such as ethnicity (Mendoza-Denton, 1996; Alam & Stuart-Smith, 2011; Kirkham, 2013) or social background (Moore, 2010).

There have been a number of studies on the acquisition of a second language in adolescent peer groups. Such studies tend to focus on Type 2 variation, which Mougeon, Rehner & Nadasdi (2004, p. 409) define as 'aspects of the target language where native speakers display sociolinguistic variation, that is they alternate between variants'. Mougeon et al. (2004) investigated a range of variables in the speech of adolescent school students in French immersion education in Canada, where over 50% of the teaching is delivered in French, and found that variation patterned differently in their speech when compared to corpora of native speakers.

More recent studies have compared the acquisition of native speaker variation by comparing native and non-native speech from speakers in the same peer groups. For example, Schleef, Meyerhoff & Clark (2011) examined Polish teenagers' acquisition of variation in Edinburgh and London by comparing groups of students from the same schools (see also Clark & Schleef 2010; Meyerhoff & Schleef 2012). Although there were differences between the two groups, they found that the Polish teenagers were acquiring

native speakers' productions of (ing), especially those who had a mixture of Polish and British friends.

Nance (2013) investigated the role of identity in the context of variation and change in Scottish Gaelic. She compared both older and younger speakers from the Isle of Lewis and younger speakers from Glasgow. All of the younger speakers were attending Gaelic-medium schools and the majority did not speak Gaelic at home. Differences were not only found in the production of the alveolar laterals, [ɯ], and intonation between older and younger speakers, but she also reports areal variation between the younger speakers, and variation based on communities of practice in the individual schools. For instance, she found that two female peer groups in Glasgow differed in their production of [ɯ] in Gaelic, whereas this was not the case in English (see also Nance, 2014, 2015).

Morris (2013) examined variation in the realisation of /l/ and /r/ in both the Welsh and English speech of Welsh-English bilinguals in Welsh-medium education where all subjects apart from English are delivered in Welsh. He found that language use and home language were highly correlated with peer group membership in the Welsh-dominant town of Caernarfon, whereas this was not the case in the English-dominant town of Mold (Morris, 2014). In both areas, home language was found to be a significant predictor of /r/ production despite subtle differences in peer group dynamics. Interestingly, neither home language nor area (Welsh-dominant or English-dominant) affected variation of /l/, which is assumed to be heavily velarised under the influence of Welsh (Penhallurick, 2004, p. 118).

2.4. Welsh and English in Wales

The present study is set in Wales where Welsh, a member of the Brythonic branch of Celtic languages, and English have been in contact for centuries. According to the 2011 Census (Office for National Statistics, 2012) the Welsh language is spoken by some 562,016 people or 19% of the population of Wales. The geographical distribution of Welsh speakers is uneven, however, resulting in a complex sociolinguistic situation. Thus, large parts of the country, in particular the more heavily populated areas in the south-east, are predominantly monolingual English-speaking, while Welsh-language strongholds are found in northern and western areas.

Interestingly, there are distinct literatures on Welsh and Welsh English. With respect to the former, studies have mainly concentrated on individual areas and taken a traditional dialectological approach (see Thomas & Thomas, 1989 for an overview). Descriptive accounts of the phonetic and phonological properties of Welsh, in turn, have focused on the two main accents of the language: northern and southern Welsh (Ball & Williams, 2001). These have been supplemented in recent years with instrumental phonetic studies (e.g., Mayr & Davies, 2009, 2011).

Welsh English accents have also been examined as part of larger dialect surveys (Parry, 1977, 1979; Penhallurick, 1991). However, in addition, there is a wealth of studies that operate within a variationist paradigm and focus on the predominantly monolingual English-speaking areas of the south and south-east (e.g., Collins & Mees, 1990; Mees & Collins, 1999; Walters, 1999, 2011). While Welsh phonology is cited as the defining influence on Welsh English accents (Wells, 1982), these studies also highlight many patterns that cannot be ascribed to the Welsh language. Collins and Mees (1990: 87f) have, for instance, shown that Cardiff English shares many properties

with accents from across the Welsh-English border, such as a distinction between clear and dark /l/ or the extensive use of assimilation and elision.

Although there is hence an abundance of work on Welsh phonology and on Welsh English accents, there are surprisingly few studies on the accents of Welsh-English bilinguals which consider home language (cf. Morris, 2013), and no comparisons with monolingual English speakers who live in the same community. The present study aims to focus on this latter issue by investigating vowel realisations in the speech of monolingual and bilingual adolescents who attend a bilingual school in Carmarthenshire, West Wales. The inclusion of monolingual speakers not only made it possible to explore the role of individual linguistic experience in vowel production more fully, but also to differentiate it from the effects of long-term contact between Welsh and English.

3. Methodology

3.1. Participants

Thirty males from the Ammanford area of Carmarthenshire in South West Wales participated in the study. The participants were all aged between 16 and 18 years at the time of data collection, and were recruited from a Sixth Form unit[1] at a local secondary school. The school allows pupils either to follow the curriculum wholly in English (with the exception of Welsh Second Language), or to receive up to 80% of their teaching through the medium of Welsh.

Three groups of participants were distinguished: (1) Welsh-English bilinguals from Welsh-speaking homes, i.e. group BIL WELSH; (2) Welsh-English bilinguals from English-speaking homes who had acquired Welsh solely via immersion education,

i.e. group BIL ENGLISH, and (3) English monolinguals, i.e. group MONO E. Both sets of bilinguals followed the Welsh-medium pathway, the English monolinguals the English-medium pathway. Each of the three groups comprised ten participants. All were male so as to facilitate acoustic comparisons.

Table 1. *Self-reported weekly use of Welsh amongst participants from Welsh-speaking (W) and English-speaking (E) homes.*

Speaker	**% parents**	**% siblings**	**% school friends**	**% friends from outside school**	**% in the community**	**% media**
W1	80	100	5	0	10	25
W2	80	70	20	0	0	5
W3	100	50	0	0	0	0
W4	100	100	0	0	0	25
W5	80	50	0	0	0	0
W6	95	90	0	0	50	20
W7	100	N/A	10	20	10	10
W8	90	N/A	0	0	50	0
W9	100	100	20	25	5	5
W10	80	50	30	55	0	40
E1	0	10	0	20	0	20
E2	0	5	0	0	0	0
E3	0	N/A	5	0	0	0
E4	0	N/A	0	0	0	10
E5	0	N/A	0	5	5	10
E6	0	N/A	2	0	0	20
E7	0	50	0	0	10	10
E8	0	0	0	0	25	0
E9	0	N/A	0	0	0	20
E10	0	0	0	0	0	0

Table 1 depicts the self-reported weekly use of Welsh by the bilingual participants. Inspection of the table shows that the two groups predominantly differ in terms of their language use with parents and siblings. Thus, in the BIL WELSH group, Welsh is the primary language used with parent(s) and sibling(s). Speakers W3, W5,

and W10 reported using both Welsh and English equally often with their siblings, although it was revealed that siblings conversed in English primarily at school rather than in the home. In contrast, in the BIL ENGLISH group, no Welsh is used with parents and the use of Welsh amongst siblings is also low.

Further inspection of the domains included in the questionnaire (friends from school, friends from outside school, the wider community, and media) shows a slight tendency for those from Welsh-speaking homes to use Welsh more frequently, although Welsh appears not to be a majority language in any domain. The participants reported that the main language of peer interaction at the school is English, while Welsh is only occasionally used between pairs of speakers and in small groups. Indeed, participants reported that peer groups were formed based on common interests such as sport, music, or school work rather than preferred languages.

The participants in the monolingual English group are 'functional monolinguals' insofar as they received all their education through the medium of English, except during compulsory Welsh L2 classes. This involved 2.5 hours of Welsh lessons per week until the age of 16. Nevertheless, they reported being unable to speak or express themselves in Welsh beyond a few words or simple sentences. This is not surprising in the Welsh context, where the provision of Welsh as a second language has been subject to much criticism following an in-depth review by the Welsh Government (2013) that showed poor standards and lack of attainment.

3.2. Materials and Procedure

Data were collected in English from the monolingual participants, and in English and Welsh from the bilingual participants. All sessions were recorded in WAV format using

a Zoom H2 Handy Recorder with integrated microphone. The sampling frequency of the recordings was 96 kHz with 16-bit quantization.

Each Welsh-English bilingual participant was allocated two recording sessions of approximately 30 minutes, which took place on different days in a quiet room on the school premises. Unlike many sociolinguistic studies, we opted for an experimental design involving a reading task, rather than more naturalistic approaches. This was done to minimise the effects of different speaking styles and phonetic contexts, thereby creating a relatively formal setting. Upon encountering the participants for the first time, the fieldworker collecting the data spoke solely in English so that the participants were not aware that he was able to speak Welsh. This was done in an attempt to set the participants in a monolingual English LANGUAGE MODE (cf. Grosjean, 1989). The second session took place solely through the medium of Welsh. Monolingual English participants were recorded on a separate visit to the school.

Table 2 depicts the target words used in the study together with corresponding IPA symbols, and for English STANDARD LEXICAL SETS (Wells, 1982). In order to account for phonetic context effects, the relevant categories were embedded in a /hVd/ frame. The Welsh categories were selected on the basis of previous auditory and acoustic descriptions (Ball & Williams, 2001; Mayr & Davies, 2011). Thus, Southern Welsh has eleven monophthongs, while Northern Welsh has an additional two central vowels. To determine whether the participants' inventory featured these northern Welsh categories, they were initially included in the study and represented by the words *hûd* and *hud*. However, *hîd* and *hûd* as well as *hid* and *hud* were homophonous for all participants, and consistently produced as /iː/ and /ɪ/, respectively. As a result, the two sets of categories were merged.

Table 2. *Target words and corresponding IPA symbols.*

Welsh		**English**		
Target word	***IPA***	***Target word***	***Standard Lexical Set***	***IPA***
had	/a/	had	TRAP	/a/
hâd	/ɑ/	hard	PALM	/ɑ/ ~ /aː/
hed	/ɛ/	head	DRESS	/ɛ/
hêd	/e/	hared	SQUARE	/ɛː/
hid/hud	/ɪ/	hid	KIT	/ɪ/
hîd/hûd	/i/	heed	FLEECE	/iː/
hod	/ɔ/	hod	LOT	/ɒ/ ~ /ɔ/
hôd	/o/	hoard	THOUGHT	/oː/
hwd	/ʊ/	hood	FOOT	/ʊ/
hŵd	/u/	who'd	GOOSE	/uː/
hyd	/ə/	hud	STRUT	/ʌ/ ~ /ə/
		herd	NURSE	/əː/ ~ /œː/

The English monophthong categories included in the study were based on previous accounts of South Wales English vowels (Collins & Mees, 1990; Mees & Collins, 1999; Penhallurick, 2004; Walters, 1999, 2001; Wells, 1982). They largely map onto RP phonemes, but with different phonetic realisations. Note that there is a phonemic split between GOOSE and JUICE in Carmarthenshire English, with the former realised as a fully back monophthong and the latter as the diphthong /ɪʊ/. Note also that SQUARE is consistently monophthongised in this variety, and was hence included amongst the monophthong categories. GOAT and FACE, in turn, which are sometimes realised as monophthongs in South Wales English, were not included in the analysis as all participants produced them consistently as diphthongs.

As some of the /hVd/ words are non-words, they were primed with two real words to ensure activation of the appropriate vowel category, following Mayr and Davies' (2011) approach. For example, the English words *deed* and *feed* preceded the

target *heed*. Each target token was embedded in the carrier phrase *Dyweda X* ("Say") in Welsh and *I say X* in English. Participants were asked to read the real words at a natural pace and then repeat the respective target word three times in the carrier phrase. A total of 39 tokens (3 x 13 monophthongs) were collected in Welsh from each participant, and 36 tokens (3 x 12 monophthongs) in English. Overall, this resulted in 767 Welsh tokens and 1073 English tokens being analysed (= 39 x 20 Welsh-speaking participants + 36 x 30 English-speaking participants), with 20 tokens excluded for poor recording quality.

3.3. Data analysis

Using PRAAT software (Boersma & Weenink, 2014), the vowels were isolated from neighbouring segments at the first positive peak in the waveform and at the final peak before acoustic silence. A PRAAT script automatically collected the duration of the segmented vowels in milliseconds. As a control procedure, eight tokens from each speaker were checked manually in each language. No incorrect measurements of duration were found amongst the manually checked tokens. Subsequently, the first and second formant frequencies of each vowel token were measured at the vowel midpoint using PRAAT's formant tracking function, set at a frequency maximum of 5500Hz with a dynamic range of 35dB. Any incorrect automatic measurements as a result of mistracking were hand corrected. Raw Hertz values were converted into Bark (Traunmüller, 1990) to correspond to an auditory measure of frequency.

4. Results

Three sets of analyses were carried out. In what follows, we will first present a

comparison of the monolingual and bilingual participants' English vowel productions. Subsequently, the bilingual participants' realisations of the Welsh vowels will be discussed. The purpose of these analyses was to determine the effects of individual linguistic experience on vowel production. Finally, in order to determine the extent of phonetic overlap between English and Welsh vowels, the results of a cross-linguistic comparative analysis will be presented.

4.1. English vowels

Figure 1 presents the mean F1 and F2 values (in Bark), and figure 2 the durations of the English vowels produced by the Welsh-English bilinguals from Welsh-speaking homes, the Welsh-English bilinguals from English-speaking homes and the English monolinguals. For full details see Appendix 1.

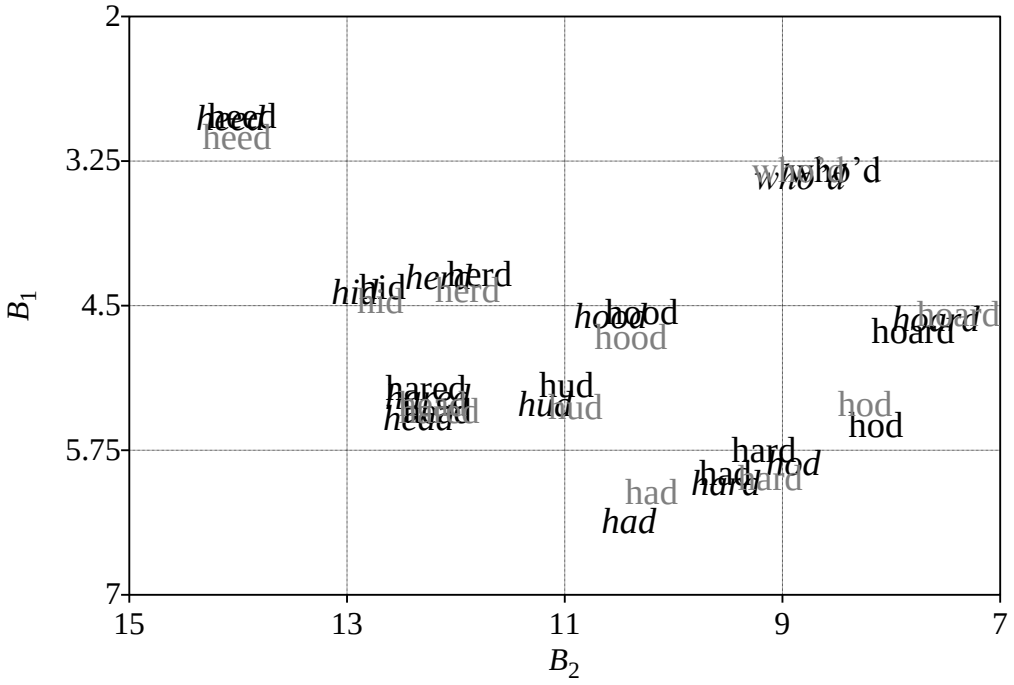

Figure 1. *F1~F2 plot (in Bark) of the English vowels produced by the Welsh-English bilinguals from Welsh-speaking homes (black), the Welsh-English bilinguals from English-speaking homes (italics) and the English monolinguals (grey).*

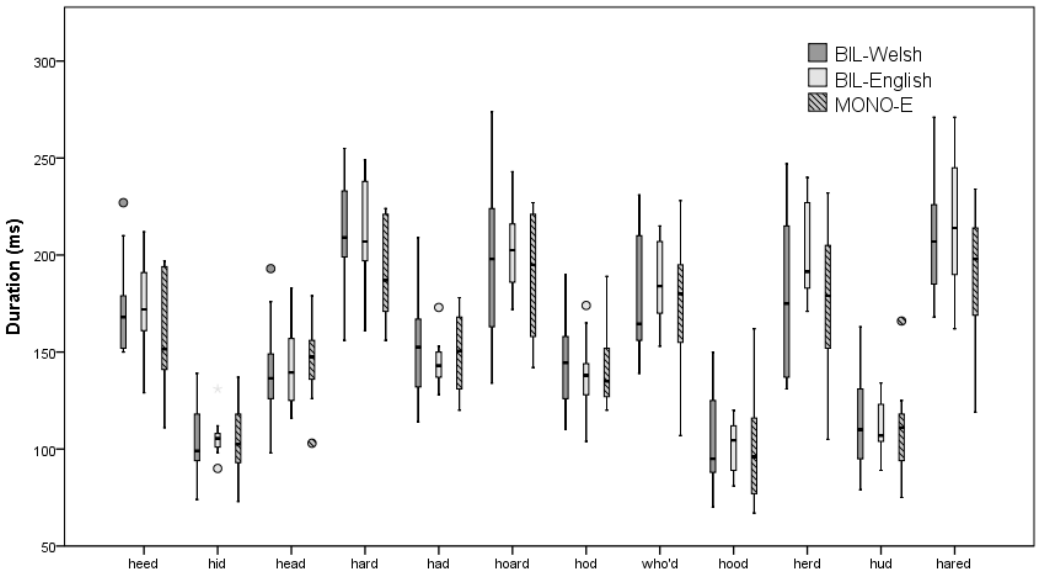

Figure 2. *Boxplot of the duration (in ms) of the English vowels produced by the Welsh-English bilinguals from Welsh-speaking homes, the Welsh-English bilinguals from English-speaking homes and the English monolinguals. BIL: Bilingual; MONO: Monolingual.*

Inspection of the figures suggests that the participants' realisations largely conform to previous accounts of South Wales English vowels (Collins & Mees, 1990; Mayr, 2010; Mees & Collins, 1999; Penhallurick, 2004; Walters, 1999, 2001; Wells, 1982). Thus, their KIT (*hid*) and DRESS (*head*) vowels are more open than in RP, their TRAP (*had*) and GOOSE (*who'd*) vowels are more retracted, their NURSE (*herd*) vowel is more fronted and their FOOT (*hood*) vowel is more centralised. Moreover, the patterns observed show little variability across the three groups, except perhaps for TRAP (*had*) and PALM (*hard*).

To serve our primary goal of investigating the effect of language background on duration, F1 (Bark) and F2 (Bark) in English vowel productions, linear mixed-effects regression modelling was used. A mixed-effects approach allows for control of issues

that are not of immediate interest, e.g., a slower speaking rate yielding longer duration values or a shorter vocal tract producing higher resonance frequencies.

Models were run separately for the three dependent variables of F1 (Bark), F2 (Bark) and duration, respectively, using all 1,073 English tokens. In each model, *English vowel* and *language group* were entered as fixed factors (including interaction) and *speaker* as a random factor with random intercepts for *speaker* and random slopes for *English vowel*. Random slopes were included to reflect the design of the task; recall that vowel tokens were collected in an experimental paradigm which yields data with a within-subjects structure. For a discussion on the use of random slopes in within-subjects designs, see Barr, Levy, Scheepers & Tily (2013).

For each model, *English vowel* was coded around zero, such that each of the 12 English vowels with means less than the grand mean of the dependent variable were coded < 0 in descending order, and those with means greater than the grand mean were coded > 0 in ascending order. *Language group* was coded such that the English-dominant group was 0 and the Welsh-dominant and English monolingual groups were 1 and -1, respectively. As the coding of the fixed factors was always centred on zero, the intercept of each model is the grand mean of that dependent variable and the fixed factors can be interpreted as main effects. Degrees of freedom were obtained using the Satterthwaite approximation with which p-values could be generated. We use an α-level of 0.05 throughout for hypothesis testing.

The results of the three models for each dependent variable are displayed in Table 3. Unsurprisingly, there were main effects of *English vowel* on F1 (Bark), F2 (Bark) and duration, which indicates that the 12 English vowels were indeed produced with different acoustic values. Interestingly, however, there were no significant main effects or interactions involving *language group* on any of the three measures,

suggesting the three groups do not differ in how they produce vowels in English despite differing linguistic experience.

Table 3. *Results of the mixed-effect models for English F1 (Bark), F2 (Bark) and duration (ms).*

Model		*ß*	SE	*t*	*p*
English F1 (Bark)	Intercept	4.83	0.05	104.64	< 0.001
	English Vowel	0.26	0.01	31.31	< 0.001
	Language Group	-0.04	0.06	-0.72	0.479
	English Vowel × Language Group	0.00	0.01	0.09	0.932
English F2 (Bark)	Intercept	10.71	0.05	202.81	< 0.001
	English Vowel	0.53	0.01	44.80	< 0.001
	Language Group	-0.02	0.06	-0.36	0.720
	English Vowel × Language Group	-0.00	0.01	0.01	0.990
English duration (ms)	Intercept	157.16	4.05	38.83	< 0.001
	English Vowel	10.28	0.44	23.33	< 0.001
	Language Group	3.72	4.96	0.75	0.459
	English Vowel × Language Group	0.81	0.54	1.50	0.146

4.2. Welsh vowels

Figure 3 presents the mean F1 and F2 values (in Bark), and figure 4 the duration of the Welsh vowels produced by the two sets of bilinguals. For full details, see Appendix 2.

The results obtained here conform closely to those reported for Southern Welsh vowels (Mayr & Davies, 2011). For example, in line with southern but not northern varieties of Welsh, the participants' realisation of *hed* is comparatively close, as represented by a low F1 (Bark) frequency. Inspection of figures 4 and 5 suggests similar patterns for the two sets of bilinguals, with some variability in the production of *hâd* and *had*, and slightly longer mean durations by the Welsh-English bilinguals from English-speaking homes.

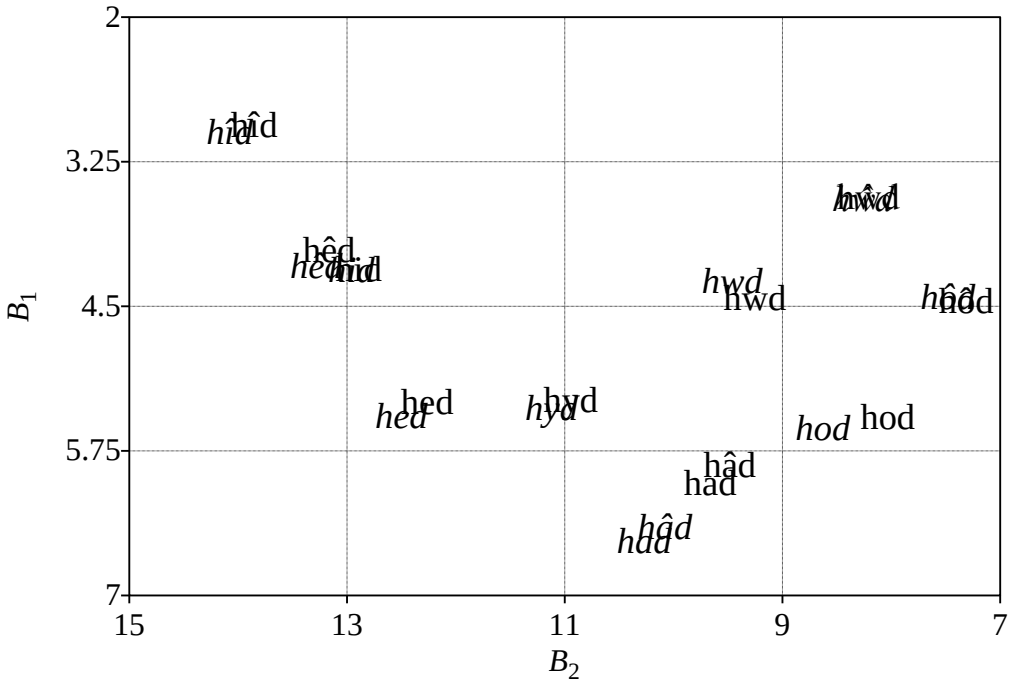

Figure 3. *F1~F2 plot (in Bark) of the Welsh vowels realised by the Welsh-English bilinguals from Welsh-speaking homes (black) and the Welsh-English bilinguals from English-speaking homes (italics).*

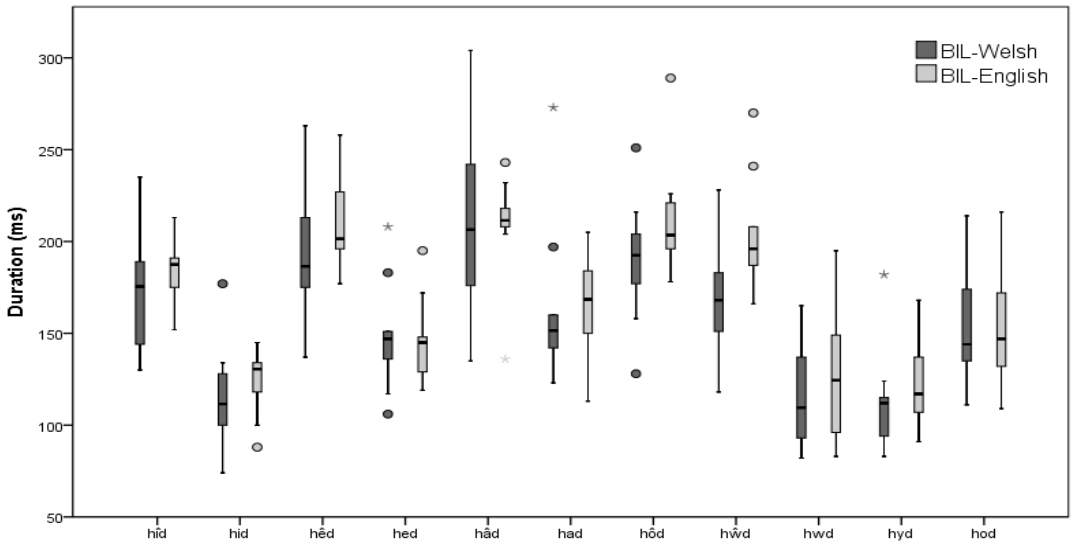

Figure 4: *Boxplot of the duration (in ms) of the Welsh vowels produced by the Welsh-English bilinguals from Welsh-speaking homes and the Welsh-English bilinguals from English-speaking homes. BIL: Bilinguals; MONO: Monolinguals.*

To serve our primary goal of investigating the effect of home language background on F1 (Bark), F2 (Bark) and duration in Welsh vowel productions, linear mixed-effects modelling was performed on the 767 Welsh tokens in analogous way to the previous analysis for English. This time the fixed factors (with interaction among them) were *Welsh vowel* (11 vowels) and *language group* (either Welsh-dominant or English-dominant), and *speaker* was entered as a random factor with random slopes for *Welsh vowel*.

The results are displayed in Table 4. As expected, there were main effects of *Welsh vowel* on the three dependent variables, demonstrating that the 11 vowels are realised with different acoustic values. Interestingly, there were no main effects or interactions involving *language group* on any of the three measures. This suggests that differences in home language use across the two bilingual groups did not affect their vowel realisations in Welsh.

Table 4. *Results of the mixed-effect models for Welsh F1 (Bark), F2 (Bark) and duration (ms).*

Model		b	SE	t	p
Welsh F1 (Bark)	Intercept	4.75	0.06	75.55	< 0.001
	Welsh Vowel	0.32	0.01	26.33	< 0.001
	Language Group	0.14	0.13	1.08	0.295
	Welsh Vowel × Language Group	0.04	0.02	1.52	0.145
Welsh F2 (Bark)	Intercept	10.60	0.08	128.32	< 0.001
	Welsh Vowel	0.68	0.02	36.48	< 0.001
	Language Group	0.25	0.17	1.49	0.155
	Welsh Vowel × Language Group	0.02	0.04	-0.46	0.651
Welsh duration (ms)	Intercept	163.31	5.39	30.29	< 0.001
	Welsh Vowel	10.48	0.55	19.09	< 0.001
	Language Group	9.60	10.78	0.89	0.385
	Welsh Vowel × Language Group	1.17	1.10	1.06	0.301

4.3. Cross-linguistic comparison

By convention, the effects of language contact are established by comparing the productions of monolingual speakers cross-linguistically (cf. Meyerhoff, 2009). This was not possible in the present study, however, since all adult speakers of Welsh are also competent in English. As the Welsh-English bilinguals from Welsh-speaking homes use Welsh the most, with consistent exposure to the language at home and at school, it was decided to compare their realisations of the Welsh vowels with the English monolinguals' realisations of the English vowels.

Table 5. *Percent classification of Welsh vowel categories (Welsh-English bilinguals from Welsh-speaking homes) in terms of English vowel categories (English monolinguals); modal classifications are in bold.*

	had	**hâd**	**hed**	**hêd**	**hid**	**hîd**	**hod**	**hôd**	**hwd**	**hŵd**	**hyd**
had	**50**	10	0	0	0	0	0	0	10	0	0
hard	30	**80**	0	0	0	0	20	10	0	0	0
hared	0	0	20	10	0	0	0	0	0	0	10
head	0	0	**70**	0	10	0	0	0	0	0	0
heed	0	0	0	10	0	**100**	0	0	0	0	0
herd	0	0	10	**70**	0	0	0	0	0	0	0
hid	0	0	0	10	**90**	0	0	0	0	0	0
hoard	0	0	0	0	0	0	20	**90**	0	20	0
hod	10	10	0	0	0	0	**60**	0	20	0	0
hood	0	0	0	0	0	0	0	0	**60**	0	20
hud	10	0	0	0	0	0	0	0	0	0	**70**
who'd	0	0	0	0	0	0	0	0	10	**80**	0
Total	100	100	100	100	100	100	100	100	100	100	100

To establish which Welsh vowel categories were acoustically closest to which English ones, a LINEAR DISCRIMINANT ANALYSIS was conducted, in line with previous studies (e.g., Williams & Escudero, 2014a). The analysis initially involved generating linear discriminant functions on the basis of the F1 (Bark), F2 (Bark) and duration

values of the Welsh vowels produced by the Welsh-English bilinguals from Welsh-speaking homes. Subsequently, each of the English monolinguals' English vowel tokens were classified in terms of the closest linear discriminant function generated from the Welsh vowel set. Table 5 depicts the number of times (in percentages) that a particular Welsh vowel produced by the Welsh-English bilinguals from Welsh-speaking homes was categorised in terms of an English vowel category produced by the English monolinguals.

Inspection of the table indicates that all Welsh categories were classified in terms of a single English category in at least 50% of instances. The resulting cross-linguistic matches are not surprising, encompassing vowel categories with similar qualities, although this is less obvious for *hêd* and herd. In some cases, the cross-linguistic match was perfect or near-perfect. Thus, *hîd*, *hôd* and *hid* were classified in terms of their closest English category, i.e. *heed*, *hoard* and *hid*, respectively, in 90% of instances or more. In contrast, *had* was only classified in terms of its closest English category, i.e. *had* in 50% of instances. The only English category which was not classified as closest to any Welsh category was *hared*.

Figure 5 presents the mean F1 and F2 values (in Bark), and figure 6 the durations of the Welsh vowels produced by the Welsh-English bilinguals from Welsh-speaking homes and the English vowels produced by the English monolinguals.

To determine cross-linguistic differences in vowel realisation, three further mixed-effects models were run separately for F1 (Bark), F2 (Bark) and duration on the English tokens produced by English monolinguals and the Welsh tokens produced by the Welsh-dominant bilinguals. The fixed factors (with interaction among them) were *vowel pair* (i.e., values collapsed across *hîd-heed, hid-hid, hêd-herd, hed-head, had-had, hâd-hard, hôd-hoard, hod-hod, hŵd-who'd, hwd-hood, hyd-hud*) and *language*

group (monolingual English or Welsh-dominant bilingual) and the random factor was *speaker*. Random slopes were not entered because *vowel pair* is not a factor repeated across all participants in the model as the tokens come from two experiments with different within-subjects items.

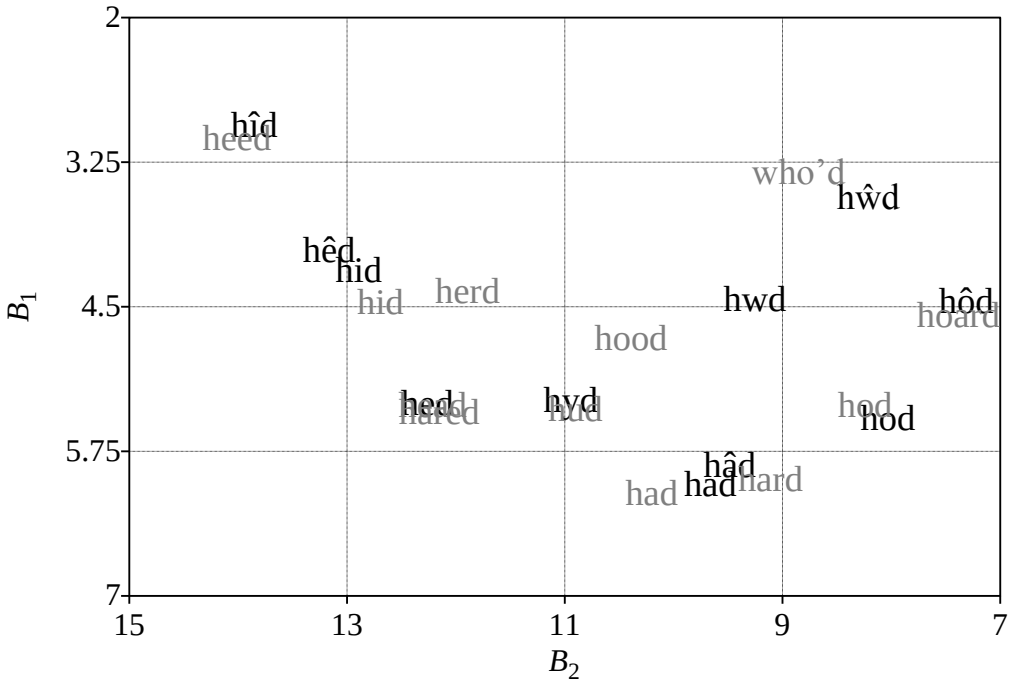

Figure 5: *Mean F1~F2 plot (in Bark) of the Welsh vowels produced by the Welsh-English bilinguals from Welsh-speaking homes (black) and the English vowels produced by the English monolinguals (grey).*

The results are depicted in Table 6. They revealed main effects of *vowel pair* on the three measures, which suggests, unsurprisingly, that the 11 vowels were produced differently. Interestingly, there were no significant main effects or interactions involving *language group* on almost all measures, suggesting a high degree of phonetic overlap between English and Welsh vowels. However, there was a significant *vowel pair* × *language group* interaction on F2 (Bark), which suggests that the two groups produced some vowels differently on this measure.

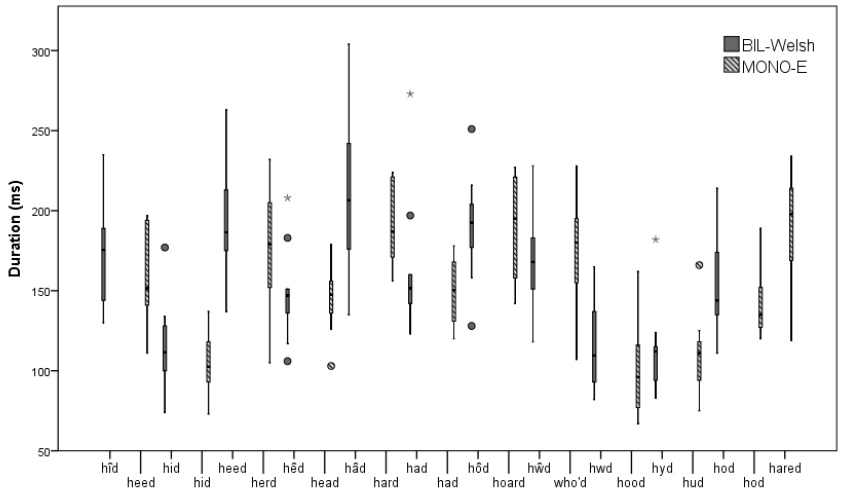

Figure 6: *Boxplot of the duration (in ms) of the Welsh vowels produced by the Welsh-English bilinguals from Welsh-speaking homes and the English vowels produced by the English monolinguals. BIL: Bilingual; MONO: Monolingual.*

Table 6. *Results of the mixed-effect models for vowel pair F1 (Bark), F2 (Bark) and duration (ms).*

Model		***ß***	**SE**	***t***	***p***
Mixed F1 (Bark)	Intercept	4.74	0.06	85.99	< 0.001
	Vowel Pair	0.29	0.01	55.34	< 0.001
	Language Group	-0.12	0.11	-1.05	0.308
	Vowel Pair × Language Group	-0.01	0.01	1.30	0.195
Mixed F2 (Bark)	Intercept	10.48	0.05	190.86	< 0.001
	Vowel Pair	0.64	0.01	80.10	< 0.001
	Language Group	0.09	0.11	0.82	0.424
	Vowel Pair × Language Group	-0.06	0.02	-3.59	< 0.001
Mixed duration (ms)	Intercept	153.44	6.05	25.37	< 0.001
	Vowel Pair	9.64	0.30	32.55	< 0.001
	Language Group	-10.22	12.09	0.85	0.409
	Vowel Pair × Language Group	-0.32	0.59	0.54	0.592

To examine the *vowel pair* × *language group* interaction on F2 (Bark), we ran separate regression models for each *vowel pair* with *language group* as a fixed factor and *speaker* as a random factor. Of the 11 vowel pairs, *language group* proved to be a significant predictor of F2 (Bark) only for *hêd-herd* and *hwd-hood*. As shown in Table 7, the F2 of *herd* of is on average 1.28 Bark lower than that of *hêd*, and the F2 of *hood* is on average 1.14 Bark higher than that of *hwd*.

Table 7. *Significant predictor of language group in vowel pair F2 (Bark) mixed-effect models*.

Model		***ß***	**SE**	***t***	***p***
hêd-herd F2	Intercept	12.52	0.6	215.60	< 0.001
(Bark)	Language Group	-1.28	0.12	-11.00	< 0.001
hwd-hood F2	Intercept	9.81	0.20	48.08	< 0.001
(Bark)	Language Group	1.14	0.41	2.80	0.012

5. Discussion

This study investigated socio-phonetic variation in the speech of adolescent males attending the Sixth Form of a bilingual school in West Wales. In order to capture fine-grained differences in the participants' accents, we focused on vowel realisations, using acoustic methods of analysis. The purpose of the study was twofold. First, we sought to determine how long-term language contact has affected the vowel systems of Welsh and English in this community. Second, we aimed to examine the role of individual linguistic experience in the participants' vowel realisations. Together, this made it possible for us to disentangle the effects of language contact and individual bilingualism. In what follows, we will first consider the implications of our cross-linguistic findings in the context of sound changes in language contact situations.

Subsequently, the role of linguistic experience in such settings and the consequences of our findings for peer group identity and Welshness will be discussed.

5.1. Sound changes in language contact situations

This study has been the first to investigate the effects of long-term language contact on the sound systems of Welsh and English. This was done by systematically comparing the English vowel realisations of English monolinguals with the Welsh vowel realisations of Welsh-English bilinguals from Welsh-speaking homes who live in the same community. The results indicate that nine out of eleven cross-linguistic vowel pairs were produced identically in the two languages in terms of F1, F2 and duration. At the same time, we also found clear evidence for language-specific vowel categories in both languages. How can these patterns be explained?

Theoretically, the vowel systems of Welsh and English could have become more alike as a result of internal mechanisms, rather than through external contact, for example by being subject to similar internal pressures (Silva-Corvalán, 2000). Indeed, we cannot rule out this possibility altogether in the absence of historical records. However, given the history of the area with mass acquisition of L2 English and a subsequent partial language shift from Welsh to English, we contend that it is more likely for the observed changes to be contact-induced. Thus, despite the absence of data from earlier periods, the large number of shared accentual features in present-day varieties of English and Welsh in Wales (Collins & Mees, 1990; Mees & Collins, 1999; Penhallurick, 2004; Walters, 1999; 2001; Wells, 1982) suggests that "convergence between the two languages took place as a result of transfer from Welsh to English when Welsh monolinguals became bilingual in English, and that this transfer effect

remained as a substrate feature in areas where there was a shift from Welsh-English bilingualism to English" (Morris, 2013: 30).

Given this scenario, the vowel categories that are non-distinct in Welsh and English then constitute instances of convergence. There is, of course, plenty of evidence for converging sound systems in the literature (Bullock & Gerfen, 2004; Campbell & Muntzel, 1989; Chang, 2009; Colantoni & Gurlekian, 2004; Louden & Page, 2005). What is remarkable about the patterns observed here is the sheer *extent* of it. Thus, unlike previous studies, which have mainly shown a few individual categories being affected, in the present study convergence is pervasive. This may be the case because we are dealing with a relatively stable language contact setting involving a historical substrate in Wales.

This study not only found evidence for large-scale convergence, but also for language-specific patterns. Thus, English NURSE (*herd*), FOOT (*hood*) and SQUARE (*hared*) were distinct from all Welsh categories, and Welsh *hwd* and *hêd* were distinct from all English categories. Some of these may have evaded convergence because there is no cross-linguistic 'counterpart' with similar phonetic and phonological properties to assimilate to. For example, Welsh has no equivalent to the English long mid vowel NURSE, and hence when English was first adopted, it would have been difficult to assimilate the vowel to an existing Welsh vowel category. Instead, a new category would have had to be created for it (cf. Flege's (1995) SPEECH LEARNING MODEL).

Other distinct categories could have converged in terms of a cross-linguistic counterpart being present, but for some reason did not do so. Amongst these, a particularly interesting case is English FOOT which is much more fronted than its Welsh counterpart *hwd*. This pattern is intriguing in the light of widespread evidence for back vowel fronting in varieties of English around the world (Cox & Palethorpe, 2001;

Ferragne & Pellegrino, 2010; Williams & Escudero, 2014b). FOOT in Carmarthenshire English may have followed this global trend, perhaps because fronted variants are perceived to have greater prestige. The patterns observed here hence indicate that English FOOT DIVERGED from its Welsh counterpart. As such, this study has provided evidence for both vocalic convergence and divergence in a single language contact situation.

5.2. Linguistic experience, peer group identity and Welshness

One of the key aims of this research was to disentangle the effects of long-term language contact and individual linguistic experience. To identify the former, we carried out the cross-linguistic comparison discussed in the previous section. To determine the role of linguistic experience, in turn, we examined the vowel realisations of three groups of speakers: (1) Welsh-English bilinguals from Welsh-speaking homes, (2) Welsh-English bilinguals from English-speaking homes, and (3) English monolinguals. The results revealed no difference among the three groups in the realisation of the English vowels, and no difference between the two sets of bilinguals in the realisation of the Welsh vowels. Overall, the study hence did not find any effect of linguistic experience. This is surprising considering most previous studies on bilingual speech have found differences between monolinguals and bilinguals (e.g., Kehoe et al., 2004; Fowler et al., 2008; Guion, 2003; Paradis, 2001; but see MacLeod, Stoel-Gammon & Wassink, 2009; Mennen, 2004), and between bilinguals who differ in their linguistic experience (e.g., Mayr, Howells & Lewis, 2015; Simonet, 2010).

To some extent, these patterns can be explained with reference to the cross-linguistic analysis reported above. Thus, one would not expect any between-group differences for categories that are non-distinct in the two languages. However, as we

have seen, Welsh and English also distinguish several language-specific categories, where differences between the groups could show up. The lack of any experience-based effects can hence not be solely ascribed to language contact. Other factors must be responsible for the observed patterns, as well.

A possible candidate is peer group identity. Indeed, as reviewed in the introduction section, there is extensive evidence from sociolinguistic research which shows that the speech patterns of adolescents are crucially affected by the peer group to which they belong (Eckert, 1989, 2000; Morris, 2013; Nance, 2013, 2014, 2015; Schleef et al., 2011), with peer group identity being marked by specific speech patterns. Nance (2013), for instance, demonstrated that the two female friendship groups in the Gaelic-medium secondary school in her study systematically differed in their production of Gaelic [ʉ], with the more 'rebellious' group adopting realisations that are associated with Glaswegian working-class English. Similarly, Morris (2013) showed that differences in the realisation of English /r/ by Welsh-English bilingual adolescents from Caernarfon coincided with differences in social practice and identity. Thus, adolescents from Welsh-speaking homes used coda /r/ as well as the variants [r] and [ɾ] in English in order to differentiate themselves from their peers from English-speaking homes.

These findings differ substantially from those obtained here. Thus, in the present study, the participants were highly homogeneous in their social practices. With few exceptions, their sole language of peer interaction was English, and, unlike Morris' (2013) study, the ability to speak Welsh was not a relevant criterion for membership. Instead, the varieties of Welsh and English that are used in this community appear to function as markers of regional identity in much the same way for all participants. What we can tentatively conclude from the present study is then that the effects of linguistic

experience can be overridden under certain circumstances, and that one of these may be a highly homogeneous peer group with shared values and social practices. This hypothesis, however, requires more systematic testing in future research.

The findings may also have important implications for notions of Welshness and Welsh identity. Thus, assuming our findings can be extrapolated more widely to other accentual features and are confirmed in perception studies, we could conclude that it may be impossible to determine whether an individual from this community has Welsh or English as their home language purely on the basis of their accent in Welsh. Similarly, it may be impossible to determine whether an individual from this community is able to speak Welsh on the basis of their English accent. Consequently, any judgments of an individual's degree of Welshness may need to be based on factors other than their accent. As such, the findings obtained here differ considerably from those collected in settings where a person's degree of Welshness is identifiable in their accentual features, as in the community in North-West Wales that Morris (2013) studied. Future research will need to determine the precise social conditions under which accents in language contact situations become homogenised or develop locally-defined differences.

6. Conclusion

This study investigated the vowel productions of adolescent males from a bilingual school in West Wales. Its aim was to determine the effects of long-term language contact, and to differentiate them from those of individual linguistic experience. The results show that the continued co-existence of Welsh and English in the community has led to a high degree of phonetic overlap, suggesting advanced levels of cross-linguistic convergence. At the same time, we also found evidence for divergent patterns across the

two languages. At the individual level, the study revealed that the Welsh and English vowel realisations did not differ according to the participants' linguistic background. This is interesting as it differs from much of the previous work on bilingual speech, and indicates that the effects of linguistic experience can be overridden under certain circumstances. In the present study, we contend that a homogeneous peer group with shared social practices and values may have been responsible for the lack of between-group differences observed. This finding raises interesting questions for future research about the interrelation between accent and identity in language contact situations.

Before we can draw any definitive conclusions, it would, however, be useful to confirm our findings in a perception study. Perhaps listeners from this community make use of subtle cues that this study has not tested explicitly, such as aspects of vowel-inherent-spectral change. This will make it possible to determine whether it is indeed impossible to determine the ability of an individual from this community to speak Welsh based on their English vowel realisations, and the home language of a bilingual from this community based on their Welsh vowel realisations. More data are also needed from different settings, involving greater stylistic variation, to determine whether our results hold beyond the formal experimental setting of the present study. Finally, future work should go beyond vowels and target other areas of pronunciation with the potential for between-group differences. Such research may provide us with a better understanding of the socio-phonetic variation involved in complex language contact situations, as in Wales.

Notes

[1] In England, Wales and a number of other countries, *Sixth Form* (or *Key Stage 5*) refers to the last two years of secondary school during which students prepare for their A-level examinations, or equivalent qualifications that entitle them to enter university-level education.

References

Adamson, H. D. & Regan, V.M. (1991). The acquisition of community speech norms by Asian immigrants learning English as a second language: A preliminary study. *Studies in Second Language Acquisition, 13:1*, 1–22.

Alam, F. & Stuart-Smith, J. (2011). Identity and ethnicity in /t/ in Glasgow-Pakistani high-school girls. *Proceedings of the XVII International Congress of Phonetic Sciences*, 216-219.

Backus, A. (2004). Convergence as a mechanism of language change. *Bilingualism: Language and Cognition, 7,* 179-181.

Ball, M.J. & Williams, B. (2001). *Welsh Phonetics* (=Welsh Studies 17). Lewiston: The Edward Mellen Press.

Barr, D.J., Levy, R., Scheepers, C. & Tily, H.J. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language, 68,* 255-278.

Boersma, P. & Weenink, D. (2014). *Praat: doing phonetics by computer* (Version 5.3.82) <http://www.praat.org/> [retrieved 26th July 2014].

Bullock, B.E. & Gerfen, C. (2004). Phonological convergence in a contracting language variety. *Bilingualism: Language and Cognition, 7,* 95-104.

Campbell, L. & Muntzel, M.C. (1989). The structural consequences of language death. In N. Dorian (Ed.), *Investigating obsolescence: Studies in language contraction and death* (pp. 181-196). Cambridge: Cambridge University Press.

Chang, C.B. (2009). Convergence and divergence in language obsolescence. In M. Pak (Ed.), *Current issues in unity and diversity of languages* (pp. 933-952). Seoul, South Korea: Linguistic Society of Korea.

Clark, L. & Schleef, E. (2010). The acquisition of sociolinguistic evaluations among Polish-born adolescents learning English: Evidence from perception. *Journal of Language Awareness, 19:4,* 299–322.

Colantoni, L. & Gurlekian, J. (2004). Convergence and intonation: historical evidence from Buenos Aires Spanish. *Bilingualism: Language and Cognition, 7*, 107-109.

Collins, B. & Mees, I.M. (1990). The phonetics of Cardiff English. In N. Coupland & A.R. Thomas (Eds.), *English in Wales: Diversity, conflict and change* (pp. 87-103). Clevedon/ Philadelphia: Multilingual Matters.

Cook, E.-D. (1995). Is there convergence in language death? Evidence from Chipewyan and Stoney. *Journal of Linguistic Anthropology, 5,* 217–231.

Cox, F. & Palethorpe, S. (2001). The changing face of Australian English vowels. In D.B. Blair & P. Collins (Eds.), *Varieties of English around the world: English in Australia* (pp.17-44). Amsterdam: John Benjamins.

Drummond, R. (2010). Sociolinguistic variation in a second language: The influence of local accent on the pronunciation of non-native English speakers living in Manchester. PhD thesis, University of Manchester.

Eckert, P. (1989). The whole woman: Sex and gender differences in variation. *Language Variation and Change, 2*, 205-254.

Eckert, P. (2000). *Linguistic variation as social practice*. Oxford: Blackwell.

Eckert, P. & McConnell-Ginet, S. (1992). Think practically and look locally: Language and gender as community-based practice. *Annual Review of Anthropology*, 21, 461-490.

Elordieta, G. & Calleja, N. (2005). Microvariation in accentual alignment in Basque Spanish. *Language and Speech, 48(4),* 397–439.

Ferragne, E. & Pellegrino, F. (2010). Formant frequencies of vowels in 13 accents of the British Isles. *Journal of the International Phonetic Association, 40,* 1-34.

Filppula, M., Klemola, J. & H. Paulasto (2009).Vernacular universals and language contacts: an overview. In M. Filppula, J. Klemola & H. Paulasto (Eds.), *Vernacular Universals and Language Contacts: Evidence from Varieties of English and Beyond* (pp. 1-16). London/New York: Routledge.

Flege, J.E. (1995). Second language speech learning: Theory, findings, and problems. In W. Strange (Ed.) *Speech perception and linguistic experience: Issues in cross-language research* (pp. 233-277). Timonium, MD: York Press.

Flege, J. E. (2007). Language contact in bilingualism: Phonetic system interactions. In J. Cole, & J.Hualde (Eds.), *Laboratory Phonology 9* (pp. 353–381). Berlin: Mouton de Gruyter.

Fought, C. (1999). A majority sound change in a minority community: /u/-fronting in Chicano English. *Journal of Sociolinguistics, 3:1*, 5−23.

Fowler, C.A., Sramko, V., Ostry, D.J., Rowland, S.A. & Hallé, P. (2008). Cross-language phonetic influences on the speech of French-English bilinguals. *Journal of Phonetics,* 36, 649-663.

Grosjean, F. (1989). Neurolinguists beware! The bilingual is not two monolinguals in one person. *Brain and Language, 36*, 3-15.

Guion, S.G. (2003). The vowel systems of Quichua-Spanish bilinguals: Age of acquisition effects on the mutual influence of first and second languages. *Phonetica, 60,* 98-128.

Heselwood. B. & McChrystal, L. (1999). The effect of age group and place of L1 acquisition on the realisation of Panjabi stop consonants in Bradford: an acoustic sociophonetic study. *Leeds Working Papers in Linguistics and Phonetics, 7,* 49-68.

Højen, A. & Flege, J.E.. (2006). Early learners' discrimination of second-language vowels. *Journal of the Acoustical Society of America, 119: 5,* 3072–3084.

Holm, S. (1979). A simple sequentially rejective multiple test procedure. *Scandinavian Journal of Statistics, 6,* 65–70.

Holmes, J. (1996). Losing voice: Is final /z/ devoicing a feature of Maori English? *World Englishes,* 15:2, 193−205.

Kehoe, M.M., Lléo, C. & Rakow, M. (2004). Voice onset time in bilingual German-Spanish children. *Bilingualism: Language and Cognition, 7,* 71-88.

Kerswill, P. & Williams, A. (2000). Creating a new town koine: Children and language change in Milton Keynes. *Language in Society, 29:1,* 65−115.

Kirkham, S. (2013). Ethnicity, social practice and phonetic variation in a Sheffield secondary school. Ph.D. dissertation, University of Sheffield.

Kirkham, S. & E. Moore. (2013). Adolescence. In J. Chambers & N. Schilling (Eds.), *Handbook of Language Variation and Change* (pp. 277–296), Malden, Massachusetts: Wiley-Blackwell.

Louden, M.L. & Page, R. (2005). Stable bilingualism and phonological (non)convergence in Pennsylvania German. In J. Cohen, K. T. McAlister, K.

Rolstad, & J. MacSwan (Eds.), *ISB4: Proceedings of the 4th International Symposium on Bilingualism* (pp. 1384-1392). Somerville, MA: Cascadilla Press.

MacLeod, A., Stoel-Gammon, C., Wassink, A. (2009). Production of high vowels in Canadian English and Canadian French: A comparison of early bilingual and monolingual speakers. *Journal of Phonetics, 37*, 374–387.

Mayr, R. (2010). What exactly is a front rounded vowel? An acoustic and articulatory investigation of the NURSE vowel in South Wales English. *Journal of the International Phonetic Association, 40*, 93-112.

Mayr, R. & Davies, H. (2009). The monophthongs and diphthongs of North-eastern Welsh: An acoustic study. *Proceedings of the 10th Annual Conference of the International Speech Communication Association, INTERSPEECH 2009* (pp. 2315-2318). Brighton, UK.

Mayr, R. & Davies, H. (2011). A cross-dialectal acoustic study of the monophthongs and diphthongs of Welsh. *Journal of the International Phonetic Association, 41*, 1-25.

Mayr, R., Howells, G., & Lewis, R. (2015). Asymmetries in phonological development: The case of word-final cluster acquisition in Welsh-English bilingual children. *Journal of Child Language, 42*, 146-179.

McCarthy, K.M., Evans, B.G. & Mahon, M. (2013). Acquiring a second language in an immigrant community: The production of Sylheti and English stops and vowels by London-Bengali speakers. *Journal of Phonetics, 41(5)*, 344-358.

Mees, I. & Collins, B. (1999). Cardiff: A real-time study of glottalisation. In P. Foulkes & G. Docherty (eds.), *Urban voices: Accent studies in the British Isles*, pp. 185-202. London: Routledge.

Mendoza-Denton, N. (1996). "Muy Macha": Gender and ideology in gang girls' discourse about makeup. *Ethnos,* 61(1-2), 47-63.

Mennen, I. (2004). Bi-directional interference in the intonation of Dutch speakers of Greek. *Journal of Phonetics, 32*, 543-563.

Meyerhoff, M. (2009). Replication, transfer and calquing: Using variation as a tool in the study of language contact. *Language Variation and Change, 21,* 297-317.

Meyerhoff, M. & Schleef, E. (2012). Variation, contact and social indexicality in the acquisition of (ing) by teenage migrants. *Journal of Sociolinguistics, 16:3*, 398-416.

Moore, E. (2010). The interaction between social category and social practice: Explaining *was/were* variation. *Language Variation and Change, 22(3),* 347-371.

Morris, J. (2013). Sociolinguistic variation and regional minority language bilingualism: an investigation of Welsh-English bilinguals in North Wales. Ph.D. dissertation, University of Manchester.

Morris, J. (2014). The influence of social factors on minority language engagement amongst young people: an investigation of Welsh-English bilinguals in North Wales. *International Journal of the Sociology of Language,* 230, 65-89.

Mougeon, R., Rehner, K. & Nadasdi, T. (2004). The learning of spoken French variation by immersion students from Toronto, Canada. *Journal of Sociolinguistics, 8*, 408-432.

Nance, C. (2013). Phonetic variation, sound change, and identity in Scottish Gaelic. Ph.D. dissertation, University of Glasgow.

Nance, C. (2014). Phonetic variation in Scottish Gaelic laterals. *Journal of Phonetics*, 47, 1-17.

Nance, C. (2015). Intonational variation and change in Scottish Gaelic. *Lingua, 160,* 1-19.

Paradis, J. (2001). Do bilingual two-year-olds have separate phonological systems? *International Journal of Bilingualism, 5,* 19-38.

Parry, D. (1977). *The survey of Anglo-Welsh dialects*. *Volume 1*: *The South-East*. Swansea: University College Swansea.

Parry, D. (1979). *The survey of Anglo-Welsh Dialects*. *Volume 2*: *The South-West*. Swansea: University College Swansea.

Paulasto, H. (2006). *Welsh English Syntax: Contact and Variation* (University of Joensuu Publications in the Humanities 43) Joensuu: Joensuu University Press.

Penhallurick, R. (1991). *The Anglo-Welsh Dialects of North Wales: A Survey of Conservative Rural Spoken English in the Counties of Gwynedd and Clwyd.* Frankfurt am Main: Lang.

Penhallurick, R. (2004). Welsh English: Phonology. In E. W. Schneider, K. Burridge, B. Kortmann, R. Mesthrie & C. Upton (Eds.), *A handbook of the varieties of English. Volume 1: Phonology* (pp. 98-112). Berlin/New York: De Gruyter.

Piske, T., MacKay, I.R.A. & Flege, J.E. (2001). Factors affecting degree of foreign accent in an L2: a review. *Journal of Phonetics, 29,* 191-215.

Sankoff, G. (2001). Linguistic outcomes of language contact. In P. Trudgill & N. Schilling–Estes (Eds.), *Handbook of Sociolinguistics* (pp. 638–668). Oxford: Blackwell.

Schleef, E., Meyerhoff, M. & Clark, L. (2011). Teenagers' acquisition of variation: A comparison of locally-born and migrant teens' realisation of English (ing) in Edinburgh and London. *English World-wide, 32:2,* 206–236.

Schneider, E.W. (2011). *English Around The World: An Introduction*. Cambridge: Cambridge University Press.

Sharma, D. & L. Sankaran. (2011). Cognitive and social forces in dialect shift: Gradual change in London Asian speech. *Language Variation and Change,* 23:3, 399-428.

Silva-Corvalán, C. (2000). *Language contact and change*. Oxford: Clarendon Press.

Simonet, M. (2010). Dark and clear laterals in Catalan and Spanish: Interaction of phonetic categories in early bilinguals. *Journal of Phonetics, 38*, 663-678.

Simonet, M. (2011). Intonational convergence in language contact: Utterance-final F0 contours in Catalan-Spanish early bilinguals. *Journal of the International Phonetic Association*, 41:2, 157-184.

Thomas, A. (1997). English in Wales. In H.L.C. Tristam (Ed.), *The Celtic Englishes* (pp. 55-85). Heidelberg: Universitätsverlag Carl Winter.

Thomas, A. (Ed.). (2000). *The Welsh dialect survey*. Cardiff: University of Wales Press.

Thomas, B. & Thomas, P.W. (1989). *Cymraeg, Cymrâg, Cymrêg: Cyflwyno'r Tafodieithoedd*. Cardiff: Gwasg Tâf.

Thomason, S.G. (2001). *Language contact: An introduction*. Edinburgh: Edinburgh University Press.

Thomason, S.G. & Kaufman, T. (1988). *Language contact, creolization, and genetic linguistics*. Berkeley, Los Angeles, & London: University of California Press.

Traunmüller, H. (1990). Analytical expressions for the tonotopic sensory scale. *Journal of the Acoustical Society of America, 88*, 97-100.

Walters, J.R. (1999). A study of the segmental and suprasegmental phonology of Rhondda Valley's English. Ph.D. dissertation, University of Glamorgan.

Walters, J.R. (2001). English in Wales and a 'Welsh Valleys' accent. *World Englishes, 20*, 285-304.

Wells, J.C. (1982). *Accents of English 2: The British Isles*. Cambridge: Cambridge University Press.

Welsh Government. (2013). *One language for all: Review of Welsh second language at Key Stages 3 and 4*. <http://wales.gov.uk/docs/dcells/publications/130926-review-of-welsh-second-lan-en.pdf> [retrieved 16th January 2014].

Williams, D. & Escudero, P. (2014a). Influences of listeners' native and other dialects on cross-language vowel perception. *Frontiers in Psychology, 5*, 1065. doi: 10.3389/fpsyg.2014.01065.

Williams, D. & Escudero, P. (2014b). A cross-dialectal acoustic comparison of Northern and Southern British English vowels. *Journal of the Acoustical Society of America, 136*, 2751-2761.

Appendix 1: *Mean spectral values in Bark for the English monophthongs; 95% Confidence Intervals (lower bound; upper bound) in parentheses.*

		BIL-Welsh	**BIL-English**	**MONO-E**
heed	F1	2.87 (2.69; 3.05)	2.89 (2.7; 3.08)	3.05 (2.9; 3.21)
	F2	13.96 (13.76; 14.16)	14.05 (13.71; 14.39)	14.01 (13.75; 14.26)
hid	F1	4.35 (4.2; 4.49)	4.39 (4.18; 4.59)	4.47 (4.27; 4.67)
	F2	12.67 (12.49; 12.84)	12.91 (12.56; 13.27)	12.69 (12.38; 12.99)
head	F1	5.42 (5.15; 5.69)	5.48 (5.14; 5.82)	5.36 (5.03; 5.69)
	F2	12.17 (11.89; 12.44)	12.32 (11.98; 12.66)	12.21 (11.91; 12.52)
hard	F1	5.76 (5.45; 6.07)	6.04 (5.67; 6.41)	6 (5.63; 6.37)
	F2	9.17 (8.53; 9.81)	9.5 (9.18; 9.82)	9.11 (8.72; 9.51)
had	F1	5.96 (5.59; 6.33)	6.37 (5.85; 6.9)	6.12 (5.85; 6.39)
	F2	9.52 (8.97; 10.07)	10.39 (9.81; 10.98)	10.2 (9.66; 10.73)
hoard	F1	4.73 (4.38; 5.08)	4.63 (4.48; 4.78)	4.58 (4.36; 4.8)
	F2	7.8 (7.2; 8.41)	7.57 (7.26; 7.87)	7.38 (6.79; 7.97)
hod	F1	5.54 (5.23; 5.85)	5.87 (5.64; 6.1)	5.36 (5.04; 5.67)
	F2	8.14 (7.49; 8.79)	8.88 (8.5; 9.26)	8.24 (7.75; 8.72)
who'd	F1	3.34 (3.12; 3.55)	3.4 (3.2; 3.6)	3.34 (3.05; 3.63)
	F2	8.52 (7.81; 9.24)	8.82 (8.19; 9.46)	8.85 (8.17; 9.54)
hood	F1	4.56 (4.33; 4.79)	4.6 (4.45; 4.75)	4.78 (4.58; 4.98)
	F2	10.29 (9.97; 10.62)	10.56 (10.2; 10.91)	10.39 (9.91; 10.88)
herd	F1	4.24 (4.05; 4.42)	4.26 (4.02; 4.5)	4.37 (4.23; 4.51)
	F2	11.78 (11.57; 11.99)	12.14 (11.85; 12.43)	11.89 (11.66; 12.11)
hud	F1	5.2 (4.93; 5.46)	5.36 (5.05; 5.67)	5.39 (5.24; 5.54)
	F2	10.98 (10.74; 11.22)	11.16 (10.88; 11.45)	10.9 (10.66; 11.15)
hared	F1	5.22 (4.98; 5.45)	5.3 (5.03; 5.58)	5.42 (5.16; 5.68)
	F2	12.27 (12.08; 12.45)	12.24 (11.84; 12.64)	12.15 (11.82; 12.47)

Appendix 2: *Mean spectral values in Bark for the Welsh monophthongs; 95% Confidence Intervals (lower bound; upper bound) in parentheses.*

		BIL-Welsh	**BIL-English**
hîd	F1	2.94 (2.74; 3.14)	3 (2.79; 3.21)
	F2	13.85 (13.58; 14.12)	14.06 (13.62; 14.49)
hid	F1	4.19 (3.96; 4.41)	4.2 (3.98; 4.41)
	F2	12.89 (12.7; 13.09)	12.94 (12.56; 13.32)
hêd	F1	4.02 (3.85; 4.19)	4.16 (3.86; 4.47)
	F2	13.16 (13.01; 13.3)	13.26 (13.05; 13.46)
hed	F1	5.34 (5.08; 5.6)	5.46 (5.24; 5.68)
	F2	12.26 (12.11; 12.42)	12.48 (12.1; 12.86)
hâd	F1	5.88 (5.47; 6.28)	6.42 (5.97; 6.88)
	F2	9.48 (8.99; 9.97)	10.06 (9.51; 10.6)
had	F1	6.04 (5.65; 6.42)	6.54 (6.11; 6.97)
	F2	9.66 (9.18; 10.13)	10.25 (9.69; 10.81)
hôd	F1	4.46 (4.11; 4.81)	4.43 (4.21; 4.65)
	F2	7.31 (6.89; 7.73)	7.46 (6.98; 7.95)
hod	F1	5.47 (5.11; 5.83)	5.56 (5.27; 5.84)
	F2	8.03 (7.42; 8.64)	8.61 (8.06; 9.16)
hŵd	F1	3.56 (3.35; 3.78)	3.58 (3.18; 3.98)
	F2	8.21 (7.58; 8.83)	8.24 (7.61; 8.87)
hwd	F1	4.44 (4.05; 4.83)	4.29 (3.92; 4.66)
	F2	9.25 (8.46; 10.03)	9.44 (8.8; 10.08)
hyd	F1	5.32 (5.08; 5.55)	5.39 (5.19; 5.59)
	F2	10.94 (10.65; 11.24)	11.1 (10.75; 11.45)