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'Mae pobl monolingual yn minority': Factors Favouring the Production of Code Switching by Welsh–English Bilingual Speakers

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Mae'r bennod hon yn adrodd ar ganlyniadau dadansoddiad awtomatig o 67,515 o gymalau mewn corpws Cymraeg-Saesneg sy'n cynnwys 151 o siaradwyr. Nod yr ymchwil oedd canfod i ba raddau mae oedran, rhywedd, iaith gyntaf, iaith addysg a rhwydwaith gymdeithasol yn dylanwadu ar gyfnewid cod ac archwilio a oedd gwerthusiadau'r siaradwyr o'u hymddygiad ynglŷn â chyfnewid cod yn gywir. Astudiwyd cyfnewid cod o fewn cymalau a rhwng cymalau drwy ddefnyddio awtoglosydd ac fe ddadansoddwyd dylanwad ffactorau all-ieithyddol ar gynhyrchu cymalau dwyieithog neu uniaith drwy ddefnyddio modelau effeithiau cymysg. Dengys ein canlyniadau fod cyfnewid cod yn fwy

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cyffredin yn lleferydd siaradwyr ifainc ac ymhlith siaradwyr sydd wedi caffael y Gymraeg a'r Saesneg ar yr un pryd. Roedd y siaradwyr yn rhyfeddol o gywir ynghylch eu canfyddiadau o'u defnydd o gyfnewid cod.

Introduction

Although monolinguals constitute a minority in the world, English monolinguals make up the majority of speakers in the UK, and this has been the case in Wales too since early in the twentieth century. Welsh speakers in Wales appear to have been in the majority throughout the nineteenth century (see Jones 1993: 549), but the results of the 1901 census showed them to make up only half of the population of Wales, and their proportion dropped throughout the twentieth century. As Penhallurick (2007: 152) points out, by the 1960s not only had monolingualism in Welsh disappeared, but monolingualism in English had become characteristic of three quarters of the population (Penhallurick 2007: 152). According to the census in 2011, 19% of the population of Wales reported speaking Welsh, which means (given Penhallurick's observation and exposure to English in compulsory education) that 19% are bilingual in Welsh and English. There is considerable regional variation in this percentage, however, and Welsh speakers make up a higher proportion of the population in the north and west than in the south and east. Where the proportion of Welsh speakers is relatively high, Welsh is the primary language of communication for bilinguals. However, their competence in English means that code switching to English (as in the switches to 'monolingual' and 'minority' in the title of this chapter) is an option in informal communication, and varies from speaker to speaker. The study to be reported here investigates how patterns of bilingual acquisition affect the quantity of Welsh–English code switching by speakers, and how this may be changing over time. Our study relies on a naturalistic bilingual corpus collected from 151 speakers, most but not all residing in northwest Wales where the proportion of bilingual speakers in the population is over 40% in most places.

Mention of code switching in Wales can be found in publications from the 1980s onwards (see, for example, Thomas 1982a, b) but no systematic study on a reasonably large scale seems to have been conducted until the collection of the *Siarad* corpus (see Deuchar et al. 2014). However, our work builds on a well-established body of systematic research on other

language pairs, especially Spanish and English. Poplack's (1980) landmark study of code switching among Puerto Rican Spanish-English speakers in New York City provided evidence that 'code-switching, rather than representing debasement of linguistic skill, is actually a sensitive indicator of bilingual ability' (Poplack 1980: 581). She found that those speakers who did the most intrasentential code switching (i.e. switching inside a sentence) had acquired both English and Spanish in early childhood and also rated themselves as 'bilingual' as opposed to dominant in Spanish or English.

Given the evidence that code switching appears to be facilitated by proficiency in the two languages, a question which has not yet been fully answered is how varying patterns of bilingual acquisition lead to a greater or lesser propensity to code switch. Meisel (2004), for example, distinguishes between simultaneous acquisition of two languages, child second-language acquisition, and adult second-language acquisition. He argues that the differing effects of these patterns of bilingual acquisition need to be determined 'in the light of empirical research investigating linguistic and neuropsychological aspects of bilingualism acquired during different age ranges' (Meisel 2004: 105). Indeed, in a study of structural plasticity in the bilingual brain, Mechelli et al. (2004) report on how the timing of bilingual acquisition and proficiency attained affect the density of grey matter and structural reorganisation in the brain. It seems likely, then, that similar factors may affect code-switching behaviour.

Poplack's (1980) study was not able to deal directly with the relation between patterns of acquisition and code switching, since only two of her 20 speakers were simultaneous bilinguals. However, since the time of her study, developments in corpus linguistics mean that we can now analyse much larger sets of data in a relatively short amount of time. These developments allow, among other things, the automatic extraction of data for analysis, as we shall demonstrate in our study of 148 Welsh–English bilinguals with varying patterns of bilingual acquisition.

Review of the Literature

In this section, we review some of the previous work which has investigated the relation between social and linguistic factors in the study of code switching, with special emphasis on the role of early bilingual acqui-

sition. We also review relevant work on corpus linguistics and previous work specifically on Welsh–English data.

Relevant Studies on Code Switching

Poplack (1980) is one of the best known early studies on the multivariate analysis of code switching. Her data were collected in 'El Barrio', an area of New York City inhabited by a Puerto Rican community since the 1930s. Data were analysed from 20 speakers who differed from one another regarding their age of arrival in the USA. Eleven were male and nine female. Data were collected through interviews and 'natural' recordings by a member of the community, and speakers also completed a language attitude questionnaire. Sixty-six hours of recordings yielded 1835 instances of code switching, all of which were coded in terms of syntactic function. A broad distinction was drawn between intrasentential[1] and extrasentential switches,[2] and the relation between these categories and extralinguistic characteristics of the speakers was studied using VARBRUL 2 (Sankoff 1975), a tool for multivariate analysis. The results showed that the factors which were related to the production of intrasentential code switching were gender, age of arrival/L2 acquisition, language dominance, and work place. More intrasentential code switching was produced by women than men, by those who had been born in the USA or arrived in early childhood, by those who were balanced bilinguals rather than Spanish dominant, and by those who worked inside the community.

Almost all of Poplack's speakers had acquired English later than Spanish, albeit at different ages, and since the age of acquisition of English corresponded perfectly with the age of speakers' arrival in the USA, age of acquisition was not considered separately. Furthermore, since only two speakers had acquired English in early childhood, the effect of simultaneous versus successive acquisition could not be compared. Our study differs from Poplack's in that we are able to compare the effect of simul-

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[1] An example from her data is *Why make Carol* **sentarse atrás pa' que** ('sit in the back so') *everybody has to move* **pa' que se salga** ('for her to get out').

[2] This included both 'sentential' (switches between sentences, also called 'intersentential') and 'tag' switches.

taneous and successive acquisition at different ages, and in that we are dealing with a fairly stable bilingual community which is not the result of the immigration of minority language speakers.

The study by Backus (1996) of Turkish-Dutch code switching provides some information about the effect of age of acquisition of the two languages in an immigrant context in the Netherlands. He classifies his speakers into three groups based on their age of arrival in the Netherlands. Those belonging to the 'first generation' arrived in the Netherlands and so were first exposed to Dutch when they were older than 12; the 'intermediate generation' arrived at between 5 and 12 years old, and the 'second generation' were either born in the Netherlands or were under 5 at the age of arrival. He found different patterns of code switching in the three groups. The first generation generally produced Dutch insertions within a Turkish morphosyntactic framework, while the intermediate generation produced frequent intersentential code switching as well as the same type of intrasentential code switching as the first generation. The second generation produced mostly intersentential code switching with infrequent intrasentential switching in which either language could provide the morphosyntactic frame. While the three groups doubtless differed from one another in their patterns of acquisition, we do not have sufficient detail about the bilingual acquisition of the second generation to determine whether they acquired Turkish in the home first and Dutch later, or whether they acquired both Turkish and Dutch simultaneously from birth.

Treffers-Daller (1992) reports on a study of Dutch-French code switching in Brussels which might be considered more similar to the community in our own study in that the community is not the result of recent migration. Of the factors that Treffers-Daller expected to contribute to intrasentential code switching, she found that local background, language of education, self-rated proficiency in each language, and degree of puristic attitudes were all significant predictors, although there was some interaction between local background and language of education. Treffers-Daller (1994) includes details of the background questionnaire administered to participants, but information about their patterns of language acquisition in childhood is not elicited, and so we cannot determine how this might be linked to their code-switching patterns. However, she did investigate the effect of age on the production of code switching. The

code switching of speakers over the age of 60 was compared with those under 60, and though no significant difference was found, Treffers-Daller reports a 'trend that older informants switch more within sentences than younger informants' (Treffers-Daller 1992: 148) She suggests that intra-sentential code switching is actually disappearing in Brussels owing to the influence of purism in Dutch.

In studies of language variation, the age of the speaker is of course an important independent variable because of the possibilities of the 'apparent time paradigm' (cf. Bailey 2002), according to which the speech of younger speakers may be indicative of language change. Thus, the extent of code switching by younger speakers compared with older speakers may provide an indication of whether code switching is decreasing or increasing. Poplack (1980) found that the age of the speaker was not a significant variable in predicting the type of code switching. However, this may be because of the relatively small number (20) of her speakers and the fact that 75% of them were between the ages of 20 and 40. The age of our 148 speakers ranged from 10 to 89 and we shall show how age is a key variable in our study.

As mentioned above, Poplack (1980) found that gender was a sig-nificant variable and that women produced more intrasentential switch-ing than men. In fact, over half of their switches were intrasentential compared with only one-third of men's switches. Given what are often considered robust findings regarding the differences between male and female monolingual speech in English, termed 'the sociolinguistic gen-der pattern' by Cheshire and Gardner-Chloros (1998), these authors set out to investigate whether 'other factors being equal, the general pattern appeared to hold, with women code-switching less than men in order to conform with a more purist or socially acceptable speech style' (Cheshire and Gardner-Chloros 1998: 14). They were able to find little evidence for this 'general pattern', reporting, for example, that Treffers-Daller (1992) had found no significant difference between men's and women's use of intrasentential switching and that Gardner-Chloros (1992) had found no significant difference in the switching rates of male and female Greek Cypriot-English bilingual speakers. Overall, they conclude that 'although a consistent pattern of sex differentiation is assumed to exist in [language use in] monolingual communities, there is no evidence of any consistent patterning of this kind in bilingual communities' (Cheshire and Gardner-Chloros 1998: 28).

Previous Studies of Welsh–English Code Switching

Our study on the factors influencing the code-switching patterns of Welsh–English also builds on previous work we have done in this area. Deuchar (2005) used pilot conversational data to demonstrate that code switching was more likely to occur where there was both paradigmatic and syntagmatic congruence between the grammatical categories of Welsh and English. Deuchar (2006) used a small sample of conversational data to argue that Welsh–English code switching was conducive to analysis by the Matrix Language Frame (MLF) approach in that a matrix language (ML) (usually Welsh) could clearly be identified in bilingual clauses. Similar results were reported by Davies and Deuchar (2010) in a paper which argued that there was very little evidence that the speech of bilinguals was leading to convergence between Welsh and English. Similarly, Deuchar and Davies (2009) argued that although some of the clauses (16%) of a sample of speakers were bilingual in that they contained both Welsh and English words, the morphosyntactic frame of the clauses was almost always Welsh, justifying confidence in the stability of the Welsh language.

Lloyd (2008) conducted a study using some of the same data as ours in order to determine which external variables affected the percentage of English words used in otherwise Welsh conversations. She analysed the speech of 121 speakers from our *Siarad* corpus who had been brought up in North Wales. Using background information from our questionnaire, she found that the age of the speaker, the language of their education, and parental input were all important factors. However, she did not examine the effect of pattern of bilingual acquisition, a key variable in our study. Her results showed that older speakers used a smaller percentage of English words on average than younger speakers. In particular, that speakers aged under 30 used a significantly greater proportion of English words than speakers in their 1960s. Regarding language of education, Lloyd found that speakers who had received both their primary and their secondary education through the medium of Welsh tended to insert more English than those who had had their education in both Welsh and English. This result was contrary to her predictions in that she had expected the latter category to use more English words. However, there was a confound with age in that those who had received their education in both Welsh and English tended to be older. Regarding home

language, Lloyd found that speakers who had heard Welsh from at least one parent had a (statistically non-significant) tendency to use more English than those who had heard only English. She suggests that those speakers who have heard more Welsh at home may be more likely to be balanced bilinguals because of the large amount of English input in society at large. This argument might also help to explain her results relating to the language of education and are in line with Gathercole and Thomas (2009)'s findings that enhanced input in Welsh is necessary for command of Welsh to equal command of English in Wales.

Carter, Deuchar, Davies, and Parafita Couto (2011) reported on a comparative analysis of the factors influencing code-switching patterns in a sample of speakers from three bilingual corpora.[3] One of these was the Welsh–English corpus analysed here, and the other two were collected in Miami (USA) and Patagonia (Argentina). They compared the proportion of bilingual versus monolingual clauses in each sample and identified the matrix language or morphosyntactic frame of each clause. The highest proportion of bilingual clauses (19%) was found in the Welsh–English sample collected in Wales, while the lowest proportion (3%) was found in the Welsh-Spanish sample collected in Patagonia. Regarding the matrix language of the bilingual clauses, this was found to be most uniform in the sample from Wales, where 100% of the clauses had Welsh as the matrix language. The Patagonia sample was almost as uniform, with 93% of the bilingual clauses having Welsh as a matrix language, but the Miami data showed more variability with 66% of the Spanish-English bilingual clauses having a Spanish ML and the remaining 34% having English as a matrix language. Carter et al. (2011) noted that there was uniformity in the choice of ML when the language pair had contrasting word orders, as in VSO (Welsh) versus SVO (English and Spanish) in Wales and Patagonia. They then sought to account for the specific choice of the ML in terms of external factors. Self-reported proficiency in both languages turned out to be relatively high in both Wales and Miami, and it seems that this may have favoured the production of bilingual clauses in those two samples, whereas the lower proportion of fluent bilinguals in Patagonia may account for the smaller proportion of bilingual clauses there. Regarding the choice of the matrix language, Carter et al. predicted

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[3] See www.bangortalk.org.uk.

that the most common language of the social network would also be the most common matrix language. This prediction was fulfilled in Wales, where speakers' mainly Welsh-speaking social network could be linked to their overwhelming choice of Welsh as a matrix language. Similarly, the tendency of Spanish-English speakers in Miami to have a more bilingual social network was arguably reflected in the more diverse choice of both Spanish and English as matrix languages. In Patagonia, the relation between social networks and matrix language was unclear, partly because of the small number of Welsh speakers in that community.

Parafita Couto et al. (2014) report on the first multivariate analysis of our Spanish-English data, in which we attempted to find a relation between external factors and the choice of Spanish versus English as matrix language in our Miami data. An analysis of 2611 clauses extracted manually from three transcripts of conversations, using the Goldvarb X program, revealed no significant relationship between the choice of matrix language and external factors, but this may have been because of the small amount of data. In the study to be reported here, we were able to analyse 67,515 clauses as a result of computer-assisted glossing and clause segmentation.

Our study is therefore set against a body of previous work in code switching, in the development of corpora and tools for analysing variation, and in our own previous work specifically on Welsh–English code switching. In the next sections, we describe how we addressed the following research questions:

1. What is the extent of intraclausal code switching (switching within clauses) in the *Siarad* corpus?
2. Do speaker characteristics such as age and pattern of bilingual acquisition predict the observed code switching?

Data Collection and Transcription

In collecting our corpus, we were able to build on the example of other corpora containing code switching which have been available in the public domain since about 2000 (see e.g. Talkbank.org/BilingBank and the appendix to Gardner-Chloros 2009 on the LIDES project). For example, one of the first corpora on the Talkbank website to be extensively analysed

is the Eppler corpus of German-English conversation by Austrian immigrants in London, described in a monograph by Duran Eppler (2010). Duran Eppler used the CHAT system from Talkbank (MacWhinney 2000) for the transcription of her data, which means that she could also use the Talkbank CLAN programs for its analysis. She used the CLAN programs to generate quantitative analyses of her data, for example, on the frequency of code switching, but her syntactic analysis was done manually. She uses CLAN to report on the distribution of languages per speaker, but did not otherwise study code-switching patterns in relation to speakers or speaker characteristics.

In collecting the *Siarad* Welsh–English corpus, we obtained 40 hours of spontaneous data based on 69 half-hour informal conversations between pairs of bilingual speakers. Most of the data were collected over a two-year period (2005–2007) and came from 151 speakers. On average, the corpus contains about 3000 words per speaker.

Our aim was to recruit a wide range of bilingual speakers, the main criterion being that participants considered themselves to be bilingual in Welsh and English. We were based in Bangor, NW Wales, and recruited mostly but not exclusively in that area. We aimed to record both men and women, of a wide range of ages (but mostly adults), with varying proficiency in the two languages. Proficiency was self-assessed[4] as part of questionnaires administered after the recordings. We also gathered information on a wide range of other external variables which included age, gender, area of upbringing,[5] occupation, age of acquisition of the two languages, language input in the family, social networks, and self-report on the extent of participants' code switching. Our method of recruitment was to send letters to bilingual speakers known to our research team or their contacts and also to place advertisements in the university and in public places. Our researchers were themselves Welsh–English bilinguals who could draw to some extent on their own social networks. The proj-

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[4] Participants were asked to rate their ability to speak Welsh and English. For each language, there were four possible responses: (i) only know some words and expressions, (ii) confident in basic conversations, (iii) fairly confident in extended conversations, and (iv) confident in extended conversations.

[5] Details of the areas where individual participants were brought up (NW, NE, Mid, SW, and SE Wales) are provided in the *Siarad* 'questionnaire data' file available at www.bangortalk.org.uk.

ect was described as concerning bilingual communication, and the letter mentioned that we wanted to make recordings of informal conversation between bilingual people. We invited letter recipients to choose a bilingual family or friend with whom they would be willing to be recorded. Recipients were invited to choose the place of recording, whether at home or work, for example. While this freedom of choice meant that we could not control the environmental sound in the recordings, it helped to ensure informality.

Once appointments had been made with participants, they were met by one of the researchers and given a short briefing about the project: they were told that we were studying how bilinguals communicate with each other, although no mention was made of mixing languages or code switching, and that we would record them having a conversation for 35–40 minutes. Before the recording, it was explained that their anonymity would be protected by using pseudonyms for them and anyone they mentioned in the course of the conversation, and that they would be able to ask for anything they said to be deleted if they subsequently changed their mind. The recording equipment used for most recordings was a Marantz hard disk recorder, while a small number were recorded with a portable Sony minidisk recorder. Several steps were taken to reduce as much as possible any effect of the Observer's Paradox. The speakers were recorded with partners whom they already knew, in most cases very well. Audio recording without video was used so as to intrude less on the conversation. Wherever possible, the researcher left the room or house so that their presence would not influence the language choices made by the participants or inhibit code switching because of any self-consciousness. The pair was also left to talk for several minutes longer than the length that would become the final edited version in the corpus. This was so that the first five minutes of each recording could be removed in case the participants' speech might have been affected while they became accustomed to the recording equipment. These precautions proved to be highly successful in eliciting the naturalistic data sought. It is noticeable from the relaxed way in which the speakers interact, and the potentially sensitive topics that they discuss, that they did not seem to feel observed.

The transcription system selected was CHAT, and its associated CLAN software CLAN (see MacWhinney (2000) and http://childes.psy.cmu.

edu/manuals/CHAT.pdf) since it was to be made available on *Talkbank*, where CHAT is the standard software system. The fundamental features of CHAT notation are that utterances are placed on tiers: minimally, a main tier that consists of an orthographic representation of the words in the utterance. There are also optional tiers which may contain phonological and/or phonetic representations, word-by-word glosses of non-English material, a translation of the utterance, discourse level markup, comments, and so on. We decided that each transcribed utterance would minimally have a main tier, a gloss tier, and a tier with translation into English. These tiers are illustrated in example (1) below from stammers2. The first (line 91) is the main tier, the second (line 93) a gloss tier, and the third (94) is the translation tier.

91	*JAQ:	mi ges i heddiw # crackers@s:cym&eng # a # egg@s:eng mayonnaise@s:cym&eng .
93	%gls:	PRT get.1S.PAST PRON.1S today crackers and egg mayonnaise
94	%eng:	I had today crackers and egg mayonnaise

The main tier contains the actual words of the speaker's utterance, and also shows the source language of each word. Following the current norms in CHAT, words belonging to the ('default') language, which has the most words in the transcript, are not marked for language, but words from other languages are so marked. In *Siarad*, Welsh is always the default language, and English words are marked with the tag '@s:eng' as in the English word 'egg@s:eng' in the above example. There are also a large number of words (often loans from English into Welsh) which are marked with the tag '@s:cym&eng' indicating 'undetermined language'. Words such as 'mayonnaise@s:cym&eng' in the example above are originally English words but are found in Welsh dictionaries and often pronounced as in English. Words of this kind are spelled with English orthography but marked as undetermined. Similar neutral language marking was also used with place names and some interactional markers that we considered to belong to both language systems, for example, 'ah@s:cym&eng'.

The glossing of the main tier (resulting in the words in the gloss tier (marked with '%gls')) was initially done manually, but was later augmented by adding a further tier (%aut) containing glosses generated automatically by computer (Donnelly and Deuchar 2011), and it is these glosses which were used for the analysis reported in this paper. The

location	surface	auto	langid
1	mi	PRT.AFF	cym
2	ges	get.V.1S.PAST+SM	cym
3	i	I.PRON.1S	cym
4	heddiw	today.ADV	cym
5	crackers	cracker.N.SG+PL	cym&eng
6	a	and.CONJ	cym
7	egg	egg.N.SG	eng
8	mayonnaise	mayonnaise.N.SG	cym&eng
9	.	*NULL*	999

Fig. 8.1 Example of utterance with automatic glosses

automatic system splits the transcribed utterances into words, looks up the words in open source dictionaries, adds glosses to each word, uses constraint grammar[6] to disambiguate multiple glosses, and writes the final glosses into the CHAT file. It is calculated to be 97–98% accurate. Figure 8.1 shows the utterance from example (1) as stored in the database: the spoken words are in the column labelled 'surface', the automatic glosses in the 'auto' column, and the language origin of each word ('cym' for Welsh, 'eng' for English) is in the last column.

Example (1) can then be expanded with more detailed glossing information as (1a) below:

(1a)

*JAQ:	mi ges i heddiw # crackers@s:cym&eng # a # egg@s:eng mayonnaise@s:cym&eng.
%gls:	PRT get.1S.PAST PRON.1S today crackers and egg mayonnaise
%aut:	PRT.AFF get.V.1S.PAST+AM I.PRON.1S today.ADV cracker.N.SG+PL and.CONJ egg.N.SG mayonnaise.N.SG
%eng:	I had today crackers and egg mayonnaise

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[6] Constraint grammar contains rules which help to identify which gloss is correct in dictionary entries containing more than one possible gloss. For example, *i* in Welsh could be either a first person singular pronoun or a preposition. Constraint grammar identifies it as a first person singular pronoun if it follows a first person verb form.

The automatic glosses in the '%aut' tier allow the analysis to be performed. We shall see how this works in our data analysis, to which we now turn.

Data Analysis

Our unit of analysis was the clause, and our measure of the extent of intraclausal code switching was the proportion of clauses containing code switching compared with the proportion that did not.

Intraclausal versus Interclausal Code Switching

The terms *intraclausal* and *interclausal* correspond roughly to what are called *intrasentential* and *intersentential* code switching elsewhere but are more precise. Deuchar (2012) argues that the term *intrasentential* can be ambiguous between *intraclausal* and *interclausal* when *intrasentential* refers to switching between two clauses in the same sentence. Intraclausal code switching (as understood in our study) is illustrated by example (2) [7] below and interclausal code switching by example (3):

(2)	**[maen**	**nhw**	**(y)n**	**rhoi**	**e**
	be.V.3S.PRES	they.PRON.3P	PRT	give.V.INFIN	he.PRON.M.3S
	yn	**y**	**STEAM**	**ROOM**	**[dw**
	in.PREP	the.DET.DEF	steam.N.SG	room.N.SG	be.V.1S.PRES
	i	**mynd**	**yn]]**	**.**	
	I.PRON.1S	go.V.INFIN	in.PREP		

'They put it in the steam-room I go to.' [fusser27: 139[8]]

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[7] Words in lower case bold are Welsh, in upper case English, and bold italics are used for words belonging to both languages. The glosses have been aligned with the words for the ease of reading and are explained in the *Siarad* documentation file to be found at www.bangortalk.org.uk.

[8] Examples (2)–(10) are referenced by giving the name of the file they come from, followed by the number of the utterance (called the 'main tier' in CLAN).

(3)	[*so*	**bosib**	**hwnna**	**(y)dy**	**o]**
	so.ADV	possible.ADJ+SM	that.PRON. DEM.M.SG	be.V.3S.PRES	he.PRON.M.3S
	[I I.PRON. SUB.1S	DON'T do.V.1S.PRES+NEG	KNOW] know.V.INFIN	.	

'So possibly that's it, I don't know' [fusser25: 1073].

In example (2), there is a switch within the clause to the English phrase *steam room,* whereas in example (3) there is a switch from an entire Welsh clause to the English clause *I don't know.* This can be verified by noting the position of the clause boundaries, marked with square brackets.

Our analysis focused on intraclausal code switching, which was much more frequent in our data than interclausal code switching. For the purposes of the analysis, intraclausal code switching was considered to be manifest in clauses coded as bilingual rather than monolingual. Example (2) above would be coded as bilingual because it contains words from both English and Welsh. Example (3), however, would be considered to consist of two monolingual clauses, one in Welsh and the other in English. Words which could belong to either Welsh or English (on the grounds that they were found in dictionaries of both languages) were ignored in the process of coding. Thus, English loanwords in Welsh were distinguished from switches. The extent of intraclausal code switching was measured in terms of the number of bilingual clauses produced as a proportion of the total number of clauses.

Data Preparation

Because of our focus on the clause as a unit of analysis, all utterances from the corpus had to be split into clauses. In fact, only 24% of the utterances in the corpus were longer than one clause and therefore required this. Welsh is the predominant language of the corpus (only 4% of words are unambiguously English), but since no parser is as yet available for Welsh, we used a relatively unsophisticated method to segment these utterances. (A similar approach was used for English and mixed utterances.) This involved (i) using the autogloss to mark all finite verbs, (ii)

moving the marker leftwards as required onto conjunctions, relatives or interrogatives where these preceded the verb, and (iii) dividing the utterance at the marker.[9]

To test the accuracy of the segmentation of clauses in Welsh, the predominant language, 1318 Welsh-only utterances which had been split into four or more clauses were collected, and every tenth one was examined to check whether the clauses were correctly segmented. In the 528 clauses in the sample, there were 35 errors (7%). There were 30 instances of a split where none was required, four of a required split not being made, and one where a clause had been marked as finite when it contained no verb. Although utterances consisting of four clauses or more (as in the test) make up only 2.4% of the corpus, they make a particularly rigorous test sample because their length increases the number of possible places for segmentation errors to occur. Thus, the error rate for these longer utterances is likely to be an upper limit on the overall error rate, and one would expect the error rate to be lower overall. This expectation was tested manually using a sample from stammers4. The first 200 utterances of the transcript of stammers4 were split by hand and compared to the output from the clause splitter. In these 277 clauses, there was only one error (a split where none was required)—an error rate of less than 1%.

Statistical Analysis

For our analysis, we used Rbrul (Johnson 2009), a new version of the variable rule program originally developed by Sankoff (1975). Johnson (2009) describes the variable rule program as 'one of the predominant data analysis tools used in sociolinguistics, employed successfully for over three decades to quantitatively assess the influence of multiple factors on linguistic variables'. The various versions of the program allow sociolinguists to calculate the effects of multiple factors (both linguistic and extralinguistic) on linguistic choices between variants, broadly alternative ways of saying the same thing. Johnson argues that Rbrul is less idiosyncratic than Goldvarb when compared with other statistical packages

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[9] For more information about how the corpus was segmented, see section 4.2 of an earlier version of this paper at http://www.ling.cam.ac.uk/COPIL/.

in common use, although its results can be presented in a similar format to that of Goldvarb if desired. One of the advantages of Rbrul over Goldvarb is that it uses mixed-effects modelling which allows the investigator to take into account random effects such as those introduced by individual speakers (cf. Baayen et al. 2008). On comparing Rbrul with Goldvarb, Johnson notes that the latter treats each token as if it were independent, even though this is not the case: the tokens are not independent, since they occur in groups produced by individual speakers. There is therefore a danger of Goldvarb overestimating external effects such as gender and age. However, mixed-effects models can distinguish between 'fixed effects' such as gender and age and 'random effects' such as the effects of individual speakers. Drager and Hay (2012: 60) argue that an increase in statistical robustness is the main reason that this model should be adopted by sociolinguists, and point out that the model allows the simultaneous study of both group and individual variation.

Data Coding and Sample

The coding of each clause for linguality (monolingual vs. bilingual, as described above) allowed us to quantify the amount of code switching by speakers in terms of its presence (in bilingual clauses) versus absence (in monolingual clauses). The categories 'bilingual clause' versus 'monolingual clause' were treated as variants of the dependent variable which we label 'linguality'. Table 8.1 illustrates the automatic coding of the linguality of each clause, whether bilingual ('biling'), monolingual Welsh

Table 8.1 Illustration of how linguality of extracted clauses was coded

File name	Utterance ID	Speaker	Clause	Verblg	Linguality
fusser17	1257	AET	oedd o yn dechrau diflannu	cym	monoW
fusser25	148	HUN	because they're leaving	eng	monoE
robert2	267	RIS	achos mae gynna chdi spellchecker Cymraeg arno fo	cym	biling
lloyd1	720	GRG	in Cymru we recycle	eng	biling

(monoW), or monolingual English (monoE). Clauses coded as monolingual contain only words from one language (whether Welsh or English), whereas bilingual clauses contain one or more words from both languages. In addition, the language of the verb ('verblg'), whether Welsh ('cym') or English ('eng'), as well as the name of the file for the recording, the utterance ID, and the pseudonym of the speaker were all automatically coded.

The data comprised 80,352 clauses from the 151[10] speakers in the *Siarad* corpus. The speakers were distributed by age and gender as shown[11] in Table 8.2. The effect of speaker gender turned out not to be significant unlike that of age, on which we report below.

Before the analysis of intraclausal code switching could begin, clauses consisting of only one word were removed from the data set. This is because we considered it necessary for there to be at least two words within a clause to provide an opportunity for intraclausal code switching to take place.[12] In total, 11,601 clauses of only one word were removed leaving 67,515 clauses in the data set distributed as shown in Table 8.3.

Table 8.3 shows that the majority of clauses (88%) are monolingual Welsh and only a tiny fraction (2%) are monolingual English. However,

Table 8.2 The speaker sample by age and gender

	Overall	Male	Female
N	148	70	78
Average age	42	43	40
Youngest	10	12	10
Oldest	89	86	89
%	100	47	43

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[10] For this analysis, we removed two speakers EVA and GLA who had learned Dutch as their first language, because we wished to focus on the role of Welsh and English acquisition in early childhood as a predictor of code switching. It was also necessary to remove a further speaker, ARD, since the data on first language acquired were missing. Removing these three speakers gives a large data set for the analysis of 148 speakers and 79,116 clauses.

[11] More detailed information about each speaker's age and gender is available in the documentation file at http://www.bangortalk.org.uk/speakers.php?c=siarad.

[12] Word-internal code switching can occur in Welsh when an English verb is given a verbal suffix, for example, concentrate-io. There were 333 instances of this in the 11,061 clauses that we removed and thus these instances were not included in our analysis of intraclausal code switching.

Table 8.3 Distribution of clauses consisting of more than word by language and speaker

Distribution of clauses	N	%
Total clauses	67,515	100
Of which:	59,152	88
Monolingual Welsh		
Monolingual English	1656	2
Bilingual (Welsh and English)	6707	10
Mean per speaker	456	
Minimum per speaker	47	
Maximum per speaker	1106	

bilingual clauses (those containing intraclausal code switches) make up 10% of all clauses. The morphosyntactic frame of the bilingual clauses is almost always Welsh: bilingual clauses with an English grammatical frame are very rare, and none at all were found in the sample analysed by Deuchar and Davies 2009 (see also Parafita Couto et al. 2014: 127–128). One hundred and forty-seven of the 148 speakers in the analysis to be reported here used a majority of Welsh monolingual clauses (range 61.7–99.7% per speaker). Contrast this with the use of English: here, the range of use, excepting speaker GRG (81.8% solely English clauses), was 0–28% monolingual English clauses; indeed, this analysis shows that 21 speakers used no monolingual English clauses at all. All but one speaker, DER, produced intraclausal code switches to varying degrees; the range per speaker is 0–31.1% intraclausal code switches per speaker.

The bilingual clauses listed in Table 8.3 are evidence of intraclausal code switching. The aim of our study was to examine to what extent speaker attributes were correlated with the use of intraclausal code switching. The *Siarad* questionnaire responses provided a rich and diverse set of social data to analyse. However, many of the questionnaire responses were designed to elicit related information, and answers to these questions were therefore often correlated. For example, speakers were asked to assess their own ability in Welsh and English and also about when they learned both languages. In order to ensure the independence of external factors in the multivariate model, we chose to focus in the analysis to be reported here on how diverse patterns of bilingual acquisition and the age of the speaker influenced the produc-

tion of code-switching. Age was treated as a continuous variable, while the factor group 'pattern of bilingual acquisition' included five factors: (1) Welsh and English were acquired simultaneously from birth, (2) the second language (L2, whether Welsh or English) was being acquired by age four, (3) L2 was acquired at primary school, (4) L2 was acquired at secondary school, and (5) L2 was acquired in adulthood. Information about participants' age of acquisition was obtained from their answers to the questionnaire items 'Since when have you been able to speak Welsh?' and 'Since when have you been able to speak English?' They were asked to indicate one of the following categories in relation to each language: (a) since 2 years old or younger, (b) since 4 years old or younger, (c) since primary school, (d) since secondary school, and (e) since becoming an adult. The answers in relation to the two languages were combined to yield the five categories outlined above, where the term 'L2' is used for convenience to indicate the timing of sequential acquisition in categories (2)–(4).

Results

The multivariate analysis was conducted in R using Rbrul (Johnson 2009). The dependent variable was the linguality of each clause: bilingual versus monolingual Welsh or English. The analysis used a mixed-effects model with speaker included as a random intercept. This approach has the advantage of compensating for the effects of idiosyncratic linguistic behaviour by particular speakers. The results of our analysis are shown in Table 8.4. Table 8.4 shows that the age and pattern of bilingual acquisition are related to the number of intraclausal code switches a speaker produces.

Regarding age, the analysis shows that as age increases the presence of bilingual clauses decreases. Details of the relation between age and code switching are shown in Fig. 8.2.

Table 8.4 also shows that speakers who learned Welsh and English simultaneously were more likely to produce intraclausal code switches than speakers who learnt one language later than the other.

Table 8.4 Mixed effects logistic regression predicting bilingual clauses with speaker as a random effect

	Log-odds	Number of clauses	% of bilingual clauses	Centred factor weight
Age	−0.02	67,515		
Pattern of bilingual acquisition				
Both Welsh and English from birth	0.407	15,572	14.7	0.6
L2 by age four	−0.053	19,006	10.3	0.487
L2 at primary school	−0.087	26,501	7.8	0.478
L2 at secondary school	−0.059	3710	6.6	0.485
L2 in adulthood	−0.209	2726	5.6	0.448
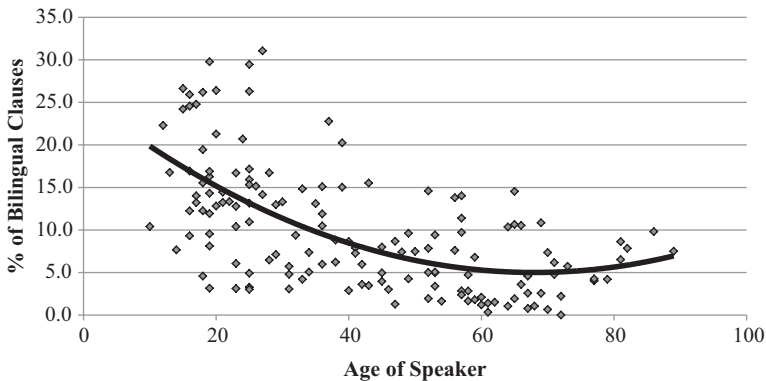
Fig. 8.2 Percentage of bilingual clauses by speaker age

The analysis of intraclausal code switching reported so far has been quantitative, but we also considered whether simultaneous acquisition of two languages in infancy would lead to qualitative as well as quantitative differences in code switching. Although not working with simultaneous bilinguals, Finlayson et al. (1998) found that multilinguals with a higher level of English proficiency produced more switched English phrases than those with a lower level of proficiency, who tended to switch single English words. Treffers-Daller (1992: 144) reports excluding single-word switches from her analysis of French-Dutch code switching in case they might be borrowings. In our study, we excluded borrowings (described above as loans marked in our transcription as '@s:cym&eng') from our analysis of

code switching, but decided to investigate whether simultaneous bilinguals produced more switched phrases (as opposed to switched single words) than those who had acquired one language later than the other.

To do this, we classified the bilingual clauses into two types: single-word insertions and multi-word insertions. Single-word insertions were defined as being single words in otherwise monolingual Welsh clauses as seen in (4). Or they could be multiple incidences of single-word insertions within an otherwise Welsh clause as seen in (5).

(4)	**ti**	**(e)rioed**	**yn**	**SERIOUS**
	you.PRON.2S	never.ADV	PRT	serious.ADJ

'You're never serious.' [davies6: 494]

(5)	*well*	**APPARENTLY**	*well*	**APPARENTLY**	*mae*
	well.ADV	apparently.ADV	well.ADV	apparently.ADV	be.V.3S.PRES
	MONOLINGUAL	**pobl**	**MONOLINGUAL**	**yn**	**MINORITY**
	monolingual.ADJ	people.N.F.SG	monolingual.ADJ	PRT	minority.N.SG
	bach	**yn**	**y**	**byd**	**.**
	small.ADJ	in.PREP	the.DET.DEF	world.N.M.SG	

'Well, apparently monolingual people are a small minority in the world' [stammers3: 339].

Multi-word insertions are those that have longer structures of the switched language. Example (6) shows a multi-word insertion of English into a clause with a Welsh-inflected verb and (7) shows a multi-word insertion of Welsh into a clause with an English-inflected verb.

(6)	**dylet**	**ti**	**fod**	**yn**	**gallu**
	ought_to.V.2S. IMPERF	you.PRON.2S	be.V.INFIN+SM	PRT	be_ able.V.INFIN
	gwrando	**(ar)no**	**fe**	**TOP**	**TO**
	listen.V.INFIN	on_him.PREP +PRON.M.3S	he.PRON.M.3S	top.N.SG	to.PREP
	BOTTOM	**AND**	**ENJOY**	**THE**	**WHOLE**
	bottom.N.SG	and.CONJ	enjoy.V.INFIN	the.DET. DEF	whole.ADJ
	THING	**.**			
	thing.N.SG				

'You should be able to listen to it top to bottom and enjoy the whole thing' [davies9: 183].

| (7)	**YOU**	**KNOW**	**DOING**	**USUAL**	**a**
	you.PRON. SUB.2SP	know.V.2SP. PRES	do.V.PRESPART	usual. ADJ	and.CONJ
	siarad	*dros*	*popeth*	.	
	talk.V.INFIN	over.PREP+SM	everything.N.M.SG		

'You know, doing the usual and talking across everything' [davies12: 3380].

Table 8.5 shows that in our data the majority of code switches were single-word insertions.

In this analysis, we divided our speakers into three groups: those who acquired English and Welsh simultaneously, those who acquired English first, and those who acquired Welsh first. Figure 8.3 shows the percentage of single-word versus multi-word insertions produced by each group. It can be seen that single-word insertions are used more

Table 8.5 Distribution of single-word versus multi-word insertions

	No. of bilingual clauses	% of bilingual clauses
Total	6707	100
Of which single-word insertions	4772	71
Of which multi-word insertions	1935	29
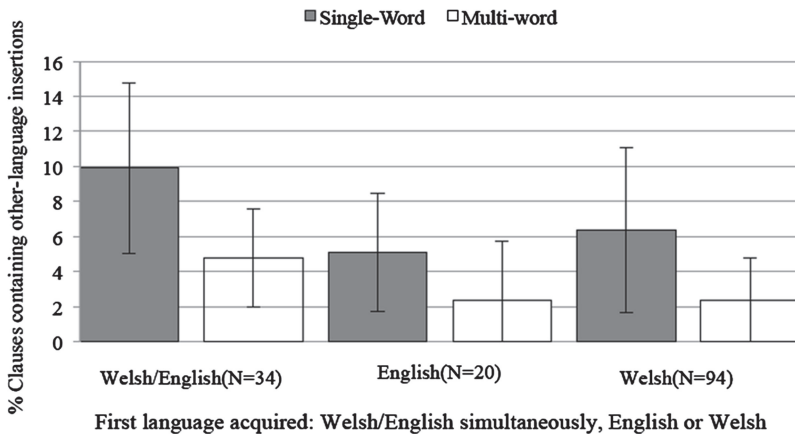
Fig. 8.3 Single-word versus multi-word insertions by first language acquired
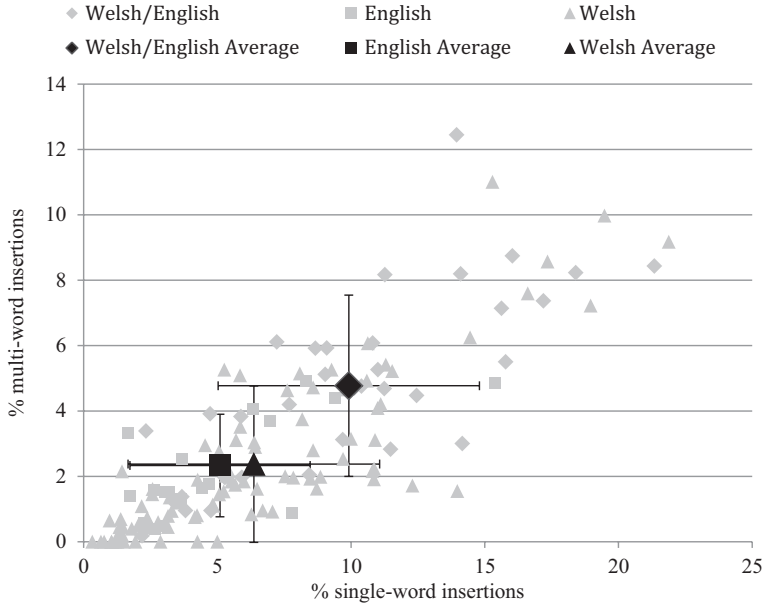
Fig. 8.4 Correlation between single-word and multi-word insertions
Note: Error bars show one standard deviation.

frequently than multi-word insertions by all groups, but that the speakers who learnt both English and Welsh simultaneously use more of both.

Two-tailed *t*-tests showed that the groups who had learnt English or Welsh first were not significantly different from each other in their production of either single-word insertions ($p = 0.26$) or multi-word clauses ($p = 0.94$). Furthermore, single-word insertions and multi-word insertions were positively correlated ($r = 0.83$, $p = $ <0.0001), as shown in Fig. 8.4. This means that speakers who use more single-word insertions also use more multi-word insertions. Thus in our data at least we do not yet have evidence for the pattern of bilingual acquisition affecting the size of insertions in code switching.

Discussion

In the 'Introduction' section, we pointed out that although ideas about the relation between code switching and proficiency have been familiar since Poplack's (1980) work, little has previously been known about the impact of patterns of bilingual acquisition on adult bilinguals' speech production. In particular, we have not known how these patterns are related to speakers' choice to code switch within clauses or not to switch. Our results as reported in Table 8.4 show that those speakers who had acquired both Welsh and English from birth were significantly more likely to produce intraclausal code switching than all other categories of speaker, including those who had acquired their second language as young as age four. Although the overall percentage of bilingual clauses in our data is 10%, the bilingual clauses of speakers who were simultaneous bilinguals as infants make up 15% of their output. This percentage drops to 6% for those who acquired their second language as adults.

It is well known that achieving native-like competence in a language or languages is very rarely possible unless the languages are acquired at a young age, but there is debate about what exactly this cut-off age is. Meisel (2010) found that sequential German-French bilinguals who had begun acquiring French at age three in Hamburg produced errors in the production of French finite verb forms even after 6 years of exposure to the language, whereas errors of this type where virtually never produced by simultaneous German-French bilinguals. Meisel suggests that these differences may be explained by neural maturation, with some important changes occurring in the fourth year of life. He refers to neuroscientific studies which support his conclusion. Our results suggest that it may make a difference whether bilingual acquisition is simultaneous or successive even when the second language is acquired very early but not simultaneously with the first.

In the 'Introduction' section, we referred to the study by Mechelli et al. (2004) which showed how the timing of bilingual acquisition affected the density of grey matter in the brain. Specifically, they found that grey matter density in the inferior parietal cortex was negatively correlated with the age of acquisition in the second language. In other words, simultaneous bilinguals had the greatest density of grey matter in this

area, followed by those who had acquired their second language early, followed by those who had acquired it later. Furthermore, the authors point out that 'the inferior parietal region that is associated with second-language acquisition corresponds exactly to an area that has been shown by functional imaging to become activated during verbal-fluency tasks' (Mechelli et al. 2004: 757). We suggest that intraclausal code switching is the type of activity to be particularly favoured by verbal fluency. Another relevant study is that by Weber-Fox and Neville (1999) who explore how the age of acquisition of a second language affects the neural subsystems involved in language processing. The participants in their study were Chinese-English bilinguals who had acquired English at five different age categories similar to those used in our study. ERPs elicited by phrase structure violations showed 'increased bilateral distribution with increased second language immersion' (Weber-Fox and Neville 1999: 30). These and some behavioural results showing slower syntactic processing with increased age of second language acquisition led them to conclude that 'the development of at least some neural subsystems for language processing is constrained by maturational changes, even in early childhood' (Weber-Fox and Neville 1999: 36). This conclusion suggests to us that the timing of bilingual acquisition may indeed affect that facility with which speakers switch back and forth between two languages with different syntactic structures, and thus the frequency with which they will choose to code switch.

Although our results show a relation between simultaneous acquisition of the two languages and the more frequent production of code switching, this does not mean that such a relationship will be found in all bilingual communities, since community norms doubtless play a role. While our own observations in Wales and the evidence of the *Siarad* corpus demonstrate that code switching is a community norm in informal conversations between Welsh–English bilinguals, not all bilingual communities use code switching. For example, it is not common in Patagonia, Argentina, where we collected a Welsh-Spanish corpus; see the Patagonia corpus at www.bangortalk.org.uk and Carter et al. (2011). However, we do predict a similar finding to ours in an analysis of our Spanish-English corpus from Miami (see www.bangortalk.org.uk and Parafita Couto et al. (2014)).

Our results showed that the other important external factor was age. Figure 8.2 shows a negative correlation between age and code switching, such that the older the speaker, the less frequent the proportion of bilingual clauses. A similar result was found by Lloyd (2008) who used some of the same speaker data as us but measured the proportion of English words rather than the proportion of bilingual clauses used by speakers. We may interpret our and Lloyd's results within the 'apparent time' paradigm, inferring that there is an ongoing change in language norms and that code switching is becoming more common and acceptable, at least in informal contexts. This interpretation is supported by Lloyd's additional finding that younger people showed more positive attitudes to code switching than older people. Both Lloyd's and our results show a slight upturn in the quantity of code switching used by the most elderly people, and though the numbers are small it may be possible to interpret their usage in terms of 'age-grading' or the idea that people's usage may change over their lifespan, for example, because of the relaxation of 'marketplace pressure' (cf. Wagner 2012: 378).

Our results have methodological as well as theoretical implications. Although our methods of automatic parsing and analysis can be improved further, we have shown that it is possible to extract large amounts of data with a low level of error. Using automatic glossing and data extraction methods has made it possible to deal with data from a larger number of speakers than has previously been possible in code-switching studies. This means that we can also be more confident in the validity of our results.

Finally, we can consider the implications of our results for the future of bilingualism in Wales. Our findings suggest that early exposure to both languages has a good chance of leading to fluent bilingualism, which will include code switching. Given the minority status of Welsh and the conclusions of Gathercole and Thomas (2009) reported above, parents making decisions about which language to use with their children may need to pay special attention to the role of Welsh. Furthermore, the connection we have demonstrated between code switching and fluency should help to persuade those who still associate code switching with inadequate command of Welsh to rethink their positions.

Conclusion

Our multivariate analysis of 67,515 bilingual and monolingual clauses from 40 hours of Welsh–English conversational data collected from 148 speakers showed that intraclausal code switching was produced more frequently by those who had acquired Welsh and English in infancy than those who had acquired the two languages sequentially. We speculated that this difference could be due to the timing of different patterns of bilingual acquisition in relation to neural maturation. We also found a tendency for younger speakers to code-switch more than for older speakers, and suggested that there is a change in progress related to more permissive attitudes to code switching. Finally, we suggest that the large size of our corpus and our automatic data extraction methods allow considerable confidence in our results.

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