Minority Language Survival: Input Factors Influencing the Acquisition of Welsh[1]

Virginia C. Mueller Gathercole and Enlli Môn Thomas
University of Wales Bangor

This paper examines the acquisition of Welsh in Gwynedd and Anglesey counties in North Wales, the stronghold of the Welsh language in Wales (see Thomas & Gathercole, this volume, Deuchar, this volume). The North Wales bilingual context provides a unique opportunity to examine the extent to which various factors affect acquisition in bilinguals. These include the following: First, there is a large population of fully fluent bilingual speakers--fully fluent in both languages (Welsh and English). This means that children growing up in the area are exposed to fully competent adult models for both languages. Second, the Gwynedd and Anglesey schools have a Welsh language policy. This means that every child being educated in the county schools is taught in their early primary school years through the medium of Welsh. Thus, children coming from both Welsh-speaking and English-speaking homes acquire Welsh. Finally, the Welsh language is in many ways dramatically different structurally from English. This allows one to easily examine children's abilities in each language and possible influences from one language to the other. The focus of this paper is on the role of input factors in the acquisition of Welsh in this bilingual population.

1. Background

1.1. Role of input in language and language development

Much current research emphasizes the critical role of frequency and input characteristics in language, for both adults and children. With regard to adult and child processing of language, Ellis (2002) has recently provided a review of studies in which frequency of occurrence has been shown to be key to linguistic processing. These include, among others: phonotactic knowledge in speech segmentation (e.g., Saffran, Aslin, & Newport 1996, Saffran, Johnson, Aslin, & Newport 1999); spelling-to-sound correspondences in reading (e.g., Coltheart 1978, Coltheart & Leahy 1996); auditory word recognition and speed of production (e.g., Luce 1986, Kirsner 1994); friends/enemies effects in morphology (e.g., Daugherty & Seidenberg 1994, Seidenberg & Bruck 1990); collocational probabilities in sentence interpretations (e.g., Seidenberg 1997); and probabilistic lexical and syntactic access and disambiguation (e.g., Jurafsky 1996, Jurafsky & Martin 2000).

Beyond these, there is ample evidence in the literature on language development that children are quite proficient at keeping track of co-occurrences across structures. For example, in the developing knowledge of Count/Mass syntax, children are quite proficient early on in knowing which words go with *a*, which words go with *some* (Gordon 1986, 1988, Gathercole 1986); young children can be quite proficient in respecting co-occurrence patterns for grammatical gender, especially in languages for which the gender marking is fairly transparent, such as Spanish (Karmiloff-Smith 1978; Cain, Weber-Olsen, & Smith 1987; Hernández-Pina 1984); children learn that the question 'What color is this?' 'goes with' answers like 'red', 'blue', 'yellow' before they know what the referents of the color terms are (Rice 1980); children may even learn which words are nouns and which are adjectives at least in part according to which questions they can answer (Gasser & Smith 1998).

Much of the recent research on children has focused on the question of how much exposure children need in order to gain a productive command of a construction. Some have argued that a 'critical mass' of input data has to be accumulated for a child to generalize beyond stored instances; this has been suggested for monolinguals (Marchman & Bates 1994, Maratsos 2000), for children with

[1]Supported in part by ESRC grants R000 23 7882 and H474254101/R25037.

Specific Language Impairments, for whom the critical mass needed may be higher than in normally developing children (Conti-Ramsden & Jones 1997, Jones & Conti-Ramsden 1997), and in connectionist modelling of acquisition (Elman 2000, Ellis & Schmidt 1998).

In addition, the attainment of a 'critical mass' of input has been posited as a critical factor in acquisitional patterns shown by bilingual populations (Gathercole 2002c). In a recent large-scale study of bilinguals in the Miami setting (Oller & Eilers 2002; see Oller, this volume, Pearson, this volume, and Gathercole, Laporte, & Thomas, this volume), the English and Spanish abilities of children were measured at Kindergarten, second grade, and fifth grade. Bilingual children came from homes in which only Spanish was spoken or both Spanish and English were spoken; they attended either English immersion schools or 'two-way' (two-language) schools. Children's abilities in each language was directly related to the exposure children received to that language in these contexts: For English, the bilinguals who came from homes in which both Spanish and English were spoken performed better at an early age than those who came from Spanish-only homes, and children who attended English immersion schools performed better at an early age than those who attended two-way schools. For Spanish, it was the reverse: children from only-Spanish homes performed better at an early age than those from Spanish and English homes; and children attending two-way schools performed better than children at English-immersion schools.

Significantly, these results showing differences across groups as a function of exposure held in most cases only at the younger ages. Differences at grade 2 were often neutralized by grade 5. This suggests that children's abstraction of the relevant knowledge depended on a 'critical mass' of input data, and this critical mass was attained at different times, depending on the amount of exposure received. The timing of the attainment of such a critical mass depended as well on the complexity of the structures in question. So, for example, all groups learned the appropriate constraints on noun number formation with mass/count nouns early, but no group had completed the acquisition of the constraint on the use of *much* with plural nouns even by grade 5; similarly, children's learning of *that*-trace forms in Spanish came in quite early, while performance on *that*-trace structures in English were still causing difficulties for some sub-groups at grade 5 (see Gathercole 2002a, 2002b, 2002c, Gathercole & Montes 1997).

One of the difficulties with the Miami study was the uncertainty of what type of linguistic input the bilingual children in Miami were receiving. First, there is a large population of recent immigrants into the area; many of them come with little or no knowledge of English and may, as a result, be providing non-native-like English input to the children. It is also not known to what extent the children are exposed to monolingual peers for the two languages in question. That is, the children may interact with peers who have a non-native-like command of either one or both of the two languages in question.

A contrasting picture is available in the case of Welsh bilingualism. The bilingual community in North Wales is a fairly stable, non-transient community. As a result, and because of a major presence of both languages in the community, bilingual adult speakers, as mentioned above, are on the whole fully fluent in both languages. Children are, thus, exposed to native adult models for both languages. The Welsh bilingual situation, then, provides an optimal comparison group, to examine more closely the potential effects of input patterns and complexity on the acquisition of language by children.

1.2. Welsh studies

The present studies center on the acquisition of Welsh among the bilingual children in North Wales. The data to be reported here come from a larger study involving two major structural constructs, grammatical gender and the expression of subjects and objects in transitive sentences. We report on the former of these here. The studies involve the production of grammatical gender by 5-, 7-, and 9-year-olds, and the comprehension of grammatical gender by 3-, 5-, 7-, and 9-year-olds. The participants come from three types of home-language backgrounds and attend two types of school.

1.2.1. Grammatical gender
1.2.1.1 Soft mutation and aspirate mutation

Welsh grammatical gender is encoded primarily through a process called 'Soft Mutation', and secondarily through 'Aspirate Mutation'. Mutations are common among the Celtic languages; they are a set of morpho-phonological processes that affect word-initial consonants under a variety of environmental conditions. Soft Mutation is one of three mutation types in Welsh, the most pervasive of the three. The consonants of Welsh are shown in Figure 1.

The phonological changes that occur under Soft Mutation are shown in Figure 2. Under Soft Mutation, voiceless stops and liquids become voiced, the voiced stops /b/ and /d/ become fricatives, /g/ is deleted, and /m/ becomes /v/. For example, Soft Mutation occurs after the preposition *i* 'to', as in (1).

(1)	/bangor/	'Bangor'	-	/i vangor/	'to Bangor'
	/p^{h}awb/	'everyone'	-	/i bawb/	'to everyone'

The phonological changes that occur for consonants under Aspirate Mutation are shown in Figure 3. Under Aspirate Mutation, voiceless stops become the corresponding fricatives (and /h/ is inserted before vowels). For example, Aspirate Mutation takes place after the conjunction *a(c)* 'and', as in (2).

(2)	/k^{h}i/	'dog'	-	/k^{h}aθ a xi /	'cat and dog'
	/k^{h}aθ/	'cat'	-	/k^{h}i a xaθ /	'dog and cat'

Figure 1. Consonants of Welsh

MANNER	VOICING	PLACE OF ARTICULATION			
		LABIAL	ALVEOLAR	VELAR	UVULAR
Stops	Voiceless	p^{h}	t^{h}	k^{h}	
	Voiced	b	d	g	
Fricatives	Voiceless	f	θ	x	h
	Voiced	v	ð		
Nasals	Voiceless	m^{h} [=m̥]	n^{h} [=n̥]	ŋ^{h} [=ŋ̊]	
	Voiced	m	n	ŋ	
Laterals	Voiceless		ɬ [=l̥]		
	Voiced		l		
Trills	Voiceless		r̥		
	Voiced		r		

Figure 2. Soft Mutation

MANNER	VOICING	PLACE OF ARTICULATION			
		LABIAL	ALVEOLAR	VELAR	UVULAR
Stops	Voiceless	p^h	t^h	k^h	
	Voiced	b	d	g	
Fricatives	Voiceless	f	θ	x	h
	Voiced	v	ð		→ Ø
Nasals	Voiceless	m^h [=m̥]	n^h [=n̥]	$ŋ^h$ [=ŋ̊]	
	Voiced	m	n	ŋ	
Laterals	Voiceless		$ɬ$ [=l̥]		
	Voiced		l		
Trills	Voiceless		r̥		
	Voiced		r		

Figure 3. Aspirate Mutation (Consonants)

MANNER	VOICING	PLACE OF ARTICULATION			
		LABIAL	ALVEOLAR	VELAR	UVULAR
Stops	Voiceless	p^h	t^h	k^h	
	Voiced	b	d	g	
Fricatives	Voiceless	f	θ	x	h
	Voiced	v	ð		
Nasals	Voiceless	m^h [=m̥]	n^h [=n̥]	$ŋ^h$ [=ŋ̊]	
	Voiced	m	n	ŋ	
Laterals	Voiceless		$ɬ$ [=l̥]		
	Voiced		l		
Trills	Voiceless		r̥		
	Voiced		r		

1.2.1.2 Mutation and Grammatical Gender

1.2.1.2.1. Local Marking

In 'local marking' (i.e., within the Noun Phrase) of grammatical gender, Soft Mutation is used to encode gender. First, feminine nouns undergo Soft Mutation after the definite article, *y(r),* or the numeral *un* 'one', whereas masculine nouns remain in their basic forms. Examples are shown in (3).

(3) Feminine:

cath /kʰaθ/	'(a) cat'	-	*y gath* /ə gaθ/	'the cat'
pont /pʰont/	'(a) bridge'	-	*y bont* /ə bont/	'the bridge'
Masculine:		-		
ci /kʰi/	'(a) dog'	-	*y ci* /ə kʰi/	'the dog'
prawf /pʰrawv/	'(a) test'	-	*y prawf* /ə pʰrawv/	'the test'

Note that this process only applies when the noun is a definite noun, when the noun is in the singular (not in the plural), and only if the noun begins with a mutatable consonant.

In addition, adjectives undergo soft mutation after feminine nouns, but remain in their basic forms after masculine nouns. Examples are shown in (4) with the adjective *mawr* 'big'.

(4) Feminine:

cath fawr /kʰaθ vawr/	'(a) big cat'	-	*y gath fawr* /ə gaθ vawr/	'the big cat'
pont fawr /pʰont vawr/	'(a) big bridge'	-	*y bont fawr* /ə bont vawr/	'the big bridge'
Masculine:				
ci mawr /kʰi mawr/	'(a) big dog'	-	*y ci mawr* /ə kʰi mawr/	'the big dog'
prawf mawr /pʰrawv mawr/	'(a) big test'	-	*y prawf mawr* /ə pʰrawv mawr/	'the big test'

Again, note that this process only applies when the noun is in the singular and when the adjective begins with a mutatable consonant. The process is iterative, so that 'big fat cat' is *cath fawr dew*, while 'big fat dog' is *ci mawr tew*.

1.2.1.2.2. Distant marking

In 'distant marking' of grammatical gender (i.e., in relation to gender agreement of anaphoric forms with antecedents), both Soft Mutation and Aspirate Mutation are used. However, while Soft Mutation is associated with feminine forms in local marking, it is associated with masculine forms in distant marking. With feminine forms, Aspirate Mutation applies instead. These distant markings occur with the third person singular possessive adjective *ei*. If *ei* has a feminine antecedent, it triggers Aspirate Mutation on the following noun (expressing the possessed item); if *ei* has a masculine antecedent, it triggers Soft Mutation on the following noun. Examples are provided in (5) with the noun *coes* /kʰɔes/ 'leg'.

(5) Feminine Antecedents:

cath	'(a) cat'	-	*ei choes* /eɪ xɔes/	'its leg'
pont	'(a) bridge'	-	*ei choes*	'its leg'
Masculine Antecedents:		-		
ci	'(a) dog'	-	*ei goes* /eɪ gɔes/	'its leg'
bwrdd	'table'	-	*ei goes*	'its leg'

1.2.1.3. Opacity of the system

There are a number of features of the gender system that makes it highly opaque. Three of these have already been mentioned: The first factor that lends opacity is that the application of these markings is restricted to words with mutatable sounds. Thus, words like *ffenestr* 'window' (feminine), beginning with /f/, and *ofnadwy* 'awful', beginning with a vowel, will show no surface evidence of

their gender or the gender of the noun they modify. The second factor is that the application of the local marking occurs only with singular forms, and nouns are only mutated for gender if they occur with the definite article. Thus, in many contexts, the feminine nouns--even those that begin with mutatable consonants--will show no overt marking of their gender. Thirdly, the mutation type associated with feminine nouns in local marking--Soft Mutation--is associated with masculine gender in distant marking.

Table 1. Sample of Non-Gender Triggers for Soft Mutation in Welsh

Trigger		Examples	
ar____	'on'	*Mae Mair ar gadair* (< *cadair,* ***F***[2])	'Mary is on (a) chair'
i ____	'to'	*'Dw i'n mynd i lwyddo* (< llwyddo)	'I'm going to succeed'
dy____	'your'	*Lle mae dy bêl? (< pêl,* ***F)***	'Where's your ball?'
		Saf ar dy draed (< traed, ***F,M)***	'Stand on your feet'
neu____	'or'	*tatws neu foron?* (< *moron,* ***F***)	'Potatoes or carrots?'
pan____	'when'	*Pan ddigwyddith* (< digwyddith)	'When it happens...'
Dyna____	'there is'	*Dyna wely* (< *gwely,* ***M***)	'There's (a) bed'
Dyma____	'here is'	*Dyma raw* (< *rhaw,* ***F***)	'Here's (a) shovel'
dau____	'two', M	*dau flodyn* (< *blodyn,* ***M***)	'two flower(s)'
dwy____	'two', F	*dwy fasged* (< *basged,* ***F***)	'two basket(s)'
yn____		*Roedd y caffi 'n wag (< gwag)*	'The cafe was empty'
Phrasal Category ____		*Mi welodd cath gi* (< *ci*, M)	'A cat saw a dog'

In addition to these factors, both Soft Mutation and Aspirate Mutation apply in a variety of contexts beyond grammatical gender. By far the more prevalent of these is Soft Mutation. It occurs, for example, after certain prepositions, after certain conjunctions, after certain numerals, and in certain syntactic frames. A sample of such triggers for Soft Mutation is shown in Table 1 (see Thorne 1993, Watkins 1993, Ball & Müller 1992, Borsley & Tallerman 1996, Harlow 1989 for thorough treatments). The pervasiveness of Soft Mutation across these constructions means that children will be hearing mutated and non-mutated forms for both feminine and masculine nouns (as well as for adjectives and verbs), and the presence of mutation occurs for a variety of reasons. This, thus, lends even further opacity to the marking of gender in Welsh.

2. Studies

Both studies to be reported here are part of a larger study on the acquisition of Welsh (Gathercole & Thomas, in preparation). The first study tested children's productive command of local marking of gender on nouns and adjectives, and distant marking with the third person singular possessive, *ei*. The second examined children's comprehension of sentences involving distant marking of gender in relation to two anaphoric forms, the third person singular possessive, *ei*, and third person singular pronouns, *hi* (feminine) and *(f)o* (masculine).

2.1. Study 1: Gender production: Local and distant marking

2.1.1. Method

The general method was to ask children to describe video cartoons that they saw on a video monitor.

[2]F=feminine noun, M=masculine noun

2.1.1.1. Stimuli
2.1.1.1.1. Cartoon stimuli

A total of 102 cartoons were constructed. The cartoons were designed to elicit structures involving Determiner + Noun + Adjective sequences, as well as *ei* + Noun sequences. In each cartoon, two items (two humans, two animals, or two inanimate objects) first appear on the left of the screen. These items are identical except for color. Then one of the items moves towards the right of the screen and 'enters' an enclosure. At first the item is fully obscured by that enclosure, but then the item sticks some part of itself out of the enclosure.

Linguistic stimuli were stored on the computer with the cartoons, so all children heard uniform linguistic stimuli.

2.1.1.1.2. Forms elicited

The 102 cartoon stimuli were designed to elicit Determiner + Noun + Adjective and *ei* + Noun structures. Children were expected to produce forms such as that in (6).

(6) Aeth y frenhines goch i mewn i gar a dangos ei choes.
'The red queen went into the car and showed her leg.'

The noun forms elicited were balanced in a number of ways:

(i) The stimuli were designed to elicit structures involving 66 real nouns and 36 nonsense/novel nouns.
(ii) Among the real nouns, 54 were 'native' Welsh vocabulary items, 12 were borrowed vocabulary items (i.e., borrowed from English).
(iii) For each category of noun, 1/2 of those tested were feminine nouns and 1/2 were masculine nouns.
(iv) Native vocabulary real nouns included 36 involving mutatable onsets (with the word-initial consonants /p^h, t^h, k^h, b, d, g, m/ represented about equally in each cell), and 18 involving non-mutatable onsets (/f, s, x, n/ or a vowel). Borrowed vocabulary items all began with mutatable onsets.
(v) Among the native real nouns involving mutatable onsets, 1/2 involved words without word form cues to the noun gender, and 1/2 involved word form cues (involving endings such as *-es* for feminine and *-wr* for masculine) to noun gender. Half of the borrowed vocabulary items had word form cues, and 1/2 were without word form cues. Similarly, half of the nonsense words involved word form cues and half did not.
(vi) Not counting the borrowed vocabulary items, 1/3 of the nouns in each type referred to humans, 1/3 to animals, and 1/3 to inanimates.
(vii) The borrowed vocabulary items all referred to inanimates.

The adjectives elicited all began with mutatable onsets, /p^h/: *pinc* 'pink', /k^h/: *coch* 'red', /b/: *brown* 'brown', /d/: *du* 'black', /g/: *glas* 'blue', and /m/: *melyn* 'yellow'. These were distributed across the noun types.

The enclosures used as 'containers' were a box, a house, a drum, a car, a purse, and hair.

The parts that were stuck out of the enclosures all began with /p^h/, /t^h/, or /k^h/, as these are mutatable under both Soft Mutation and Aspirate Mutation, thus making it possible to distinguish children's command of *ei* with masculine and feminine antecedents. The parts used were: /p^h/: *pen* 'head/end', *petal* 'petal'; /t^h/: *troed* 'foot', *trwyn* 'nose', *top* 'top'; /k^h/: *cynffon* 'tail', *coes* 'foot', *clust* 'ear', *cornel* 'corner'.

2.1.1.2. Procedure

Testing was carried out by Welsh native speakers who grew up in the Gwynedd/Anglesey area. Children were seen individually. Children were told, in Welsh, that they were going to see some cartoons, each of which told a 'story'. Before each story, the child was told, e.g., 'Enw'r stori yma ydy coes brenhines' ('The name of this story is leg (of a) queen'). This was to give the child the noun to be used as well as the name of the part that would be stuck out of the enclosure; note that these forms were given to the child in this structure so that they were given in their basic forms, rather than mutated forms. This procedure was used in the hope that it would encourage children to use the words being elicited in describing the scenes.

2.1.1.3. Participants

2.1.1.3.1. Children

The primary subjects for the larger study were children in the Gwynedd/Anglesey area, from four age groups between 2 1/2 and 11 years of age ('3': M=3;9.11, range=2;3.18-4;7.26; '5': M=5;8.1, range=4;7.30-6;7.28; '7': M=7;11.23, range=6;8.29-8;10.1; '9': M=10.0.25, range=8;11.1-11;5.0). They were divided into three groups according to home language and two groups according to school language.

Home Language: On the basis of a parental questionnaire, children were assigned to a 'Welsh-only' home language group ('OWH') if the parents were native speakers of Welsh and they spoke Welsh to the child at least 80% of the time from the child's birth up to the present[3]; children were assigned to the 'English-only' home language group ('OEH') if the parents were native speakers of English and they spoke English to the child at least 80% of the time from the child's birth up to the present [4]; and children were assigned to the Welsh-English home language group ('WEH') if the parents reported at least 40% and no more than 60% use of each of the two languages in the home in speech to the child from the child's birth up to the present. (Any child whose home language did not fall into one of these patterns was not included in the study.)

School Language: Children came from two types of school, depending on the medium of education used in the school. School language was determined on consultation with head teachers. Six schools were classified as 'Welsh only' schools ('OWS'), and seven were classified as 'Welsh and English' ('WES').

A total of 324 child subjects were tested. The distribution of subjects was as in Table 2. However, the number of children who completed this production task in particular was only a subset of the subjects. We set a criterion of the production of a relevant form in 90% or more of the relevant cells in order to include the child's data in statistical analyses. The number of children who reached this criterion level varied according to which aspect of the data was being examined. In the case of the production of nouns, for example, many of the children failed to produce the nouns with a definite article, so the relevant context for mutation was not present in their data; other children often produced forms without the relevant adjectives, again making it impossible to examine this aspect of their knowledge; still others failed to produce the relevant *ei* forms. Because the resulting numbers for the three-year-olds were so low, we have left them out of the analyses reported below. In the case of the 5-, 7-, and 9-year-olds, with each of the analyses reported below, the number of children whose data reached the 90% criterion and, hence, went into the statistical analyses varied. All means reported below are based on these subsets of children who reached the 90% criterion of performance.

[3] In fact, 63% of the children in this group came from homes for which the parents reported 100% use of Welsh to the children over that period of time.

[4] In fact, 58% of the children in this group came from homes for which the parents reported 100% use of English to the children over that period of time.

2.1.1.3.2. Adults

To obtain a base-line comparison group, we also tested 43 native-speaking Welsh adults who were born and are still living in Gwynedd/Anglesey. Approximately half the adults grew up in homes in which only Welsh was spoken, and half in homes in which both Welsh and English were spoken. (Their data will not be discussed here, but can be found in Gathercole & Thomas, in preparation; see also Thomas & Gathercole, this volume.)

2.1.2. Results

The major results of the study are reported here, with a focus on those results involving the effects related to the influence of home language and school language on children's performance. (See Gathercole & Thomas, in preparation, for a full analysis of all results.)

Table 2. Children participating in the study

AGE	SCHOOL LANGUAGE	HOME LANGUAGE			TOTAL
		OEH	OWH	WEH	
3	OWS	6	15	10	31
	WES	6	6	7	19
	TOT	**12**	**21**	**17**	**50**
5	OWS	10	22	15	46
	WES	22	11	6	39
	TOT	**32**	**33**	**22**	**87**
7	OWS	13	21	12	46
	WES	21	10	10	41
	TOT	**34**	**31**	**22**	**87**
9	OWS	12	22	11	45
	WES	27	18	10	55
	TOT	**39**	**40**	**21**	**100**
	TOT	**117**	**125**	**82**	**324**

2.1.2.1. Noun marking

Children's performance was examined for real versus nonsense nouns, for native versus borrowed vocabulary items, for masculine versus feminine nouns, and for nouns for humans, animals, and inanimate objects. The general results will be briefly reported first, followed by a report of the Home Language and School Language effects.

2.1.2.1.1. General findings

In general, performance on the production of nouns after the definite article showed the following significant effects, all p's $\leq .05$:

(i) Performance was better on real nouns than on nonsense nouns: 55.8% correct vs. 50.4% correct. This was particularly true for feminine nouns, 13.7% real nouns vs. 3.0% nonsense nouns.

(ii) Performance was better on masculine nouns (involving no mutation of the noun) than on feminine nouns (involving Soft Mutation): 97.9% vs. 8.3%.

(iii) For feminine nouns only, performance was better on native nouns than on borrowed nouns: native feminine words: 9.1%, borrowed feminine nouns: 6.3%.

(iv) Performance was affected by animacy of nouns: Performance was best on nouns for Humans (53.9%), next best on nouns for Animals (53.3%), and least good on nouns for Inanimates (52.1%).

(v) Presence of a gender cue on the noun root affected performance on nouns, especially nouns for humans (55.1% vs. 52.7% with and without cues) and nouns for inanimates (53.3% vs. 51.0% with and without cues). (Performance on nouns for animals: 52.8% and 53.8% with and without cues, respectively.)

2.1.2.1.2. Home language and school language findings

In addition to these general findings, there were effects involving Home Language (but not School Language):

(vi) Children from OWH homes outperformed children from both WEH and OEH homes: OWH: 55.8%, WEH : 49.5%, OEH: 50.8%. This was particularly true for real nouns (OWH: 60.6%, WEH: 50.2%, OEH: 51.0%).

(vii) The effect of animacy mentioned above was due to differential performance by children in the OWH group. While the performance of each of the WEH and OEH groups was indistinguishable across the animacy types (WEH: 49.2%-50.1% on all three, OEH: 50.6%-50.7% on all three), the OWH group performed better on nouns for humans (57.1%) and for animals (56.1%) than on nouns for inanimates (54.2%).

(viii) Finally, on real nouns, there was better performance on feminine nouns by the OWH group than the other two home language groups: On masculine nouns, all home language groups performed between 99.0-99.8% correct, but on feminine nouns, the OWH group outperformed their peers: OWH: 14.4%, WEH: 3.0%, OEH: 0.4%.

2.1.2.2. Adjective marking

Again, children's performance on adjectives was compared for adjectives occurring with real versus nonsense nouns, with native versus borrowed vocabulary items, with masculine versus feminine nouns, and with nouns for humans, animals, and inanimate objects, and with nouns beginning with mutatable onsets versus nouns with non-mutatable onsets. The general results will be briefly reported first, followed by a report of the Home Language and School Language effects.

2.1.2.2.1. General findings

(i) Performance was better on adjectives occurring with masculine nouns (involving no mutation of the adjective) than on adjectives occurring with feminine nouns (involving Soft Mutation): 92.4% versus 17.5%.

(ii) With feminine nouns, performance was better on adjectives occurring with real nouns than with nonsense nouns: 21.6% versus 13.5%. (Performance on adjectives with masculine real vs. masculine nonsense nouns was indistinguishable: 92.0% and 92.9%, respectively.)

(iii) For masculine forms only, performance was better on adjectives with borrowed nouns than with native nouns: 93.8% versus 91.3%.

(iv) Presence of a gender cue on the noun root affected performance on adjectives, especially with native feminine nouns: native feminine with cue: 28.1%, native feminine without cue: 10.2% (borrowed feminine: 17.4% and 17.2% with and without cue; masculine: 88.9%-95.2% across forms).

(v) Children showed better performance on adjectives when nouns were non-mutatable (56.4%) than when they were mutatable (53.9%).

2.1.2.2.2. Home language and school language findings

In addition to these general findings, there were effects involving Home Language and School Language:

(vi) Children from OWH homes outperformed children from both WEH and OEH homes, and WEH children, in turn, outperformed OEH children: OWH: 58.5%, WEH: 51.8%, OEH: 50.6%.

(vii) Children from OWH homes performed better on adjectives with real nouns than adjectives with nonsense nouns: 62.4% versus 54.5% (WEH: 52.3%, 51.2%; OEH: 48.8%, 52.4%).

(viii) The presence of a cue affected the performance of OWH and OEH children differentially for native vocabulary items, but not borrowed items: OWH, native with cue 65.1%, without cue 54.2%; borrowed with cue 59.4%, without cue 58.7%; OEH, native with cue 51.2%, without cue 48.8%; borrowed with cue 51.9%, without cue 53.5%. WEH children performed differentially according to the presence of a cue with both native and borrowed nouns: native with cue 54.4%, without cue 51.3%; borrowed with cue 55.0%, without cue 49.3%.

(ix) Children's performance on adjectives was affected by animacy of nouns in complex ways. In general, OWH children performed better on feminine forms than the other two groups at ages 7 and 9. This was especially the case in relation to humans (OWH at 7: 32.3%, at 9: 29.5%; WEH and OEH at 7: 7-10%, OEH at 9: 3.2%), although the WEH children performed similarly to the OWH group on feminine forms for humans by age 9 (25.5%). But it was also true in relation to animals (OWH: 7: 32.6%, 9: 32.4%;WEH and OEH at 7: 6-8%, at 9: 8-9%), and inanimates (OWH at 7: 20.1%, at 9: 22.6%; WEH and OEH at 7: 0-6%, at 9: 3-9%).

(x) There were School Language effects in children's abilities to draw on cues with real nouns : For inanimates, both School Language groups performed better when nouns had gender cues than when they did not, but for humans, only OWS children showed better performance when nouns had cues (64.2%) than when they did not (56.4%) (WES children performed at 55-56% for both of these.) (With nonsense nouns, cues on nouns helped children from both School Language groups for every animacy type.)

2.1.2.3. Marking with possessive ei

Again, children's performance on *ei* was compared for occurrence with real versus nonsense antecedent nouns, with native versus borrowed noun antecedents, with masculine versus feminine antecedents, and with antecedents for humans, animals, and inanimate objects. The general results will be briefly reported first, followed by a report of the Home Language and School Language effects.

2.1.2.3.1. General findings

The general findings across groups were as follows:

(i) Performance was better in relation to real noun antecedents than nonsense antecedents: 36.0% vs. 32.4%.

(ii) Performance was better with masculine *ei* (entailing Soft Mutation) than with feminine *ei* (entailing Aspirate Mutation): 52.7% vs. 15.7%.

(iii) Within masculine *ei*, performance was better with native vocabulary antecedents (52.4%) than with borrowed vocabulary antecedents (47.4%).

(iv) Performance significantly differed by animacy type: Humans 40.3% > Animals 32.8% > Inanimates 29.4%.

(v) This difference across animacy types was particularly true when antecedent nouns contained gender cues: With cues: Humans: 42.3%, Animals: 33.5%, Inanimates: 27.7%. With no cues,

performance on humans was still higher than on the other two types: Humans: 38.4%, Animals: 32.1%, Inanimates: 31.1%.

(vi) This animacy difference also held more with real nouns, either gender, than with nonsense nouns of that same gender: real feminine: H: 31.0% > A: 14.2% > I: 9.2%; real masculine: H: 57.1% > A: 53.9% > I: 50.8%; nonsense feminine: H: 19.4% > A: 11.1%, I: 9.3%; nonsense masculine: H: 53.8%, A: 52.1% > I: 48.4%.

(vii) There were age progressions within Animacy types, however: With feminine antecedents, there was improvement with age for both real and nonsense forms (sometimes with steady improvement at every age, sometimes only at age 9); with masculine antecedents, there was in many cases a decrease in performance at age 9: real masculine animals at 9: 48.1% (cf. 61.7% at age 7), real masculine inanimates at 9: 44.3% (cf. 58.3% at age 7), nonsense masculines for all animacy types: 43%-46% at age 9 (56%-64% at age 7).

(viii) Similarly, while performance in relation to nouns involving cues remained fairly steady for both real and nonsense nouns across ages, performance in relation to nouns without gender cues fell at age 9, for both real nouns (33.6% at age 9, cf. 39.2% at age 7) and nonsense nouns (29.1% at age 9, cf. 36.2% at age 7).

2.1.2.3.2. Home language and school language findings

As in the cases of noun and adjective production, Home Language and School Language affected performance.

(ix) Children from the three Home Language groups performed significantly differently: OWH: 54.4%, WEH: 28.7%, OEH: 9.9%.

(x) Children from the two School Language groups also performed significantly differently: OWS: 47.1%, WES: 23.4%.

(xi) The above-mentioned effect showing better performance in relation to real noun antecedents than nonsense antecedents was significant only in the case of OWH children: 58.2% vs. 50.6% (WEH: 29.4%, 28.0%; OEH: 9.9% for both).

(xii) Performance by Gender showed complex patterns within each Home Language group with age: On feminine forms, the OWH group showed steady improvement (5: 12.2%, 7: 23.1%, 9: 30.8%); the WEH group showed some improvement at age 9 (5: 11.1%, 7: 7.3%, 9: 17.6%); and the OEH group showed little improvement with age (5: 0.0%, 7: 5.6%, 9: 2.6%). On masculine forms, the OWH group seems to have been the group responsible for the decline in performance at age 9 (5: 95.8%, 7: 89.7%, 9: 75.6%); the WEH group showed improvement between ages 5 and 7 (5: 20.8%, 7: 49.4%, 9: 42.7%); and the OEH group showed somewhat erratic performance (5: 1.4%, 7: 21.8%, 9: 15.3%).

(xiii) The differences by Animacy Type mentioned above appear most relevant to the OWH group: H 66.7, A 50.5%, I 46.1%. It is not applicable to the OEH group (H, A, I: 8.9%-10.5%) and only marginally to the; WEH group: H 30.9%, A 29.8%, I 25.5%.

(xiv) Children from different Home Language groups appeared to use gender cues on nouns differently in their performance on *ei*: For OWH children, cues aided differentially in the performance on nonsense nouns (with cue: 54.1%, without cue: 47.2%; cf. real nouns with cue 58.8%, without cue 57.7%); for OEH children, cues did not make any difference with real or nonsense nouns (all: 8.9-10.8%); for WEH children, the presence of cues appears to have depressed performance: real with cue: 28.6%, without cue: 30.3%; nonsense with cue: 25.7%, without cue 30.4%.

(xv) School Language and Home Language interacted in their effect on performance on feminine versus masculine forms: On feminines, children from the same Home Language group performed similarly regardless of School Language (OEH: 2.6-3.5%, OWH: 26.6-26.4%, WEH: 13.0-11.3%). On masculines, children at OWS schools outperformed their peers in WES schools (OWH: OWS: 90.0%, WES: 71.1%; WEH: OWS: 57.6%, WES: 35.4%; OEH: OWS: 52.5%, WES: 3.6%).

2.1.3. Summary, study 1

These results on the production of gendered forms in Welsh together provide the following picture. First, in relation to general performance,

(i) In gender production in Welsh, children performed better on masculine forms than on feminine forms. For Nouns and Adjectives, this is likely due to the fact that masculine forms use the basic forms of nouns and adjectives, while the feminine forms use the Soft Mutated forms. For Nouns and Adjectives, performance on masculine forms was near ceiling in most cases. For the possessive *ei*, performance on the masculine was not at ceiling, but it was still much higher than performance on the feminine. So even with *ei*, for which both genders require some form of mutation (masculine Soft Mutation, feminine Aspirate Mutation), the leading edge of development occurs with the masculine form more than with the feminine form.

(ii) Performance was better in relation to real words than nonsense words. For nouns and adjectives, where masculine forms were at ceiling even in relation to nonsense words, the differential performance by noun type was related to performance on feminine forms. In relation to *ei*, the differential performance on real and nonsense forms occurred only within the OWH group.

(iii) Animacy type affected performance for all three linguistic forms. For Nouns, performance on humans was better than both that on animals and that on inanimates, and in some cases performance on animals was better than performance on inanimates. With adjectives, Animacy effects were observed only in those Home Language groups who showed improvement with age on feminine nouns--namely OWH children at all ages, and WEH children at age 9. With *ei*, performance differed on all three animacy types. This was especially apparent in relation to words marked with gender cues, to nouns that were real, and especially within the OWH group.

(iv) Differential performance between forms involving native vs. borrowed nouns was evident for both Nouns and Adjectives. With Nouns, this applied to feminine nouns (not masculine nouns, where performance was at ceiling), where performance was better on native words than on borrowed words. However, with Adjectives, there was the opposite effect. The differential performance on native and borrowed forms affected adjectives with masculine forms, and performance was better with <u>borrowed</u> nouns than with native nouns. This effect was likely due to the fact that masculine nouns require the non-mutated form of the adjective, and perhaps the borrowed words are less likely to encourage mutation on the part of the speaker.

(v) Gender cues on nouns did not influence performance across the board; however, they had some effect in the case of each of the linguistic forms. With nouns, words with cues yielded better performance than words without cues in the cases of words for humans and inanimates. With adjectives, cues improved performance in relation to feminine forms with native vocabulary items. This was particularly the case for OWH and OEH children; for WEH children, cues improved performance for both native and borrowed words. With *ei*, cues appeared to play a role in improving performance only in the case of performance of OWH children in relation to nonsense words. Notably, for WEH children, the presence of gender cues on the noun appeared to <u>decrease</u> their performance.

(vi) Finally, the presence of mutatable vs. non-mutatable onsets on nouns appears to have had little effect on performance. The only place where noun onset seemed to play a role was in the production of adjectives. Here, better performance was associated with nouns with <u>non-mutatable</u> onsets, not mutatable onsets.

In addition to these general findings, the following summarizes effects related to Home Language and School Language:

(vii) First, children coming from OWH homes always outperformed children from the other two Home Language groups. In addition, in many cases, children coming from WEH homes outperformed children from OEH homes. This was true for all three linguistic forms examined.

(viii) For Nouns, OWH children showed Animacy effects, while WEH and OEH children did not. These animacy effects were related to production of feminine nouns. These findings are related to the fact that performance by WEH and OEH children on feminine nouns was at floor level. The Animacy effects observed with OWH children, then, suggest that entry into productive gender marking on nouns occurs in relation to humans more than or earlier than animals, and, in turn, in relation to animals more than or earlier than inanimates.

(ix) For Adjectives, OWH children performed better than WEH and OEH children on feminine forms for humans, animals, and inanimates at ages 7 and 9. WEH children improved performance on marking of adjectives for feminine nouns for humans by age 9.

(x) For *ei*, OWH children's performance on feminine forms improved steadily with age. WEH children's performance showed improvement at age 9. OEH children's performance remained low at the three ages tested.

(xi) School Language was less influential than Home Language. However, School Language played a role in performance on adjectives and on *ei*.

(xii) For adjectives, children from OWS schools performed better on nouns for humans than children from WES schools.

(xiii) For *ei*, children from OWS schools outperformed WES children especially on the use of the masculine.

2.1.4. Discussion

From this first study, we can rank the constructs in question according to relative difficulty for production, as follows.

First, on the 'easy' end of the continuum we could place the production of masculine nouns and masculine adjectives. These involve no mutations.

At a middle level, we could place the masculine *ei*. This involves Soft Mutation.

At a 'hard' level, we would place feminine nouns, feminine adjectives, and feminine *ei*. The first two of these involve Soft Mutation, the last Aspirate Mutation. Note that the difference in performance between masculine *ei* and feminine nouns and adjectives implies that it is not mutation *per se* that is the difficulty. Soft Mutation related to the production of masculine *ei* seems to cause less of an obstacle for children than its use in the case of feminine nouns and adjectives.

Within the 'hard' end of the scale, there appear to be certain elements that help boost performance, and certain elements that impede performance. First, the higher the relevant noun is on the animacy hierarchy, the easier the construct is. This applies to the feminine form for nouns, adjectives, and *ei* alike. In addition, the presence of a gender cue on the noun root, while not a major factor, can help lead to 'clarity' within the system. Note, however, in the case of WEH children's performance on *ei*, gender cues on nouns impeded performance. Finally, the presence of mutatable or non-mutatable onsets on nouns appears to generally neither help nor impede performance. In the one place where it did affect performance, however (in the production of adjectives), mutatable onsets appears to have added opacity to the system, rather than clarity.

In addition, the results of this first study make it clear that both Home Language and School Language affect children's performance, in ways that are directly related to the amount of exposure each group has to Welsh. Thus, children from OWH homes hear more Welsh on a daily basis than children from WEH homes, and these, in turn, hear more Welsh than children from OEH homes. Similarly, children in OWS schools hear more Welsh on a daily basis than children from WES schools. Language of the home appears to have a much greater influence overall in the results reported here, but language of the school does play a role, particularly in relation to 'intermediate' structures (e.g., the production of masculine *ei*).

2.2. Study 2: Gender comprehension: Distant marking

2.2.1. Method

The general method involved a forced-choice task involving two pictures. The child was to find the one that corresponded to the sentence uttered by the experimenter. Within each trial, participants were shown an initial picture that corresponded to an initial sentence involving two nouns, one masculine and one feminine, and then two pictures from which they had to choose one to match a second sentence that included a masculine or feminine pronoun or possessive form.

2.2.1.1. Stimuli

2.2.1.1.1. Non-linguistic stimuli

Sets of pictures were drawn to accompany each trial. In each trial set, an initial picture showed two referents corresponding to two different nouns, one masculine and one feminine--e.g., a dish (*dysgl*, F) and a flower (*blodyn*, M). This first picture was on one side of a card and was to be shown while the experimenter uttered a first sentence with the two relevant nouns. The trial set also included a pair of contrasting pictures, depicted on the other side of the same card. These were shown when a second sentence, containing either a M or F pronoun or possessive form, was uttered. One picture corresponded to an interpretation of the pronoun or possessive as coreferential with the feminine noun in the first sentence, and one corresponded to an interpretation of it as coreferential with the masculine noun. That is, in one of the two pictures, the referent for the masculine noun was depicted with the relevant property (e.g., being broken) expressed in the second sentence, in the other the referent for the feminine noun was depicted with the relevant property expressed in the second sentence.

There were 36 such stimulus sets, corresponding to the 36 linguistic stimuli.

2.2.1.1.2. Linguistic stimuli

Linguistic stimuli were prepared, with each containing two sentences. In the first sentence, a masculine and a feminine noun occurred; in the second, either a masculine or a feminine pronoun or possessive form occurred.

The two nouns that occurred in the first sentence fell into three referent types: two nouns referring to humans, two nouns referring to animals, or two nouns referring to inanimate objects. Examples of sentential stimuli involving pronouns and *ei* are as in (6) and (7).

(6) S1: Roedd y ddysgl (F) las a'r blodyn (M) piws ar y bwrdd.
The blue dish and the purple flower were on the table
S2: Ond nath o/hi dorri.
But it (M/F) broke.

(7) S1: Dyma'r wasgod (F) ddu a dyma'r crys (M) pinc.
Here's the black waistcoat and here's the pink shirt.
S2: Ond ma'i phoced yn las.
ei + AM (therefore, F)
But its (F) pocket is blue.

The initial sentence in every case was designed so that the nouns were introduced with the definite article *y(r)* and a modifying adjective. Furthermore, these nouns and the adjectives modifying them all began with one of the following sounds susceptible to Soft Mutation: /p^h, t^h, k^h, b, d, g/. This was done to ensure that in every case, the first sentence would contain clear clues to each noun's gender, since feminine nouns after *y(r)* undergo Soft Mutation and trigger mutation on the following adjective, while masculine nouns do not.

In the case of the stimuli testing the interpretation of *ei*, the noun modified by *ei* in the second sentence always began with /p^h/, /t^h/, or /k^h/, all susceptible to both Soft Mutation and Aspirate

Mutation; hence, the construct in every case was clearly marked for masculine (*ei* + Soft Mutation) or feminine (*ei* + Aspirate Mutation) gender.

Each participant had a total of 36 stimulus trials. These trials were constructed as follows:

(i) There were 12 sentences with nouns for humans, 12 with nouns for animals, and 12 with nouns for inanimate objects.

(ii) Within each group of 12, 6 tested interpretations of pronouns, and 6 tested interpretations of *ei*.

(iii) Within each of the 6 trials on pronouns, half tested the interpretation of *hi*, the feminine pronoun, half *(f)o*, the masculine pronoun.

(iv) Similarly, within each of the 6 trials on *ei*, half tested the feminine *ei* (i.e., with Aspirate Mutation), half tested the masculine *ei* (i.e., with Soft Mutation).

(v) Furthermore, within each of the 6 trials in each group, 3 trials presented the masculine noun before the feminine noun in the first sentence, while 3 presented the feminine noun first.

2.2.1.2. Procedure

Testing was carried out by Welsh native speakers who grew up in the Gwynedd/Anglesey area. Each child was seen individually and sat next to the experimenter. Children were asked, in Welsh, to play a game. The experimenter showed a picture and uttered a sentence corresponding to it. She then turned over the card, to show the two choice pictures, and uttered the second sentence. The child was instructed to point to the picture that the experimenter was 'talking about'.

Two practice items that were not relevant to the task were used; these were followed immediately by the trial items.

2.2.1.3. Participants

The participants for this study were identical to those for the previous study and were participating in the larger study on the acquisition of Welsh (Gathercole & Thomas, in preparation). Not all of the original subjects completed this task, however. The resulting participants entered into the analyses to be reported below are shown in Table 3. (Three more children (2 3-year-olds and 1 5-year-old) completed the task, but because of an abundance of 'No Response' trials in their data, they have not been included in these analyses.)

Table 3. Participants included in Gender Comprehension Analyses

AGE	SCHOOL LANGUAGE	HOME LANGUAGE			TOTAL
		OEH	OWH	WEH	
3	OWS	5	13	8	26
	WES	6	5	5	16
	TOT	**11**	**18**	**13**	**42**
5	OWS	8	20	15	43
	WES	22	10	6	38
	TOT	**30**	**30**	**21**	**81**
7	OWS	13	21	12	46
	WES	21	10	10	41
	TOT	**34**	**31**	**22**	**87**
9	OWS	9	22	10	41
	WES	27	18	10	55
	TOT	**36**	**40**	**20**	**96**
	TOT	**111**	**119**	**76**	**306**

2.2.2. Results

The major results of the study are reported here, with a focus on those results involving the effects related to the influence of Home Language and School Language on children's performance. (See Gathercole & Thomas, in preparation, for a full analysis of all results.) First, the general findings will be reported, then those relating to Home Language and School Language.

2.2.2.1. General Findings

In general, the results reveal:

(i) Performance improved overall with age (3: 68.5% < 5: 75.3% < 7: 81.5%, 9: 85.6%).

(ii) Children performed better on pronouns (63.2%) than on the possessive *ei* (59.9%).

(iii) Children's performance on pronouns and *ei* were similar at ages 3 and 5 (3: Pro 55.9%, *ei* 55.1%; 5: Pro 59.7%, *ei* 59.1%), but at ages 7 and 9, children performed better on the pronouns than on *ei* (7: 63.7%, 61.6%; 9: 68.5%, 61.0%).

(iv) Performance was better on feminine forms (62.9%) than on masculine forms (60.1%). This was particularly true at ages 5, 7, and 9 (5: F 60.8%, M 58.0%, 7: F 64.2%, M 61.1%, 9: F 66.9%, M 62.7%) (cf. 3: F 54.8%, M 56.2%).

(iv) Better performance on feminine than on masculine occurred in relation to *ei*, not the pronouns: *ei*: F 62.9%, M 56.9% (cf. F pronoun 63.0%, M pronoun 63.4%).

(v) Children performed better on forms referring to Humans (76.0%) than to either Animals (54.9%) or Inanimates (53.7%). This was especially true at ages 5, 7, and 9 (5: H 68.9%, A 54.3%, I 55.1%; 7: H 80.8%, A 53.9%, I 53.2%; 9: H 86.0%, A 55.6%, I 52.7%).

(vi) Children performed differently on feminine forms for the three animacy types: H 78.3% > A 58.2% > I 52.3%. On masculine forms, performance on humans was better than on the other two animacy types: H 73.6% > A 51.6%, I 55.1%.

(vii) On pronouns, children performed differently on all three animacy types (H: 81.4%, A 56.3%, I 51.8%), but on *ei* children performed better on humans than on either animals or inanimates, but no differently on animals vs. inanimates (H 70.5%, A 53.6%, I 55.6%).

(viii) Performance on *ei* was better for feminine forms than for masculine forms in relation to humans (F 75.1%, M 66.0%) and animals (F 60.6%, M 46.5%). (Performance was equivalent for the two genders on the pronouns.)

(ix) However, the major developmental changes that occurred with age for both pronouns and *ei* were in relation to human referents.

2.2.2.2. Home Language and School Language findings

In addition, Home Language and School Language affected performance:

(x) All Home Language groups performed significantly differently: OWH: 66.5% > WEH: 63.3% > OEH: 55.0%.

(xi) Home Language performance differed mostly in relation to Human referents: OWH: 84.9%, WEH: 80.1%, OEH: 63.7%.

(xii) Performance on the pronouns in relation to humans was good by age 5 in the OWH and WEH (85.6% and 81.0%) groups, and by age 7 in the OEH group (79.1%). In relation to animals and inanimates performance on pronouns remained low at all ages (49.5% to 67.7% for animals, 43.1% to 59.0% for inanimates).

(xiii) Performance on the possessive *ei* in relation to humans was good by age 5 in the OWH group and improved at ages 7 and 9 (5: 76.2%, 7: 85.6%, 9: 92.5%); it was also good by age 7 in the WEH group (7: 78.9%, 9: 84.2%); in the OEH group performance on *ei* for humans remained poor (43.2% - 61.0%). In relation to animals, the best performance on *ei* was obtained from the OWH group at age 9, 62.2%. The OWH group was particularly good on *ei*

in relation to feminine animal antecedents (72.3%, cf. *ei* with masculine animal antecedents at 46.4% in this group and with feminine animal antecedents at 58.7% and 49.7% in the WEH and OEH groups, respectively). On inanimates, performance on *ei* was uniformly poor.

(xiv) School Language also primarily affected performance on items related to Human referents: OWS: 81.3%, WES: 70.3%.

(xv) School Language appears to have affected performance when children were first learning these forms. For children from OWH homes, School Language had an effect at age 3, with OWS children performing better than WES children (OWS: 61.7%, WES: 51.1%); for children from OEH homes, School Language had an effect at ages 7 and 9, again with OWS children outperforming WES children (7: OWS: 59.0%, WES: 52.5%; 9: OWS: 61.9%, WES: 56.1%).

2.2.3. Summary, study 2

These results on the comprehension of distant marking in gendered forms in Welsh provide the following picture. First, in relation to general performance:

(i) In gender comprehension in Welsh, children's performance on pronouns was better overall than performance on the possessive *ei.*

(ii) For pronouns, performance within each group was similar on masculine and feminine forms.

(iii) For possessive *ei*, performance was better on feminine forms than on masculine forms. This contrasts with the finding for gender production of *ei*, showing better performance on the masculine forms. The difference is likely to be due to the fact that Aspirate Mutation, used with the feminine *ei*, is more 'transparent' (i.e., is less pluri-functional--and, in fact, may only be heard by children in this context, see Thomas & Gathercole, this volume) than Soft Mutation, used with the masculine forms. Thus the function of the Aspirate Mutation may be more available in comprehension than Soft Mutation, but Soft Mutation, the more prevalent of the two mutation types throughout the language, may be more 'accessible' for production than the less frequent Aspirate Mutation.

(iv) Animacy type affected performance for both linguistic forms. For the pronoun, performance was best on humans, intermediate on animals, least good on inanimates. For the possessive, performance was also best on humans, and relatively low on animals and inanimates.

In addition to these general findings, the following summarizes effects related to Home Language and School Language:

(v) All Home Language groups performed differently, and in some cases OWS children outperformed WES children.

(vi) For pronouns, within the OWH and WEH groups, performance in relation to humans was good by age 5; in the OEH group by age 7.

(vii) For possessive *ei* (especially for feminine reference), the OWH group performed well on humans by age 5, and the WEH group by age 7. The OEH group performed poorly at all ages. The only group to have even fairly good performance on *ei* in relation to animals was the OWH group, and particularly in relation to feminine forms for animals.

2.2.4. Discussion

From the second study, we can rank the constructs in question according to relative difficulty for comprehension, as follows.

First, on the 'easy' end of the continuum we could place the comprehension of forms relating to humans. This is especially true for pronominal forms for humans, whether those pronouns are masculine or feminine. All groups seem to have mastered these by the ages of 5 or 7.

Slightly harder than pronouns for humans would be the feminine possessive *ei* in relation to humans. All groups showed some mastery of this form.

At an intermediate level, we could place pronouns related to animals. At a somewhat harder level, we could place the use of *ei* in relation to feminine animal terms. The only group to show any mastery of this was the OWH group.

At the 'hard' end of the scale would be any forms--pronominal or possessive--in relation to inanimate antecedents, whether masculine or feminine. In addition, masculine possessives in relation to animal antecedents are hard.

In addition, the results of the second study coincide with those of the first in showing that both Home Language and School Language affect children's performance, in ways that are directly related to the amount of exposure to Welsh. Language of the home appears to have had a much greater influence overall than language of the school in the results reported here, but language of the school did play a role, particularly in relation to structures in the process of being learned.

3. Implications of findings

The findings of these studies suggest a number of factors that influence acquisition in general and acquisition in bilinguals in particular.

3.1. Exposure

3.1.1. Frequency of exposure

First, the findings provide clear evidence supporting a critical role of exposure in language development. In each case, differences across groups studied here directly mirror differences in the amount of exposure the children in each group have to Welsh. Those with the most Welsh at home (i.e., OWH) have an early advantage over the other two groups--e.g., in the production of feminine nouns and adjectives in relation to humans and animals, and in the development of the comprehension of *ei* in relation to feminine human antecedents. Those with the lowest exposure to Welsh at home (i.e., OEH), with their primary exposure to Welsh limited to school, perform most poorly of the three home language groups. For example, although the comprehension of pronouns in relation to humans was good by age 5 in both the OWH and WEH groups, it was not good in the OEH group until age 7; at the extreme end, the OEH group showed little acquisition of the productive and receptive use of mutations with *ei* even at the oldest ages tested here.

The exposure to Welsh in the school had a similar effect, although less extreme than the home language effect. Greater exposure to Welsh in school appears to primarily affect children at stages when input may be most critical for acquisition. For example, for the young (3-year-old) OWH group's acquisition of the pronominal and possessive forms, the OWS children performed better than the WES children; by older ages, the school language difference did not affect OWH children. In contrast, school language seemed to affect OEH children acquiring the same forms at older ages; this seems to be consistent with the later timing of developing abilities with these forms among the OEH group.

3.1.2. Up to a critical mass

Because early differences across groups become mitigated or eliminated by older ages, it appears that frequency of exposure affects performance only up until the point at which children accumulate a 'critical mass' of input for them to decipher patterns in the input. Thus, for example, early differences at ages 3 and 5 across groups in their comprehension of pronouns in relation to humans became relatively indistinguishable at older ages. See Figure 4.

3.2. Structural complexity and opacity

The timing of the acquisition of these structures appears directly tied as well with the structural properties of the items in question. For example, some linguistic structures examined appear to have been quite easy. Examples of these include:

(1) The interpretation of pronouns for Humans. All groups of children performed fairly well on these by age 7.
(2) The production of masculine noun and adjective gender. These forms require the simplest, basic, form for nouns and adjectives, and thus require no manipulation on the part of the child.

Some items appear to have been somewhat more difficult--for example, possessive *ei* in comprehension in relation to human antecedents. This was learned by the OWH group by age 5, and by the WEH group by age 7, but the OEH group had not acquired these forms even by age 9.

And some forms were extremely difficult. The possessive *ei* in relation to animal antecedents seems to fall here. The OWH group is the only group that gains any mastery of this, and they do so more in relation to the feminine possessive than the masculine. The masculine *ei* in relation to animals does not appear to have been acquired by any group by age 9.

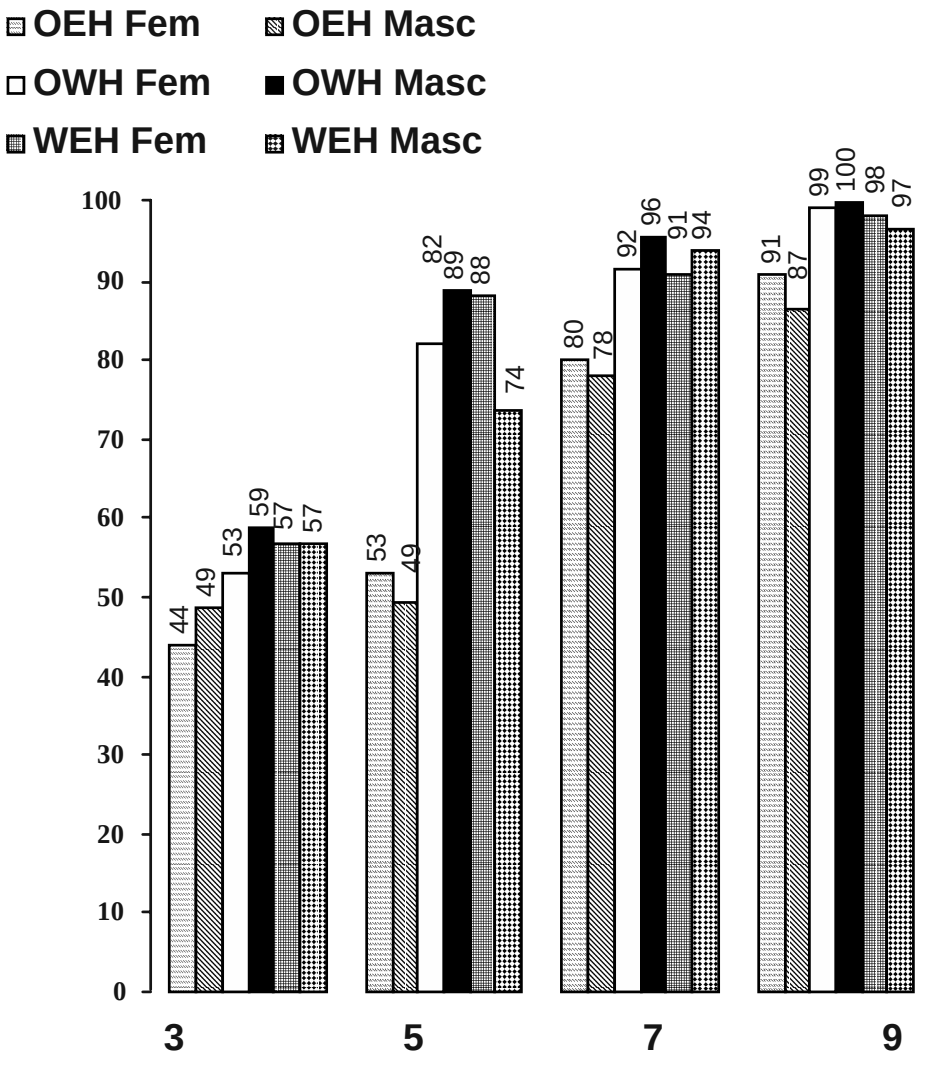
What is it that makes some of these hard and some of these difficult? At least two factors seem to contribute to difficulty. (1) First, multiple form-function pairings, as in the case of Soft Mutation in the Welsh language, appear to lend opacity and to make acquisition more difficult. Thus, the multiple form-function mappings for Soft Mutation appear to lend difficulty, for example, to the production of feminine nouns and adjectives and to the interpretation of masculine *ei*. (The fact that children in the first study did not make ready use of the fact that a noun was mutatable to produce the correct form for adjectives--and, in fact, mutatable onsets may have impeded such use--lends support to this claim of opacity for Soft Mutation in relation to gender.) Contrast this with the fact that in the comprehension task, it was the feminine form of *ei*--expressed through Aspirate Mutation--that was the easier of the two genders. Aspirate Mutation has dramatically fewer triggers in Welsh than Soft Mutation does, thus lending it greater form-function transparency. (2) A second factor that appears to be related to difficulty of a form is the cognitive complexity related to its use. For both the production and the comprehension of gendered forms in Welsh, children find use in relation to human referents, highest on the animacy hierarchy, the easiest to acquire. Whether this is because humans are highest on the animacy hierarchy or because humans happen to show 'natural gender' (so that Welsh children may be 'entering' the grammatical gender system through a 'natural gender' route) is a question to be left for future study.

4. Conclusion

The acquisition of Welsh in Welsh-English bilinguals is influenced by a variety of factors. The Language of the Home plays a critical role in the timing of acquisition, and Language of the School appears to play a supportive role at stages when acquisition is in the process of taking place. Both of these suggest that frequency of exposure plays a determining role in acquisition, at least up until a 'critical mass' of data has been accumulated by the child.

Finally, the complexity and opacity of the structures in question also affect the timing of acquisition, so that a critical mass of input may be attained early with relatively transparent or cognitively simpler structures, but later with more opaque structures. For those children with optimal exposure to the language, the later timing of acquisition for the more opaque or more complex structures is less problematic than for those with less exposure. In the case of bilinguals with less optimal exposure to the language, the late timing of acquisition for more opaque and more complex structures raises the question of whether some extremely opaque structures (e.g., *ei* for masculine antecedents for OEH children) may ultimately be timed 'off the map' for acquisition. We leave this last question for future research.

Figure 4. Performance on Pronouns in Relation to Human Antecedents, Gender Comprehension Study



References

Ball, M., & Müller, N. (1992). *Mutation in Welsh*. London: Routledge.

Borsley, R.D., & Tallerman, M.O. (1996). Phrases and soft mutation in Welsh. *Journal of Celtic Linguistics 5*.

Cain, J., Weber-Olsen, M., & Smith, R. (1987). Acquisition strategies in a first and second language: Are they the same? *Journal of Child Language 14*, 333-352.

Coltheart, M. (1978). Lexical access in simple reading tasks. In G. Underwood (ed.), *Strategies of information processing* (pp. 151-216). San Diego, CA: Academic Press.

Coltheart, M., & Leahy, J. (1996). Assessment of lexical and nonlexical reading abilities in children: Some normative data. *Australian Journal of Psychology, 48*, 136-140.

Conti-Ramsden, G. & Jones, M. (1997). Verb use in specific language impairment. *Journal of Speech, Language and Hearing Research, 40*, 1298-1313.

Daugherty, K. G., & Seidenberg, M. S. (1994). Beyond rules and exceptions: A connectionist approach to inflectional morphology. In S. D. Lima, R. L. Corrigan, & G. Iverson (eds.), *The reality o linguistic rules* (pp. 353-388). Amsterdam: Benjamins.

Ellis, Nick C. (2002). Frequency effects in language acquisition: A review with implications for theories of implicit and explicit language acquisition. (Target article) *Studies in Second Language Acquisition, 24*, 143-188.

Ellis, Nick C., & Schmidt, Richard. (1998). Rules or associations in the acquisition of morphology? the frequency by regularity interaction in human and PDP learning of morphosyntax. In Kim Plunkett (ed.), *Language acquisition and connectionism* (pp. 307-336). Hove: Psychology Press.

Elman, Jeffrey. (2000). Untitled talk presented at Workshop on Building Linguistic Structure in Ontogeny, Leipzig, May 26-28.

Gasser, Michael, & Smith, Linda B. (1998). Learning nouns and adjectives: A connectionist account. In Kim Plunkett (ed.), *Language acquisition and connectionism* (pp. 269-306). Hove: Psychology Press.

Gathercole, V. C. (1986). Evaluating competing linguistic theories with child language data: The case of the mass-count distinction. *Linguistics and Philosophy, 9*, 151-190.

Gathercole, Virginia C. Mueller. (2002a). Command of the mass/count distinction in bilingual and monolingual children: An English morphosyntactic distinction. In D. Kimbrough Oller & Rebecca E. Eilers (eds.), *Language and literacy in bilingual children* (pp. 175-206). Clevedon: Multilingual Matters.

Gathercole, Virginia C. Mueller. (2002b). Grammatical gender in bilingual and monolingual children: A Spanish morphosyntactic distinction. In D. Kimbrough Oller & Rebecca E. Eilers (eds.), *Language and literacy in bilingual children* (pp. 207-219). Clevedon: Multilingual Matters.

Gathercole, Virginia C. Mueller. (2002c). Monolingual and bilingual acquisition: Learning different treatments of *that*-trace phenomena in English and Spanish. In D. Kimbrough Oller & Rebecca E. Eilers (eds.), *Language and literacy in bilingual children* (pp. 220-254). Clevedon: Multilingual Matters.

Gathercole, Virginia C. Mueller, & Montes, Cecilia. 1997. *That*-trace effects in Spanish- and English-speaking monolinguals and bilinguals. In A. T. Pérez-Leroux & W. R. Glass (eds.), *Contemporary perspectives on the acquisition of Spanish, Vol. 1: Developing grammars*(pp. 75-95). Somerville, MA: Cascadilla Press.

Gathercole, Virginia C. Mueller, & Thomas, Enlli Môn. (in preparation). *The acquisition of Welsh: Mutation, opacity, and the bilingual context.*

Gordon, Peter. (1986). *The acquisition of syntactic categories: The case of the count/mass distinction.* Ph.D. dissertation, MIT, Cambridge, MA.

Gordon, Peter. (1988). Count/mass category acquisition: Distributional distinctions in children's speech. *Journal of Child Language, 15*, 109-128.

Harlow, S. J. (1989). Syntax of Welsh soft mutation. *Natural Language and Linguistic Theory* **7**, 289-316.

Hernández-Pina, F. (1984). *Teorías psicosociolingüísticas y su aplicación a la adquisición del español como lengua materna*. Madrid: Siglo XXI de España Editores, S.A.

Jones, M. & Conti-Ramsden, G. (1997). A comparison of verb use in children with SLI and their younger siblings. *First Language, 17*, 165-193.

Jurafsky, D. (1996). A probabilistic model of lexical and syntactic access and disambiguation. *Cognitive Science, 20*, 137-194.

Jurafsky, D., & Martin, J. H. (2000). *Speech and language processing: An introduction to natural language processing, speech recognition, and computational linguistics.* Englewood Cliffs, NJ: Prentice-Hall.

Karmiloff-Smith, Annette. (1978). The interplay between syntax, semantics and phonology in language acquisition processes. In R. N. Campbell & P. T. Smith (eds.), *Recent advances in the psychology of language*. N.Y.: Plenum Press.

Kirsner, K. (1994). Implicit processes in second language learning. In N. Ellis (ed.), *Implicit and explicit learning of languages* (pp. 283-312). San Diego, CA: Academic Press.

Luce, P. A. (1986). A computational analysis of uniqueness points in auditory word recognition. *Perception and Psychophysics, 39*, 155-158.

Maratsos, Michael. (2000). More overregularizations after all: new data and discussion on Marcus, Pinker, Ullman, Hollander, Rosen & Xu. *Journal of Child Language, 27*, 183-212.

Marchman, Virginia A., & Bates, Elizabeth. (1994). Continuity in lexical and morphological development: a test of the critical mass hypothesis. *Journal of Child Language, 21*, 339-366.

Oller, D. Kimbrough, & Eilers, Rebecca E. (eds.). (2002). *Language and literacy in bilingual children.* Clevedon: Multilingual Matters.

Rice, Mabel. (1980). *Cognition to language: Categories, word meanings, and training*. Baltimore: University Park Press.

Saffran, J. R., Aslin, R. N., & Newport, E. L. (1996). Statistical learning by 8-month-old infants. *Science, 274*, 1926-1928.

Saffran, J. R., Johnson, E. K., Aslin, R. N., & Newport, E. L. (1999). Statistical learning of tone sequences by human infants and adults. *Cognition, 70,* 27-52.
Seidenberg, M. S. (1997). Language acquisition and use: Learning and applying probabilistic constraints. *Science, 275*, 1599-1603.
Seidenberg, M. S., & Bruck, M. (1990). Consistency effects in the generation of past tense morphology. Paper presented at the 31st meeting of the Psychonomic Society, New Orleans, LA.
Thorne, D. (1993). *A Comprehensive Welsh Grammar*. Oxford: Blackwell.
Watkins, T. A. (1993). Welsh. In M. J. Ball & J. Fife (eds.), *The Celtic Languages.* London: Routledge.

ISB4: Proceedings of the 4th International Symposium on Bilingualism

edited by James Cohen, Kara T. McAlister, Kellie Rolstad, and Jeff MacSwan

Cascadilla Press Somerville, MA 2005

Copyright information

ISBN 978-1-57473-210-8 CD-ROM
ISBN 978-1-57473-107-1 library binding (5-volume set)

Ordering information

To order a copy of the proceedings, contact:

Cascadilla Press
P.O. Box 440355
Somerville, MA 02144, USA

phone: 1-617-776-2370
fax: 1-617-776-2271
sales@cascadilla.com
www.cascadilla.com

Web access and citation information

This paper is available from www.cascadilla.com/isb4.html and is identical to the version published by Cascadilla Press on CD-ROM and in library binding.