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Morphosyntactic complexity and exposure in the acquisition of gender in Welsh

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Chapter 8

Local gender marking: Numerals

8.1 Chapter Overview

This chapter presents an experimental task that elicited gendered numeral forms in structured contexts. The task elicited numerals in relation to **forty-eight Welsh nouns**. The chapter is divided into three sections. First, a methodological description of the task is presented. Then, quantitative and qualitative results of the task are presented followed by a discussion of the results.

8.2 Task Summary and Rationale

This elicited production task assessed local gender marking of nouns via gendered numeral forms. Forms were elicited in a cloze task procedure. According to the gender system of Welsh, some numerals take either a masculine or feminine form, depending on the noun they modify or refer to. When a referent is masculine the numerals **two, three and four** take the following forms: *dau* ‘two (m.)’, *tri* ‘three (m.)’, *pedwar* ‘four (m.)’. When a referent is feminine, these numerals take the forms *dwy* ‘two (f.)’, *tair* ‘three (f.)’ and *pedair* ‘four (f.)’. The task assessed whether these three numerals were produced by participants in correct gendered forms, in keeping with the grammatical gender of the relevant noun.

This feature of the Welsh gender system has not previously been explored from an acquisitional perspective. This task thus assessed another aspect of gender marking, with the same set of forty-eight nouns as were explored in the previous

tasks. This was done with a view to comparing the productivity of the different types of gender markers, and observing patterns in their use. Comparison of performance across all three tasks is explored in **Chapter 10**.

It was expected that young children might produce these numeral forms more accurately at an earlier age than gender distinctions made via SM, because these could be picked up as whole lexical items that are consistent in the forms used for marking for each gender. In addition, these numeral forms have a wider scope than SM, in that this form of gender marking can apply to all nouns, not just those that are susceptible to mutation. Gender distinctions exist only for these three numerals, however, so this may limit the salience of this particular kind of gender distinction.

8.3 Method

8.3.1 Design and Stimuli.

8.3.1.1 Linguistic Stimuli.

Nouns and numerals.

The same sub-set of forty-eight Welsh nouns that were elicited in the **Noun and Adjective Elicitation Task** featured in this task (see Chapter 5, *Table 5.1*, for the full list of nouns). Three different numerals were elicited in both masculine and feminine forms:

2 – *dau* ‘two (m.)’ / *dwy* ‘two (f.)’

3 – *tri* ‘three (m.)’ / *tair* ‘three (f.)’

4 – *pedwar* ‘four (m.)’ / *pedair* ‘four (f.)’

Sentences.

The task consisted of 48 trials. Each trial had three phases, two prompt phases and one target phase. In prompt phases the experimenter uttered two prompt sentences. Sentences referred to images displayed to participants. The first prompt sentence entailed naming the noun referent shown (and its colour); the second prompt sentence stated the number of the referent shown in a second image. In the target phase participants were required to state the number of the noun referent shown in the third (target) image.

Target sentences.

Target sentences featured the same 48 nouns featured in previous tasks. Nouns appeared with gendered numeral forms in a structured context. Full sentences expressed the number of target objects that appeared in each target image, as shown below:

(53) MASC:

Rwan	mae	‘na	dri	ci
now	BE.3p	there	three (m.)	dog (m.)

‘Now there are three dog(s) (m.)’

(54) FEM:

<i>Rwan</i>	<i>mae</i>	<i>‘na</i>	<i>dair</i>	<i>cath</i>
Now	BE.3p	there	three (f.)	cat (f.)

‘Now there are three cat(s) (f.)’

Prompt sentences.

Target sentences were preceded by two prompt sentences. The first prompt sentence referred to a single object presented in an image. Nouns were presented in one of three syntactic contexts. These three contexts controlled for gender information. Zero, one, or two syntactic cues were available that indicated the gender of the target noun. These syntactic cues were manipulated to determine whether or not the presence or absence of the syntactic cues influenced children's preposition + pronoun production.

Condition 1: 0-cues.

Target nouns were presented in a context without any gender marking; all nouns appeared in their basic forms. For example, see (55) and (56) below:

(55) MASC:

EXP: *Dyma* *lun* *ci*
 Here picture dog (m.)
 'Here's (a) picture (of a) dog (m.)'

(56) FEM:

EXP: *Dyma* *lun* *cath*
 Here picture cat (f.)
 'Here's (a) picture (of a) cat (f.)'

Condition 2: 1-cue.

The definite article *yr*, “the” preceded nouns in this condition. The definite article triggers soft mutation of a feminine noun following it, but does not trigger mutation of a masculine noun. The presence or absence of mutation on these nouns provided a cue to their gender status:

(57) MASC

EXP: *Dyma’r* *ci*
 Here-the dog (m.)
 ‘Here’s the dog (m.)’

(58) FEM:

EXP: *Dyma’r* *gath*
 Here-the cat (f.)
 ‘Here’s the cat (f.)’

Condition 3: 2-cues.

Nouns in this condition were preceded by the definite article *yr* (*’r*), as above, but, additionally, adjectives with mutable onsets followed the nouns. Both are marked for gender, as shown in (59). Masculine nouns do not mutate; nor do their corresponding adjectives, as shown in (60).

(59) MASC:

EXP: *Dyma’r* *ci* *glas*
 Here-the dog (m.) blue
 ‘Here’s the blue dog (m.)’

(60) FEM:

EXP: *Dyma’r* *gath* *las*
 Here-the cat (f.) blue
 ‘Here’s the blue cat (f.)’

The second prompt sentence in each trial referred to a second image, which showed five of the objects shown in the first prompt image. This sentence stated the number of the noun referent shown. The word for ‘five’ in Welsh has a single form – *pump* – and is not marked for gender. The word *pump* does not trigger mutation of nouns, thus no additional syntactic cues were available. This sentence served to establish the sentence structure of the participant’s elicited sentence.

(61) MASC:

Rwan *mae* ‘*na* *bump* *ci*
 Now BE.3p there five dog (m.)
 ‘Now there are five dog(s) (m.)’

(62) FEM:

Rwan *mae* ‘*na* *bump* *cath*
 Now BE.3p there five cat (f.)
 ‘Now there are five cat(s) (f.)’

Sentence sequences.

All trials featured two prompt sentences (experimenter), followed by one elicited sentence (participant). The sequence of the sentence types is shown in *Table 8.1*, below.

Table 8.1

Structure of the three trial phases

	Phase 1	Phase 2	Phase 3
Phase	1 st Prompt Phase	2 nd Prompt Phase	3 rd Prompt Phase
	Introduction of target noun – 0, 1 or 2 syntactic cues	Establishment of structure of target sentences and reference to number	Participant states number of object presented
Condition			
0 cues	<i>Dyma lun + noun</i>	<i>Rwan mae 'na 5 + noun</i>	<i>Rwan mae 'na 2/3/4 + noun</i>
	Example: <i>Dyma lun cath</i>	Example: <i>Rwan mae 'na 5 cath</i>	Example: <i>Rwan mae 'na ddwy gath</i>
	'Here's a picture of a cat.'	'Now there are five cat(s) (f.).'	'Now there are two (f.) cat(s) (f.).'
1 cue	<i>Dyma'r + noun</i>	<i>Rwan mae 'na 5 + noun</i>	<i>Rwan mae 'na 2/3/4 + noun</i>
	Example: <i>Dyma'r gath</i>	Example: <i>Rwan mae 'na 5 cath</i>	Example: <i>Rwan mae 'na ddwy gath</i>
	'Here's the cat.'	'Now there are five cat(s) (f.).'	'Now there are two (f.) cat(s) (f.).'
2 cues	<i>Dyma'r + noun + adj</i>	<i>Rwan mae 'na 5 + noun + adj</i>	<i>Rwan mae 'na 2/3/4 + noun + adj</i>
	Example: <i>Dyma'r gath las</i>	Example: <i>Rwan mae 'na 5 cath las</i>	Example: <i>Rwan mae 'na ddwy gath las</i>
	'Here's the blue cat (f.).'	'Now there are five blue cat(s) (f.).'	'Now there are two (f.) blue cat(s) (f.).' ¹

¹ N.B. Target numerals varied (the numerals 2, 3 and 4 were elicited), but were distributed equally across trials. Thus, each numeral was used in 1/3 of the trials: 16 trials – 2, 16 trials – 3, 16 trials – 4.

8.3.1.2 Non-linguistic stimuli.

Images.

One hundred and forty-four images were created. They were shown in 48 sets of three. Ninety-six prompt images elicited the prompt sentence pairs of the experimenter; the remaining 48 images elicited sentences from the participant. Images were presented mostly in black and white, but in some trials in colour, in order to allow production of colour adjectives along with nouns in both prompt and (see Appendix 19 for more examples of images used). The first image in each set displayed one item. The second image in each set displayed five of the items that had been displayed previously. The final (eliciting) image in each set displayed two, three or four of the same item, depending on the trial, see *Figure 8.1*, for an example trial).

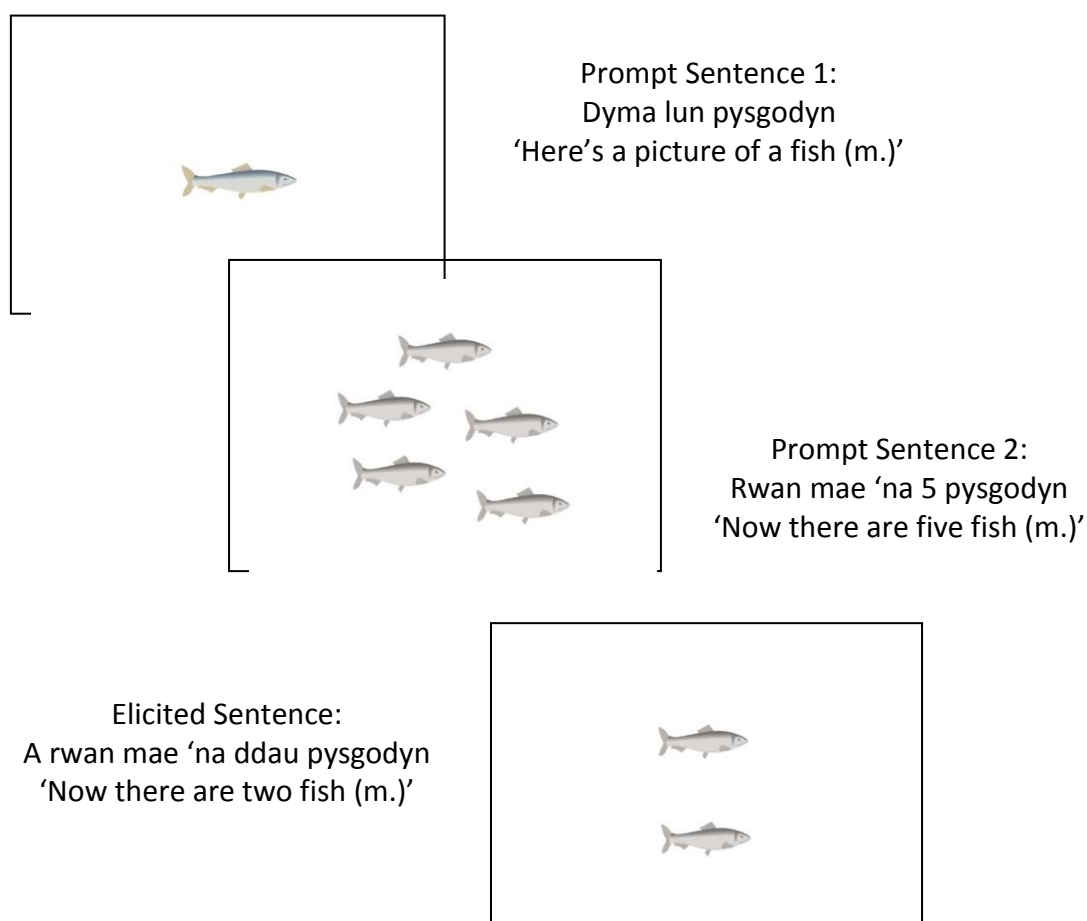


Figure 8.1. Example of trial.

8.3.2 Participants.

The same participants that participated in the *Noun and Adjective Task* and *Preposition and Pronoun Task* participated in this task (see Chapter 5, above).

8.3.3 Procedure.

Participants were told they would be playing a game, and that they would be seeing pictures and saying things about them. The experimenter explained that they would see the images in sets of three. Participants were able to practise with a few practice images first, before starting the main game (see Appendix 20 for full task instructions and example of practice trials).

In each trial, the experimenter would describe the first image in each set; then the experimenter would describe the second image. The participant was asked to describe the third image in each set, by stating how many items were in the third image. Trials were completely randomised using the RAND command in Microsoft Excel ©. A total of five randomisations of the trials were created (see Appendix 21 for details). These task randomisations were distributed equally across participants, both within and across groups.

Marking sheets were used that covered all responses the participants could conceivably make, including information on possible alternative numeral forms (see Appendix 22 for details). All trials were audio recorded for the purpose of later double-checking, if and when the experimenter was unsure of what a participant had said in a given trial.

8.4 Results

8.4.1 Overview.

The results are presented in two parts. First, quantitative results of the adult data are presented. (Only the adult data were analysed quantitatively. This was because during testing it soon became apparent that the child participants were overwhelmingly producing masculine numeral forms. Of the 150 children tested, 108 children produced masculine numeral forms in ALL trials. This meant that the child data were severely skewed; consequently, the data did not allow for statistical analysis.)

A second section presents qualitative analyses of the patterns of numeral production in the 42 children who did produce both masculine and feminine numeral forms. Overall patterns of responding, and switches in the response patterns of a number of these children are discussed.

8.4.2 Data Scoring.

Data were scored for correct/incorrect responses in the choice of numeral form. Only the adult data were analysed quantitatively.

8.4.3 Quantitative Analyses.

An initial repeated measures ANOVA was run, in which Gender (Masculine vs. Feminine), Animacy (Animate vs. Inanimate), Cue Condition, (0,1, or 2 cues), and Word Form (Marked vs. Unmarked) were the independent variables and accuracy of numeral production was the dependent variable. Three significant interactions were

attested: Gender x Animacy, $F(3, 17) = 6.346, p = .022$; Gender x Word Form, $F(1, 17) = 5.454, p = .032$ and Gender x Animacy x Word Form x Cue Condition, $F(2, 34) = 3.813, p = .032$. Given the significant interactions involving gender, and a main effect of gender, $F(1, 17) = 16.774, p < .001$, the dataset was split in two – one dataset for masculine noun trials, and one dataset for feminine noun trials.

Masculine Noun Trials.

A more focussed repeated measures ANOVA analysed the masculine noun trial data only. Two significant main effects emerged. A main effect of animacy, $F(1, 17) = 5.282, p = .035$, and a main effect of Word Form, $F(1, 17) = 5.120, p = .037$. The main effect of word form reflected better performance for unmarked noun trials as opposed to marked noun trials ($M = 86.11, SD = 14.01$ vs. $M = 90.74, SD = 14.26$).

The animacy effect revealed better performance in relation to animate masculine nouns than inanimate masculine nouns ($M = 92.13, SD = 11.60$ vs. $M = 84.72, SD = 17.91$). Scores for all trials with human masculine nouns were collapsed into one score, and then scores for all trials with animal masculine nouns were collapsed into a second score. A second repeated measures ANOVA revealed no effect of animacy, $F(1, 17) = 4.349, p = .052$. Performance in relation to animal and human nouns was very similar ($M = 97.22, SD = 6.39$ vs. $M = 87.04, SD = 21.05$).

The animate and inanimate data were then analysed separately, to further investigate the potential role of word form and cue conditions as contributing factors. The first ANOVA, (which analysed the animate noun data only), included Word Form, (Marked vs. Unmarked), and Cue Condition, (0, 1, or 2 cues), as

independent variables, and accuracy of numeral production as the dependent variable. No significant main effects or interactions were observed.

A second ANOVA included the same variables as above, but analysed the inanimate noun trial data only. Two significant main effects were observed. One main effect of Cues, $F(2, 17) = 4.195, p = .024$, and one main effect of Word Form, $F(1, 17) = 5.591, p = .030$. Planned comparisons using the LSD test revealed the main effect of cues reflected significant differences ($p = .048$) between the 0-cue ($M = 77.78, SD = 22.51$) and the 2-cue condition ($M = 88.89, SD = 21.39$), with significantly better performance on average for the latter.

Feminine Noun Trials.

A more focussed repeated measures ANOVA analysed the feminine noun trial data only. The analysis revealed a significant main effect of animacy, $F(1, 17) = 26.348, p < .001$, and a significant interaction of Animacy x Word Form x Cue Condition, $F(6, 17) = 3.372, p = .046$. The main effect of animacy reflected significantly better performance for trials with animate nouns as opposed to trials with inanimate nouns ($M = 73.15, SD = 20.32$ vs. $M = 53.24, SD = 28.89$).

Scores for all trials with human feminine nouns were collapsed into one score, and then scores for all trials with animal feminine nouns were collapsed into a second score. A repeated measures ANOVA revealed an effect animacy, $F(1, 17) = 16.108, p < .001$, with performance in relation to human nouns being significantly better ($M = 88.89, SD = 12.78$ vs. $M = 57.41, SD = 34.87$).

The animate and inanimate data were then analysed separately, to further investigate the potential role of word form and cue conditions as contributing

factors. The first ANOVA, (which analysed the feminine animate noun data only), included Word Form, (Marked vs. Unmarked), and Cue Condition, (0, 1, or 2 cues), as independent variables, and accuracy of numeral production as the dependent variable. No significant main effects or interactions were observed.

A second ANOVA included the same variables as above, but analysed the inanimate noun trial data only. A significant interaction of Word Form x Cue Condition was observed, $F(2, 34) = 7.423, p = .002$. Post-hoc t-tests revealed significant differences between marked noun trials and unmarked noun trials in the 2-cue condition $t(1, 17) = 3.500, p = .003$, but not in the 0- and 1-cue conditions ($t(1, 17) = -.294, p = .772$; $t(1, 17) = -1.288, p = .215$). This effect is thought to be a lexical effect deriving from the particular nouns that appeared in the 2-cue condition.

Summary of adult data.

The adult data give various insights into the representation of the gendered numeral system in adults. First, adults showed a tendency to produce masculine numeral forms more frequently than feminine numeral forms. Overall, adults produced masculine forms 63% of the time, and feminine forms 37% of the time. The adults' preference for masculine forms must derive from the Welsh language itself, which has a notably higher percentage of masculine nouns than feminine nouns (Surrige, 1989).

Of the 16 adults who committed errors (two adults had perfect scores), four adults did not commit errors in masculine noun trials, but committed errors in feminine noun trials. Further, although twelve adults committed errors in both

feminine and masculine noun trials, all but one of these adults committed more errors in feminine noun trials.

In addition to the gender bias observed, adults also showed evidence of natural gender effects. Adults produced target masculine and feminine numeral forms very effectively when referring to human noun referents, and with significantly more accuracy than when referring to animal or inanimate nouns. The adults have made the link between grammatically gendered numeral forms and natural gender, just as they have done for pronouns.

Importantly, the adults consistently performed better in trials where nouns were presented in a syntactic context that provided one or more cues to the gender of the noun referent. This suggests that the adults were attending to, and utilising, these cues when selecting numeral forms, reflecting knowledge of the formal properties of the gender system, and further reflecting their ability to link different aspects of that system (i.e. mutation/lack of mutation of noun and/or adjective forms in relation to gendered numeral forms).

8.4.4 Qualitative Analyses.

8.4.4.1 Response Patterns.

Qualitative analyses of the numeral data for the child participants are presented here. Comparisons across age and home language groups are made when appropriate. Individual response patterns were identified for each child, and overall patterns both within and across groups are discussed. Data are reported for the masculine noun trials (24 trials) and the feminine noun trials (24 trials) separately. In each set of 24 trials, one third of these trials were allocated to each of three target

numerals, (i.e. eight trials with *dau/dwy* ‘two (m.)/two (f.)’, eight trials with *tri/tair* ‘three (m.)/three (f.)’, eight trials with *pedwar/pedair* ‘pedwar (m.)/pedair (f.)’).

4- and 5-year-olds.

Table 8.2 shows the response patterns for the OWH 4-year-olds and the 5-year-old children across all three home language groups. Patterns across age and home language groups were very similar. Fifty-one out of 60 children produced masculine numeral forms in all 48 trials. Nine children produced both masculine and feminine numeral forms. These children’s responses fell into two different patterns. The patterns for masculine and feminine noun trials are discussed separately.

Masculine noun trials.

Three children showed very limited use of feminine numeral forms in relation to one or two masculine nouns. Three other children exhibited differential responses depending on the numeral type. TW² (OEH 5-year-old), for example, produced *dwy* ‘two (f.)’ in all trials with two of a given noun referent, but produced the masculine forms *tri* ‘three (m.)’ and *pedwar* ‘four (m.)’ in all trials with three or four of a given referent. Several other children also showed different patterns of use across numeral types, similar to the pattern observed for TW.

HO (WEH 5-year-old) also exhibited differential patterns of use across numeral types, but his responses were not consistent within numeral types. That is, he produced both masculine and feminine forms of the same numeral (i.e. *tri* (three (m.)) and *tair* ‘three (f.)’). It appeared that HO changed his pattern of responding

² The initials of the children have been changed, to ensure their anonymity.

Table 8.2. Response patterns of 4- and 5-year old children divided by home language

Gender of target nouns	Response Patterns	OWH 4	OWH 5	WEH 5	OEH 5
M and F Targets	All M Forms Throughout	13	12	12	14
M Target					
	All M – <i>dau, tri, pedwar</i>	13	13	13	14
	> 80% M – <i>dau, tri, pedwar</i>	1	1	0	0
	M for some numerals, feminine for others (inconsistent across 2, 3, and 4)	1	1	2	1
	40-60% M and F	0	0	0	0
	80% > F	0	0	0	0
	All F forms	0	0	0	0
F Target					
	All M – <i>dau, tri, pedwar</i>	13	12	12	14
	> 80% M - <i>dau, tri, pedwar</i>	1	2	1	0
	M for some numerals, feminine for others (inconsistent across 2, 3, 4)	1	1	2	1
	40 – 60% M and F	0	0	0	0
	> 80 % F	0	0	0	0
	All F forms	0	0	0	0

during the task from initially producing *tair* ‘three (f.)’ to later producing *tri* ‘three (m.)’, and then switching back again to *tair* ‘three (f.)’. FF, (OWH 4-year-old), also seemed to exhibit a switch in her response pattern for trials eliciting *tri/tair* ‘three (m.)/three (f.)’, while response patterns for trials eliciting *dau/dwy* ‘two (m.)/two (f.)’ and *pedwar/pedair* ‘four (m.)/four (f.)’ were homogeneous in each case (always *dau* ‘two (m.)’ and *pedair* ‘four (f.)’). DSB switched response patterns during testing for trials eliciting *dau/dwy* ‘two (m.)/two (f.)’. The nature of these switches is explored further in **Section 8.4.5**.

Feminine noun trials.

Nine children produced some target feminine numeral forms in relation to feminine nouns. Seven of these children were those who had produced both masculine and feminine numeral forms in masculine noun trials. The same patterns observed for these children in masculine noun trials also applied to feminine noun trials. Two children produced one feminine numeral form each, (in reference to a different feminine noun in each case).

Summary of 4-and 5-year-old data.

Overall, children at this age did not produce feminine numeral forms. A small minority (nine children) produced both feminine and masculine numeral forms. However, five of these children showed identical response patterns in terms of their production of feminine versus masculine numeral forms in relation to feminine and masculine nouns, reflecting a lack of knowledge of the system. Four children showed

selective use of a small number of feminine numeral forms. These children produced masculine numeral forms in relation to all masculine nouns, and most feminine nouns, but they also produced a very small number of feminine numeral forms in reference to feminine nouns. These children may be showing early signs of lexical learning, whereby they are acquiring distributional information regarding numeral forms in relation to specific nouns.³

7-year-olds.

OWH 7-year-olds.

Masculine noun trials.

Response patterns for the 7-year-olds are displayed in *Table 8.3*, below.

Fourteen out of 15 OWH children (correctly) produced masculine numeral forms in all trials. One child (ROE) exhibited the opposite pattern and produced predominantly feminine numeral forms. This child correctly produced *tri* ‘three (m.)’ in reference to just two masculine nouns.

Feminine noun trials.

Ten out of 15 children (incorrectly) produced masculine numeral forms in all trials. ROE conversely produced feminine numeral forms in all trials but two. This child incorrectly produced *tri* ‘three (m.)’ in reference to two feminine nouns. Four children produced a small number of feminine numeral forms in reference to some feminine nouns. These children’s feminine numeral forms did not necessarily refer to

³ For details of the response patterns of individual 4- and 5-year-olds, see Appendix 23.

Table 8.3. Response patterns of 7-year-old children divided by home language

Gender of target nouns	Response Patterns	OWH 7	WEH 7	OEH 7
M and F Targets	All M Forms Throughout	10	9	14
M Target	All M – <i>dau, tri, pedwar</i>	14	10	14
	> 80% M – <i>dau, tri, pedwar</i>	0	3	1
	M for some numerals, feminine for others (inconsistent across 2, 3, and 4)	0	2	0
	40-60% M and F	0	0	0
	80% > F	0	0	0
	All F forms	1	0	0
F Target	All M – <i>dau, tri, pedwar</i>	10	11	14
	> 80% M - <i>dau, tri, pedwar</i>	4	2	0
	M for some numerals, but not others [inconsistent across 2, 3, 4]	0	2	1
	40 – 60% M and F	0	0	0
	> 80 % F	1	0	0
	All F forms	0	0	0

the same feminine nouns. None of these children had produced feminine numeral forms in masculine noun trials.

WEH 7-year-olds.

Masculine noun trials.

Ten children (correctly) produced masculine forms in all trials. Three children incorrectly produced a very small number of feminine numeral forms in relation to masculine nouns. ODH and DR showed differential use of masculine/feminine numeral forms depending on the numeral type. Both children produced *dwy* ‘two (f.)’ in two-referent trials, but produced *tri* ‘three (m.)’ and *pedwar* ‘four (m.)’ in three- and four-referent trials. ODH initially began producing *dau* ‘two (m.)’ but switched to producing *dwy* ‘two (f.)’ early on in the task.

Feminine noun trials.

Eleven children (incorrectly) produced masculine numeral forms in all trials. ODH and DR exhibited the same differential response patterns across numeral types as those observed for masculine noun trials. NP produced target feminine numeral forms in 5/24 trials. She had also produced feminine forms in 2/24 masculine noun trials. These response patterns appeared to be due a change in response pattern for one numeral type (three). This apparent switch resembled that observed in HO, and is discussed further in **Section 8.4.5**. OW produced three target feminine numeral forms. He had not produced any feminine forms in masculine noun trials.⁴

⁴ For details of the response patterns of individual seven-year-olds, see Appendix 24.

OEH 7-year-olds.

Masculine noun trials.

Fourteen children (correctly) produced masculine numeral forms in all trials. OFH produced both masculine and feminine numeral forms. She produced *dwy* ‘two (f.)’ incorrectly once. This was taken to be a performance error. However, she incorrectly produced *tair* ‘three (f.)’ and *pedair* ‘four (f.)’ extensively. This child exhibited differential patterns of use depending on the numeral type, favouring *dau* ‘two (m.)’, *tair* ‘three (f.)’ and *pedair* ‘four (f.)’. This child did not produce these forms exclusively, however. Scrutiny of her data suggests a change in response pattern from initial production of all masculine forms to a later switch to producing *tair* ‘three (f.)’ and *pedair* ‘four (f.)’ in later trials. This switch is discussed further in **Section 8.4.5.**

Feminine noun trials.

The same pattern observed for masculine trials also applied here. OFH was the only child who produced target feminine numeral forms. She did so in a discriminate fashion based on numeral type, as outline above.

Summary of 7-year-old data.

At this age children show a progression when compared to the 5-year-olds. Those children who produced both masculine and feminine numeral forms largely did so in a more productive fashion. Four children from the OWH group, and one child from the WEH group produced masculine numeral forms when referring to all masculine nouns, and most feminine nouns. They did produce some feminine

numeral forms, and did so exclusively when referring to feminine nouns. This suggests that these children are beginning to first develop an awareness of the dual numeral forms, and further, are developing discriminatory production patterns based on the co-occurrence of certain numeral forms with certain nouns (i.e. lexically-based learning based on distributional patterns in the input).

Although some children at this age still showed biases for overuse of certain numeral forms (e.g. ROE produced feminine numeral forms in 44/48 trials, while DR and ODH showed a preference for feminine *dwy* ‘two (f.)’, but masculine *tri* ‘three (m.)’ and *pedwar* ‘four (m.)’); and others showed changes in response patterns mid-way through the task (e.g. OFH, NP), the presence of some children’s discriminatory production patterns suggests an overall progression in development at this age when compared to those at age four and five.

Notably, of the five children who exhibited discriminatory selection of numeral forms, four were in the OWH group, one was in the WEH group, and none were from the OEH group. This suggests that the OWH children may be at an advantage in this apparently early stage of acquisition, based on their being exposed to more Welsh, and in turn being exposed to more exemplars of nouns co-occurring with appropriate gendered numeral forms.

Table 8.4 Response patterns of 9-year-old children divided by home language

Gender of target nouns	Response Patterns	OWH 9	WEH 9	OEH 9
M and F Targets	All M Forms Throughout	8	10	13
M Target	All M – <i>dau, tri, pedwar</i>	11	11	13
	> 80% M – <i>dau, tri, pedwar</i>	2	0	0
	M for some numerals, but not others (inconsistent across 2, 3, and 4)	2	4	1
	40-60% M and F	0	0	1
	80% > F	0	0	0
	All F forms	0	0	0
F Target	All M – <i>dau, tri, pedwar</i>	8	10	13
	> 80% M - <i>dau, tri, pedwar</i>	4	1	0
	M for some numerals, but not others [inconsistent across 2, 3, 4]	2	4	1
	40 – 60% M and F	1	0	1
	> 80 % F	0	0	0
	All F forms	0	0	0

Nine-year-olds.

OWH 9-year-olds.

Masculine noun trials.

Table 8.4 displays the response patterns for the 9-year-olds⁵. Eleven children produced target masculine forms in all masculine trials. Two children incorrectly produced a small number of feminine numeral forms. Two other children showed variable production by numeral type. HDP showed variable production of *tri* ‘three (m.)’ and *tair* ‘three (f.)’. No apparent pattern to their responses appeared to be present.

EVJ produced a moderate number of target masculine forms, but also many feminine numeral forms. It appeared that a change in response pattern had occurred during the experiment. Production of *tair* ‘three (f.)’, and *pedair* ‘four (f.)’, but not *dwy* ‘two (f.)’ occurred in this child, reflecting differential patterns according to numeral type. These switches in pattern are discussed in **Section 8.4.5** below.

Feminine noun trials.

Eight children (incorrectly) produced masculine numeral forms in all feminine trials. EVJ and HDP exhibited the same response patterns observed in masculine noun trials. Three children largely produced masculine numeral forms but produced a small number of target feminine numeral forms. MNB produced an extensive number of target feminine numeral forms (17/24). She had also produced masculine numeral forms appropriately in 22/24 masculine trials. This child showed an overall high level of productivity in her use of masculine versus feminine numeral forms.

⁵ For details of the response patterns of individual nine-year-olds, see Appendix 25

Though far more advanced than her peers, she was yet to achieve full productive command of the system. The four remaining children produced a small number of target feminine numeral forms. Three of these children had not produced any feminine numeral forms in masculine noun trials.

WEH 9-year-olds.

Masculine noun trials.

Eleven children produced target masculine numeral forms in all masculine trials. Four children produced both target masculine numeral forms and some incorrect feminine numerals. In all cases, children showed differential response patterns based on numeral type, (e.g. TR consistently produced *dau* ‘two (f.)’, *tair* ‘three (f.)’, *pedair* ‘four (f.)’.) However, three of the four children did seem to exhibit a switch in response patterns during the task. These are explored in **Section 8.4.5**.

Feminine Noun Trials

Ten children incorrectly produced masculine numeral forms in all feminine trials. The same four children who exhibited varied production of masculine versus feminine forms in masculine trials exhibited the same patterns here. In addition, TG produced target feminine forms twice. She had not produced any feminine numeral forms in masculine noun trials, suggesting that she was operating under a lexical learning strategy, and had identified the co-occurrence of *tair* ‘three (f.)’ with these two nouns.

OEH 9-year-olds.

Masculine noun trials.

Thirteen out of 15 children produced target masculine numeral forms in all trials. DP produced target masculine forms in two thirds of trials. In all cases, these were instances of *tri* ‘three (m.)’ and *pedwar* ‘four (m.)’ In all trials eliciting the number ‘two’, DP produced *dwy* ‘two (f.)’ TV produced both masculine and feminine forms for all three numeral types. The number of feminine versus masculine numeral types was approximately equal. Scrutiny of this child’s data seemed to indicate a switch from initial production of masculine forms of all three numeral types, to later production of the feminine forms *dwy* ‘two (f.)’ and *tair* ‘three (f.)’, as well some sporadic production of *pedair* ‘four (f.)’. These switches are analysed further in

Section 8.4.5.

Feminine noun trials.

Thirteen children incorrectly produced masculine numeral forms in all trials. Only TV and DP produced any feminine numeral forms. Their patterns of production were the same as those observed for masculine trials.

Summary of 9-year-old data.

At age nine, children showed both similarities and differences when compared to the younger children. First, changes in response patterns mid-task predominated far more than in the 7-year-old group. Children from all three home language groups exhibited initial production of masculine forms, and then proceeded to switch to producing feminine forms.

Three out of five children exhibited response pattern switches for specific numeral types (i.e. EVJ and SO (OWH and WEH respectively) switched from *tri* > *tair* ‘three (m.) > three (f.)’, while AK (WEH) switched from *pedwar* > *pedair* ‘four (m.) > four (f.)’). Two children showed a more general response pattern change. ROE (WEH) switched from *dau* > *dwy* ‘two (m.) > two (f.)’, and from *pedwar* > *pedair* ‘four (m.) > four (f.)’, while TV (OEH) switched all three numeral types from masculine forms (*dau* ‘two (m.)’, *tri* ‘three (m.)’, *pedwar* ‘four (m.)’) to feminine forms (*dwy* ‘two (f.)’, *tair* ‘three (f.)’, *pedair* ‘four (f.)’).

Echoing patterns observed in the 7-year-old group, some children consistently produced the same numeral forms for each type, choosing the masculine form for some numeral types, and the feminine form for others. These preferences varied across children. For example, TR (WEH 7-year-old) almost exclusively produced *dau* ‘two (m.)’, *tair* ‘three (f.)’ and *pedair* ‘four (f.)’, while DP (OEH 9-year-old) consistently produced *dwy* ‘two (f.)’, *tri* ‘three (m.)’ and *pedwar* ‘four (m.)’.

Evidence of lexical learning was present largely in the OWH group. Six children in this home language group produced certain feminine numeral forms only in reference to feminine nouns. This suggests that lexical learning mechanisms were in play, resulting in correct feminine numeral production in relation to specific nouns. TR (WEH 7-year-old) also showed some evidence of lexical learning in her discriminative use of *dwy* ‘two (f.)’, producing it only in relation to feminine nouns, but TR did not show the same discriminatory patterns of production for the masculine and feminine variants *tri/tair* ‘three (m.)/(f.)’ and *pedwar/pedair* ‘four (m.)/(f.)’.

Overall, production of both feminine and masculine forms for all three numerals was higher in this age group than in the 5- and 7-year-old groups. But, it seemed that feminine numeral forms were still not used much by these children, as shown by the fact that the wide majority of participants of this age did not produce any feminine numeral forms. What is clear is that even at age nine, these children have generally not acquired a great deal of knowledge regarding this feature of the Welsh gender system. Children largely produced masculine numeral forms, and when feminine forms were produced they were produced based on switches in responses pattern that did not differentiate based on noun gender.

However, some discriminatory use of masculine versus feminine forms was observed for specific nouns and specific numeral types. Seven 9-year-olds were producing feminine numeral forms in relation to feminine noun forms only. The nouns which the children referred to were varied, suggesting that these children may be acquiring appropriate numeral forms on a lexical item-by-item basis. Six of the seven children were from the OWH group. This suggests that, as in the 7-year-old group, level of exposure to Welsh, and specifically frequency of exposure to numeral forms with specific nouns may be an important factor in the acquisition of this gender feature.

Overall summary of the child data.

When looking at the data across all sub-groups, various patterns emerged. First, in all age groups, and across all home language groups, the wide majority of children produced only masculine numeral forms. At the youngest ages, few children produced both masculine and feminine numeral forms, and largely produced them

in a way that did not discriminate based on noun gender. However, four children produced a very small number of feminine numeral forms correctly, suggesting that they may have learnt these forms on a lexical item-by-item basis. Three of these children were in the OWH group, and one was in the WEH group, suggesting that level of exposure to Welsh may be an important factor.

At age seven, response patterns were similar to those observed at age five. Most children still exclusively produced masculine numeral forms. But, some children produced some feminine numeral forms in relation to specific feminine nouns, again suggesting the presence of lexical learning strategies. Most of these children were from the OWH group, again hinting at a role for language exposure.

By age nine, a greater awareness of *dwy* ‘two (f.)’, *tair* ‘three (f.)’, and *pedair* ‘four (f.)’, was evident in the children. Although children at this age were still largely producing masculine numeral forms only, and still others were producing feminine and masculine forms in such a way that did not correctly discriminate between masculine and feminine nouns, children produced masculine and feminine forms of more than one numeral type (i.e. *pedwar/pedair* ‘four (m.)/four (f.)’ plus *tri/tair* ‘three (m.)/three (f.)’), and with more frequency than at other ages.

Importantly, more children were showing discriminatory use of masculine versus feminine numeral forms at this age, with over a third of children in the OWH group showing evidence of lexical learning patterns, as reflected by their correct production of feminine numeral forms in relation to small sub-sets of feminine nouns.

In sum, though there is some evidence of a progression in terms of target production of masculine and feminine numeral forms, and an improvement in their

discriminatory use of them; even at age nine, children from all home language backgrounds are still yet to acquire a great deal of knowledge about the gendered numeral system of Welsh.

8.4.5 Response pattern switches.

Fifteen children from all age and home language groups exhibited changes in response patterns during the task. The number of children per group who did so is shown in *Table 8.5*. Children showed switches in response pattern for specific numeral types in each case. In some cases, children showed response pattern changes for two numeral types.

Details of the switches of children are shown in **Table 8.6**. Data are first ordered by the numeral type that was affected by the switches. *Dau/dwy* ‘two (m.)/two (f.)’ switches are shown first, then *tri/tair* ‘three (m.)/three (f.)’ switches, and finally *pedwar/pedair* ‘four (m.)/four (f.)’ switches. Data are further organised by chronological age and by the home language group, (OWH then WEH, then OEH), of the participants.

It was proposed that these switches were indicative of an awareness of the fact that the two types of forms (i.e. masculine and feminine) were both relevant to the task, but the children did not know which type of form to use. To verify that switches in response patterns were actually full switches, the degree of each child’s perseveration with the new response pattern post-switch was identified. For example, if Child A produced *dau* ‘two (m.)’ in trials 1 to 5, but then produced *dwy* ‘two (f.)’ in trial 6, and subsequently produced *dwy* ‘two (f.)’ in trials 7 to 12 (out of twelve total trials), this child would have a post-switch percentage of 100%.

Table 8.5

The number of children who exhibited response pattern switches, organised by age and home language group

Age/Home Language	OWH	WEH	OEH
4-year-olds	1	N/A	N/A
5-year-olds	1	2	0
7-year-olds	0	3	1
9-year-olds	1	2	1

On average, all children persevered with producing the same form post-switch at least 75% of the time (with a mean of 87%). Similar consistency in response-pattern switches occurred regardless of the numeral type, age or home language. In all but two cases, all switches were in the direction of masculine > feminine. This suggests that, by default, children tended to produce masculine forms initially.

This dominance of the masculine forms may derive from the fact that *dau, tri* and *pedwar* ‘two (m), three (m.), four (m.)’ (as opposed to *dwy, tair* and *pedair* ‘two (f.), three (f.), four (f.)’) are the forms used for counting, and for basic arithmetic learned by children at school (e.g. in the phrase *Mae dau a dau yn gwneud pedwar* ‘Two (m.) plus two (m.) equals four (m.)’). This undoubtedly affects the frequency with which children encounter masculine forms versus feminine forms in the input, with the use of masculine forms in an educational setting significantly increasing exposure to masculine forms.

The reasons behind these switches in response patterns are unclear. They seem to indicate that children have been exposed to enough feminine numeral forms to

Table 8.6.

Overall consistency of children's response pattern switches, organised by numeral type, age and home language⁶

Switch Type	Participant ID	Age/Home Language	Post-switch %
<i>Dau > Dwy</i>	ODH	WEH 7-year-old	100
	DR	WEH 7-year-old	75
	<i>TVF</i>	<i>WEH 9-year-old</i>	83
	<i>TV</i>	<i>OEH 9-year-old</i>	100
<i>Dwy > Dau</i>	DSB	OWH 5-year-old	75
<i>Tri > Tair</i>	FF	OWH 4-year-old	80
	HO	WEH 5-year-old	79
	<i>OFH</i>	<i>OEH 7-year-old</i>	100
	EVJ	OWH 9-year-old	77
<i>Pedwar > Pedair</i>	<i>OFH</i>	<i>OEH 7-year-old</i>	75
	AK	WEH 9-year-old	86
	<i>TVF</i>	<i>WEH 9-year-old</i>	83
<i>Pedair > Pedwar</i>	NP	WEH7-year-old	100

⁶ N.B. Data of children with switches for two numeral types are highlighted in bold and italicised

be able to produce them, but they are perhaps yet to be exposed to enough exemplars of feminine nouns + feminine numeral forms to be able to produce them with accuracy. As the children who switched produced both masculine and feminine forms, they exhibited slightly more knowledge of the gendered numeral system than those children who produced all masculine numeral forms, as they at least knew which feminine forms matched which masculine forms (i.e. *dau* ‘two (m.)’ with *dwy* ‘two (f.)’, *tri* ‘three (m.)’ with *tair* ‘three (f.)’). Moreover, children such as TV had begun to learn which forms belonged to each set. I.e. *dau* ‘two (m.)’, *tri* ‘three (m.)’, and *pedwar* ‘four (m.)’ are the masculine set, while *dwy* ‘two (f.)’, *tair* ‘three (f.)’ and *pedair* ‘four (f.)’ are the feminine set.

8.5 Discussion

The results of the adult and child data give several insights into the acquisition of the gendered numeral system. Both the children and adults produced more masculine than feminine numeral forms. However, masculine numeral forms were far more dominant in the child data overall (adults – 63% masculine, 37% feminine vs. children 95% masculine, 5% feminine). Error types for both children and adults consisted of production of masculine numeral forms in lieu of feminine forms, reflecting the general dominance of masculine forms. This could have been due to a combination of factors; namely:

- Higher number of masculine nouns in the Welsh language
- Higher number of masculine numeral forms produced by adults
- The important role of masculine numeral forms in educational settings

The adults did, however, show some response patterns that were not present in the child data. Natural gender effects were evident in the adults, as their performance was significantly better when referring to human referents. This suggests that the adults have linked grammatical gender distinctions with natural gender distinctions, and is consistent with the patterns observed in their pronoun production (see **Chapter 7**). The children did not show signs of animacy effects, as they produced masculine forms incorrectly in reference to feminine human noun referents (and in a few cases, vice versa), and instances of correct feminine numeral forms were not limited to trials with human noun referents.

Adults also seemed to attend to syntactic cues presented in prompt phases, and use these cues to assist them in producing appropriate gendered numeral forms, while children did not show differential response patterns based on the number of syntactic cues provided.

Overall, the adults showed productive command of the system, though there was some variation in productivity across individuals. This productive knowledge was largely absent from the children, but some children's data seemed to show signs of this knowledge emerging slowly via exemplar-based learning mechanisms. MNB, a 9-year-child from the OWH group, showed relatively productive use of the system, but she seemed to be exceptional for her age, based on the performance of her age-matched peers.

A small number of children showed evidence of switches in response pattern, from initially producing masculine numeral forms to later producing feminine numeral forms. In all cases, the children showed a high level of perseveration with the new response pattern after a switch. This suggests that these children have

knowledge of both masculine and feminine numeral forms but are not producing each kind of numeral type (i.e. masculine or feminine) based on any kind of structured rule.

From the patterns observed in the adult and child data combined, it appears that the gendered numeral feature is acquired in a piecemeal fashion, based on exposure to exemplars of specific noun-numeral combinations. This is reflected by variation both within the adult group, and within the child participants group.

Chapter 9

Productivity

9.1 Chapter Overview

The previous chapter explored children and adults' production of gendered numeral forms in relation to a set of forty-eight real Welsh nouns. This chapter describes an experiment that elicited these same types of numeral forms, but this time in relation to **novel** Welsh nouns. The chapter is divided into three sections. First, a methodological description of the task is presented. Then, quantitative and qualitative results of the task are presented followed by a discussion of the results.

9.2 Task Summary and Rationale

This elicited production task assessed local gender marking of nouns via gendered numeral forms. By exploring the use of these forms in relation to novel nouns, this task aimed to test the productivity of this gender feature. The novel nouns were developed along with novel picture characters/objects (which the experimenter referred to with the novel nouns).

The second aim of the task was to assess the role of semantic gender information on grammatical gender assignment. Given the effects of natural gender observed in previous research on Welsh gender, (as mentioned above), the pictures of the novel characters/objects were developed in such a way that some of them looked male, some looked female, some were neutral animate characters, and some were inanimate objects. By controlling carefully for the animacy and natural gender

of the novel characters, it was possible to assess the role of these factors in children's and adults' grammatical gender assignment.

In addition, distributed formal gender cues were carefully manipulated in the task design. These distributional cues included the presence or absence of mutation on nouns and adjectives (depending on the gender of the noun), and the presence or absence of gendered word endings (*-wr* for masculine and *-es* for feminine). The task then, also aimed to determine firstly whether children had enough knowledge of these distributional cues to inform their gender decisions or not, (in the absence of exposure to specific noun-numeral combinations in the input, as these were novel, not real Welsh nouns). Finally, the task assessed to what extent did distributional cues override semantic gender information (or vice versa).

9.3 Method

9.3.1 Design and Stimuli

9.3.1.1 Linguistic Stimuli

Numerals.

The same numeral forms elicited in the real word task were elicited here.

Three different numerals were elicited in both masculine and feminine forms:

2 – *dau* 'two (m.)' / *dwy* 'two (f.)'

3 – *tri* 'three (m.)' / *tair* 'three (f.)'

4 – *pedwar* 'four (m.)' / *pedair* 'four (f.)'

Invented nouns.

One hundred and ninety-two novel nouns were created that conformed to the phonotactic rules of Welsh (see Awbery, 1984) and reflected its general phonological patterns. These nouns were divided into four sub-sets of forty-eight nouns. Each set of 48 nouns appeared in one of four different versions of the task. (Each participant did only one of the four versions. An equal number of participants were assigned to each version). In these versions, noun stem, noun ending, noun-initial consonant and the natural gender/animacy of the referent were controlled for, as follows.

Noun stems.

The four sub-sets of 48 nouns were constructed by beginning with an initial set of 48 stems. Stems were balanced for number of syllables; half of the stems were monosyllabic, the remaining stems were disyllabic (see *Table 9.1* for a full list of word stems). Stems were then adapted in terms of which initial consonant they had, based on the grammatical gender that nouns were assigned. The initial consonant for stems of masculine nouns was either /p/ or /t/ (e.g. *pallwr*, *tyleb*); each consonant appeared word-initially on 50% of these nouns. Feminine nouns had /b/, /m/ or /d/ word initially (in their basic forms), assuring their mutated forms (/v/ and /ð/) could be interpreted clearly as just that, mutated forms. Fifty percent of feminine nouns were /d/-initial, 25% were /b/-initial and 25% were /m/-initial. Within each set of 48 nouns, 12 nouns had /p/ initially, 12 had /t/ initially, and 12 had /d/ initially. Of the remaining 12 nouns in each set, six were /b/-initial and six were /m/-initial.

Half of the invented noun stems in each version were assigned masculine gender; half were assigned feminine gender. Nouns were created using the stems plus either a gendered ending (-*wr* for masculine nouns, and -*es* for feminine nouns) OR one of several neutral word endings that did not indicate a particular gender (e.g. -*ad*, -*el*, -*eb*, etc). The four versions of the task varied systematically according to which stems were assigned which gender, and which endings the stems were given to make complete nouns.

Table 9.1.

Starting 48 word stems - each stem resulted in four noun variants

Word Stems			
<i>pall-</i>	<i>polam-</i>	<i>tan-</i>	<i>tirlon-</i>
<i>donel-</i>	<i>dab-</i>	<i>bafol-</i>	<i>mos-</i>
<i>tyl-</i>	<i>taibyl-</i>	<i>pib-</i>	<i>patan-</i>
<i>milad-</i>	<i>brel-</i>	<i>daran-</i>	<i>don-</i>
<i>plined-</i>	<i>pyl-</i>	<i>trefyn-</i>	<i>trin-</i>
<i>dolf-</i>	<i>dan-</i>	<i>merl-</i>	<i>bamol-</i>
<i>tafell-</i>	<i>traib-</i>	<i>pynad-</i>	<i>pab-</i>
<i>bor-</i>	<i>miban-</i>	<i>dryl-</i>	<i>defyn-</i>
<i>prydan-</i>	<i>pad-</i>	<i>teinydd-</i>	<i>dolwn-</i>
<i>maen-</i>	<i>balin-</i>	<i>dwys-</i>	<i>tron-</i>
<i>tarnel-</i>	<i>twyn-</i>	<i>pabod-</i>	<i>parll-</i>
<i>dyned-</i>	<i>dirn-</i>	<i>mant-</i>	<i>banad-</i>

Noun endings.

In each of the four versions, noun stems were assigned to one of four word form conditions (as mentioned above). Each individual stem occurred in a different form across the four versions:

Masculine Noun Type 1: Stem + masculine gendered ending *-wr*

Masculine Noun Type 2: Stem + neutral ending

Feminine Noun Type 1: Stem + feminine gendered ending *-es*

Feminine Noun Type 2: Stem + neutral ending

In two out of four versions (Versions A and B), the first twenty-four stems were assigned to the masculine condition. In one of the versions, half of these masculine roots were paired with a gendered masculine ending; in the other version the same roots were paired with a neutral ending. For example, in Version A the stem *pall-* appeared with the masculine ending *-wr*. In Version B, the stem *pall-* was paired with a neutral ending, *-eb*. This resulted in the creation of two distinct novel masculine words *pallwr* and *palleb*.

In the remaining two versions (Versions C and D), the same twenty-four stems were assigned feminine gender. Again, half of these in one version were given the feminine ending *-es* and half a neutral ending, and the reverse for the other version., (e.g., in Version C the adapted stem *dall-* was paired with the feminine ending *-es*, while in Version D, the stem *dall-* was paired with the neutral ending *-il*). This resulted in the novel feminine nouns, *dalles* and *dallil*, respectively. For further illustration of what the novel nouns were across versions, see *Table 9.2*.

Table 9.2

Balancing of stems

Root	Version	Gender Condition	Ending	Noun
<i>pall-</i>	A	Masc. marked	-wr	<i>pallwr</i>
<i>pall-</i>	B	Masc. unmarked	-eb	<i>palleb</i>
<i>dall-</i>	C	Fem. marked	-es	<i>dalles</i>
<i>dall-</i>	D	Fem. unmarked	-il	<i>dallil</i>
tafell-	A	Masc. Marked	-wr	tafellwr
tafell	B	Masc. Unmarked	-il	tafellil
bafell	C	Fem. Marked	-es	bafelles
bafell	D	Fem. Unmarked	-on	bafellon

Sentences.

Each version of the task had 48 trials. The trial format was the same as for the Real Word Elicitation Task. All trials featured two prompt sentences (experimenter), followed by one elicited sentence (participant, (see section on *Sentence sequences*, in **Chapter 8**, above).

Target Sentences.

Target sentences shared the structure of the target sentences of the real word version of the task (see **Chapter 8**, above). The participant's task was to tell the experimenter how many of the novel objects appeared in the third image in each

trial by producing one of the six target gendered numeral forms, as appropriate. For example:

(63)

<i>Rwan</i>	<i>mae</i>	<i>'na</i>	<i>ddwy</i>	<i>dolfes</i>
now	is	there	two (f.)	dolfes (f.)

'Now there are two (f.) dolfes(s) (f.)'

Prompt sentences.

The trials in this task followed the format of the ***Real Word Numeral Elicitation Task*** (reported in Chapter 8). Each trial featured two prompt sentences uttered by the experimenter. The first prompt sentence of each trial took on one of four different structures. The syntactic structure of sentences in each condition provided either zero, one or two linguistic cues that were informative in terms of the grammatical gender of the noun in the sentence:

Condition 1: 0-cues.

Target nouns were presented in a context without any gender marking; all nouns appeared in their basic forms. For example, see (64) and (65) below:

(64) MASC:

<i>Dyma</i>	<i>lun</i>	<i>pallwr</i>	<i>ar</i>	<i>ben</i>	<i>wal</i>
here	picture	pallwr (m.)	on	top	wall

"Here's (a) picture (of a) pallwr(m.) on top of (a) wall (m.)."

(65) FEM:

<i>Dyma</i>	<i>lun</i>	<i>dolfes</i>	<i>o</i>	<i>dan</i>	<i>pont</i>
here	picture	dolfes (f.)	of	under	bridge

“Here’s (a) picture (of a) dolfes (f.) under (a) bridge (f.)”

No syntactic trigger = No mutation of feminine noun

Condition 2: 1-cue (noun).

There were two types of 1-cue condition presented in this task. The first type was identical to the syntactic condition presented in the ***Real Word Elicitation Task***. The definite article *yr*, “the” (represented by ‘*r*’) preceded novel nouns in this condition. The definite article triggers soft mutation of a feminine noun following it, but does not trigger mutation of a masculine noun. The presence or absence of mutation on these nouns provided a cue to their gender status:

(66) MASC:

<i>Dyma’r</i>	<i>pallwr</i>	<i>ar</i>	<i>ben</i>	<i>wal</i>
here-the	pallwr (m.)	on	top	wall

“Here’s the pallwr (m.) on top of (a) wall (m.)”

(67) FEM:

<i>Dyma’r</i>	<i>ddolfel</i>	<i>o</i>	<i>dan</i>	<i>pont</i>
here-the	dolfel (f.)	of	under	bridge

“Here’s the dolfel (f.) under (a) bridge (f.)”

Syntactic mutation trigger = Feminine noun mutation *dolfel* > *ddolfel*

Condition 3: 1-cue (adjective).

The second 1-cue condition did not have the definite article *yr* (“the”) before the noun. Instead, it had the same initial sentence structure as in the 0-cue condition; but with the addition of a mutable colour adjective after the noun, as shown in (68) and (69) below.

(68) MASC:

<i>Dyma</i>	<i>lun</i>	<i>pallwr</i>	<i>glas</i>
here	picture	pallwr (m.)	blue
<i>o</i>	<i>flaen</i>	<i>siop</i>	
of	front	shop	

‘Here’s (a) picture (of a) blue pallwr (m.) in front of (a) shop (m.).’

(69) FEM:

<i>Dyma</i>	<i>lun</i>	<i>dolfel</i>	<i>las</i>
here	picture	dolfel (f.)	blue
<i>o</i>	<i>flaen</i>	<i>castell</i>	
of	front	castle	

‘Here’s (a) picture (of a) blue dofel (f.) in front of (a) castle (m.).’

Feminine noun as a mutation trigger = Adjective mutation *glas* > *las*

Adjectives with mutable onsets undergo mutation after a singular feminine noun. The adjective forms used all began with mutable onsets, and so the presence or absence of mutation on these adjectives provided a cue to the gender status of the nouns. Both types of syntactic environments were presented to explore

whether cues on nouns versus cues on adjectives were comparably more or less effective.

Condition 3: 2-cues.

Nouns in this condition were preceded by the definite article *yr* ('r). Additionally, adjectives with mutable onsets followed all nouns. The presence or absence of mutation on these nouns and adjectives provided two cues to the gender status of the nouns:

(70) MASC:

<i>Dyma´r</i>	<i>pallwr</i>	<i>coch</i>	<i>o</i>	<i>flaen</i>	<i>siop</i>
here-the	pallwr (m.)	red	of	front	shop

'Here's the red pallwr (m.) in front of (a) shop (m).'

(71) FEM:

<i>Dyma´r</i>	<i>ddolfes</i>	<i>las</i>	<i>o</i>	<i>flaen</i>	<i>castell</i>
here-the	dolfes (f.)	blue	of	front	castle

'Here's the blue dolfes (f.) in front of (a) castle (m).'

Syntactic mutation trigger = Noun Mutation *dolfes* > *ddolfes*

Adjective Agreement = Adjective Mutation *glas* > *las*

Balancing of prompt sentence content.

The first prompt sentence also entailed describing the location of the object within the scene. Scenes varied in every trial, and characters/objects appeared in

multiple locations. This resulted in a wide variety of constructions across sentences, making the task less repetitive; with the aim of prolonging participants' active participation in the task. Five different structures were used to describe the placement of an object, and are outlined in *Table 9.3*.

The second prompt sentence in each trial referred to a second image, which showed five of the objects shown in the first prompt image. This sentence stated the number of the noun referent shown. The word for 'five' in Welsh has a single form – *pump* – and is not marked for gender. The word *pump* does not trigger mutation of nouns, thus no additional syntactic cues were available. This sentence served to establish the sentence structure of the participant's elicited sentence (see (72) and (73) below.

(72) MASC:

<i>Rwan</i>	<i>mae</i>	<i>'na</i>	<i>bump</i> ⁷	<i>pallwr</i>
Now	there	is	five	pallwr (m.)

"Now there are five pallwr(s) (m.)."

(73) FEM:

<i>Rwan</i>	<i>mae</i>	<i>'na</i>	<i>bump</i>	<i>dolfes</i>
Now	there	is	five	dolfes (f.)

'Now there are five dolfes(s) (f.)'

⁷ Pump appears in its mutated form bump because of the lexical mutation trigger 'na. This mutation is unrelated to gender.

9.3.1.2 Non-linguistic stimuli.

Images.

As mentioned previously in the task summary; novel picture characters/objects were developed along with the novel nouns. Forty-eight base sets of four novel characters/objects were created. Each base picture was then modified in four ways – (a) to make it look male, (b) to make it look female, (c) to make it look animate, but neutral as to gender, and (d) to make it look inanimate. *Figure 9.1* illustrates one set of four characters/objects, all of which shared a common basic shape.

To accompany the three steps of each trial, the first image in each set displayed one novel character/object, the second image in each set displayed five of the same novel character/objects, and the final (eliciting) image in each set displayed two, three or four of the novel character/object, depending on the trial, see *Figure 9.2*, for an example trial).

Balancing of non-linguistic stimuli with linguistic stimuli.

Each basic character/object was matched with a given stem. But the distribution of the four linguistic forms of the word in relation to the 4 types of characters (male, female, neutral animate, and inanimate) was balanced across trials and the 4 versions of the task. Within each version of the task, equal numbers of linguistic-picture type matches occurred. *Table 9.4* illustrates the balancing procedure. The four different linguistic forms (M with *-wr*, M neutral ending, F with *-es*, F neutral ending) appeared matched equal numbers of times with the four types of referents (male, female, animate neutral, inanimate). There were three nouns per

cell, (as shown in *Table 9.4*). The nouns in each cell appeared in the three different cue conditions (0-cue, 1-cue or 2-cue condition).

Table 9.3.

Linguistic structures used to describe the location of objects

Sentence Base	Location Component
<i>Dyma lun _____</i>	<i>wrth ymyl (castell)</i>
'Here's a picture of a _____'	'...next to (a) castle (m).'
<i>Dyma lun _____</i>	<i>o dan (ffenestr)</i>
'Here's a picture of a _____'	'...next to (a) window (f).'
<i>Dyma'r _____</i>	<i>ar ben (mynydd)</i>
'Here's a picture of a _____'	'...on (a) mountain (m).'
<i>Dyma'r _____</i>	<i>o flaen (ysgol)</i>
'Here's a _____'	'...in front of (a) school (f).'
<i>Dyma lun _____ glas</i>	<i>wrth ymyl (swyddfa)</i>
'Here's a picture of a blue _____'	'...next to (an) office (f).'
<i>Dyma'r _____ glas</i>	<i>mewn (llongofod)</i>
'Here's a picture of a _____'	'...next to (a) spaceship (m).'

Table 9.5. illustrates how the distribution of the four linguistic forms of the word in relation to the four types of characters (male, female, neutral animate, and inanimate) was balanced across trials and the four versions of the task. Within each version of the task, equal numbers of linguistic-picture type matches occurred. The

four word ending conditions (M with *-wr*, M neutral ending, F with *-es*, F neutral ending) were matched an equal numbers of times with the four types of referents (male, female, animate neutral, inanimate).

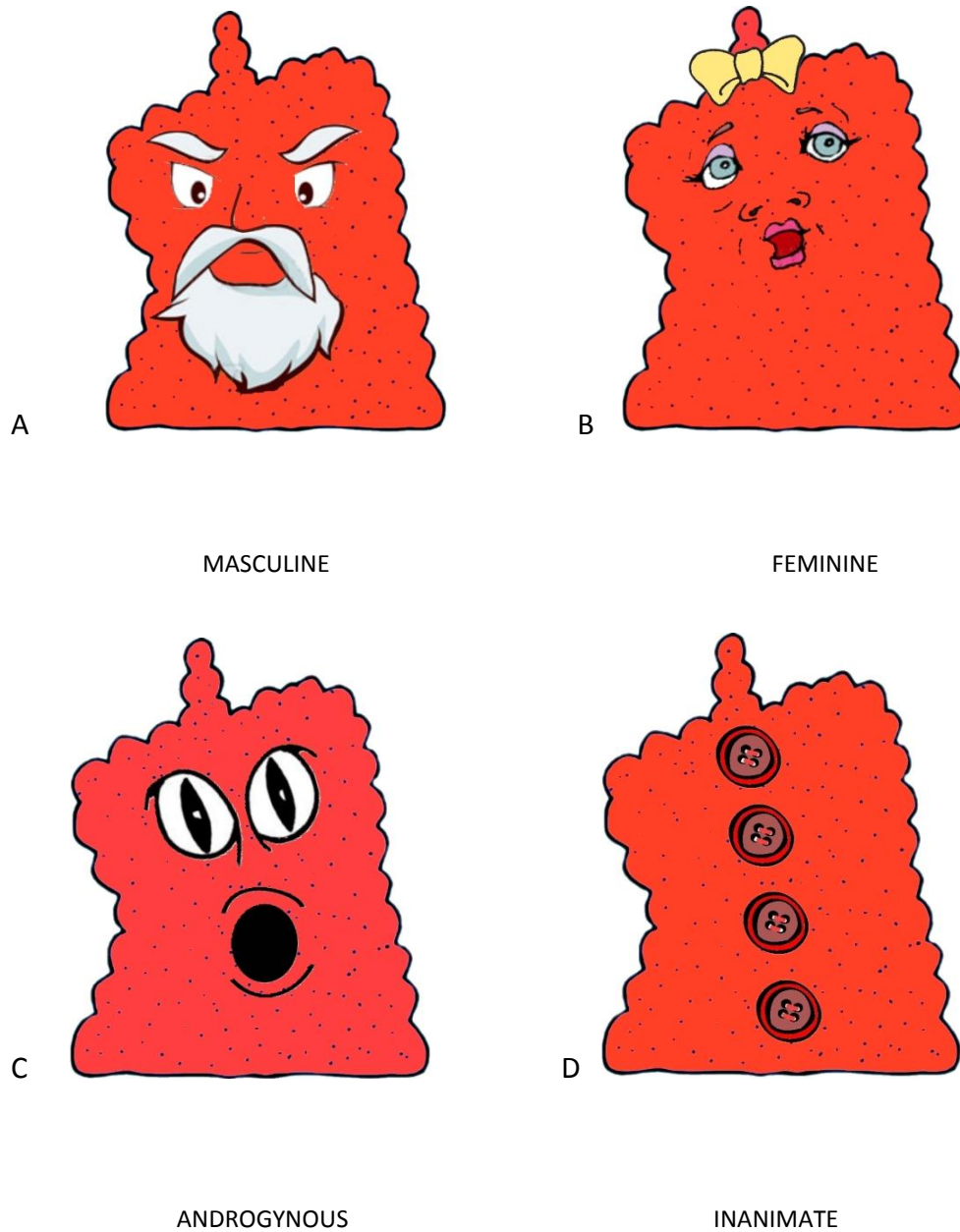


Figure 9.1. Illustration of feature rotation with basic shapes, depending on the natural gender condition assigned.

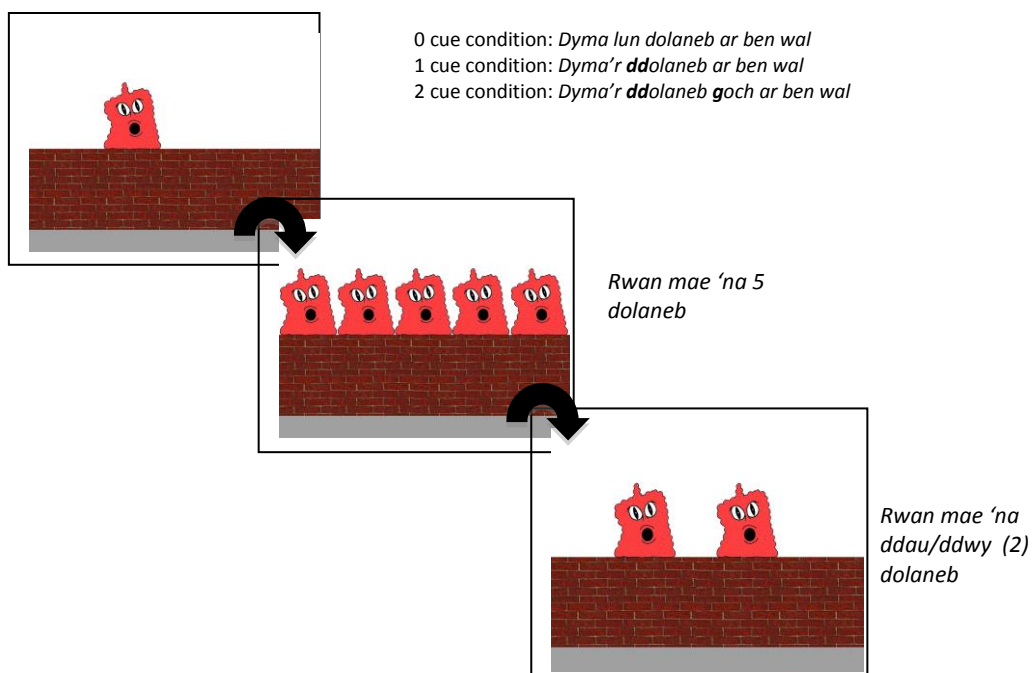


Figure 9.2 Example of one trial.

Table 9.5.

*Balancing of roots across natural gender conditions*⁸

Root	Version	Natural Gender Condition
<i>pall-</i>	A	Male
<i>pall-</i>	B	Female
<i>dall-</i>	C	Androgynous
<i>dall-</i>	D	Inanimate

⁸ N.B. Note that *dall-* was used when the complete noun was assigned feminine grammatical gender

Table 9.4

Balancing of nouns across trials

Noun ending/Noun gender				
<u>Character animacy</u>	Masculine noun with <i>-wr</i>	Feminine noun with <i>-es</i>	Masculine noun with neutral word ending	Feminine noun with neutral word ending
Animate Male	3	3	3	3
Animate Female	3	3	3	3
Animate Androgynous	3	3	3	3
Inanimate	3	3	3	3

9.3.2 Participants.

One hundred and fifty participants took part in this task. One hundred and thirty-one of these participants also completed the *Preposition and Pronoun Elicitation Task*, the *Noun and Adjective Elicitation Task* and the *Real World Numeral Elicitation Task*. The remaining 19 participants completed this task and the *Real World Numeral Elicitation Task*.⁹ Participants were divided across the same age/home language groups as outlined in previous chapters. There were three groups of 5-year-olds, three groups of 7-year-olds, and three groups of nine year-olds. For each age group there was an OWH group, a WEH group and an OEH group. There was also one group of OWH adults. All groups had 15 participants each.

9.3.3. Procedure.

The procedure for this task was identical to that of the *Real Word Numeral Elicitation Task* (see **Chapter 8** above). However, in addition, a background story was told about the novel objects prior to the task itself. The participant was told that lots of alien people, animals and objects from another planet had fallen out of their spaceship onto the earth. These “aliens” had fallen in lots of different places, and each alien had a special name. The experimenter would say the names of these aliens and describe their surroundings.

⁹ This task was developed at a later point than the other tasks, and so, some new participants had to be recruited for the 4- and 5-year-old groups, because data collection for the other tasks was already completed for some participants at these ages (and they had become too old to add the new test).

Then, the child was told that they would see a different number of each “alien” in three different pictures. In the first picture in each trial, there was only one “alien”. In the second picture there were many of them, and the experimenter would state exactly how many. In the third picture there was a different number of “aliens” again, and the participant needed to state this number, (see Appendix 26 for full task instructions).

Marking sheets were used that covered all responses the participants could conceivably make, including information on possible alternative numeral forms (see Appendix 27 for details). All trials were audio recorded for the purpose of later double-checking, if and when the experimenter was unsure of what a participant had said in a given trial.

9.4 Results

9.4.1 Overview.

The results are presented in two parts. First, quantitative results of the adult data are presented. Only the adult data were analysed quantitatively. As in the real word version of the task, children produced a very high proportion of masculine numeral forms overall in this task (96% on average). This skewed the data and made statistical analyses a non-viable option.

A second section presents qualitative analyses of the child data, with special reference to the few children who produced both masculine and feminine numeral forms. Overall patterns of responding, and switches in the response patterns of a number of these children, are discussed.

9.4.2 Data scoring.

Data were scored for correct/incorrect responses in the choice of numeral form. Only the adult data were analysed quantitatively.

9.4.3 Quantitative analyses.

An initial mixed ANOVA was run, in which Grammatical Gender (Masculine vs. Feminine), Natural Gender (Male, Female, Androgynous or Inanimate), Cue Condition (Zero, One or Two cues), and Word Form (presence or absence of gendered ending), were treated as variables. There was a significant main effect of Grammatical Gender, $F(1, 17) = 32.355$, $p < .001$, and significant interactions of Grammatical Gender x Natural Gender, $F(5, 17) = 15.765$, $p < .001$, and Grammatical Gender x Natural Gender x Word Form, $F(7, 17) = 3.326$, $p = .027$.

In light of these significant effects, the dataset was split into two smaller datasets – one with data for trials with masculine novel nouns (novel nouns that had been assigned masculine grammatical gender) and one with data for trials with feminine nouns (novel nouns that had been assigned masculine grammatical gender).

Masculine Noun Trials

A further ANOVA with Natural Gender (Male, Female, Androgynous or Inanimate), Cue Condition (Zero, One or Two cues), and Word Form (presence or absence of gendered ending), were treated as variables revealed a significant main effect of Natural Gender, $F(3, 17) = 15.783$, $p < .001$, and a significant main effect of Word Form, $F(1, 17) = 4.806$, $p = .043$. Planned comparisons using the LSD test

revealed a significant difference ($p = .002$) between trials with female characters ($M = 58.33$, $SD = 28.15$) versus trials with male characters ($M = 94.44$, $SD = 12.78$); female vs. androgynous ($M = 90.74$, $SD = 14.26$) characters ($p = .001$) and female vs. inanimate ($M = 88.89$, $SD = 17.15$) characters ($p = .007$), with performance for the female category being significantly lower in each case.

The main effect of Word Form showed how rates of target numeral forms were significantly higher for novel nouns with gendered endings ($M = 87.50$, $SD = 14.08$) than for novel nouns without gendered endings ($M = 78.70$, $SD = 14.07$).

Feminine Noun Trials

A further ANOVA with Natural Gender (Male, Female, Androgynous or Inanimate), Cue Condition (Zero, One or Two cues), and Word Form (presence or absence of gendered ending), were treated as variables revealed a significant main effect of Natural Gender, $F(3, 17) = 7.196$, $p < .001$, and a significant main effect of Word Form, $F(1, 17) = 4.806$, $p = .003$. Planned comparisons using the LSD test revealed significant differences between trials with female characters ($M = 55.56$, $SD = 37.48$) versus trials with inanimate ($M = 28.85$, $SD = 26.28$) characters, ($p = .013$), with performance for the inanimate category being significantly lower (see *Figure 9.3*, which illustrates performance across natural gender conditions for masculine and feminine noun trials respectively).

As with the masculine trials, the main effect of Word Form reflected significantly higher target response rates for novel nouns with gendered endings as opposed to novel nouns without gendered endings ($M = 43.98$, $SD = 31.54$ vs. $M =$

30.56, SD = 21.58). A significant interaction of Natural Gender x Word Ending was also attested, $F(5, 17) = 4.212, p = .010$.

Post-hoc paired t-tests compared performance across marked and unmarked noun trials for each of the four natural gender conditions. Significant differences were observed for marked versus unmarked novel nouns for the androgynous condition $t(1, 17) = 3.828, p = .001$, and the inanimate condition $t(1, 17) = 2.265, p = .037$), but not for the female condition, $t(1, 17) = 1.917, p = .072$, nor the male condition, $t(1, 17) = -1.288, p = .215$.

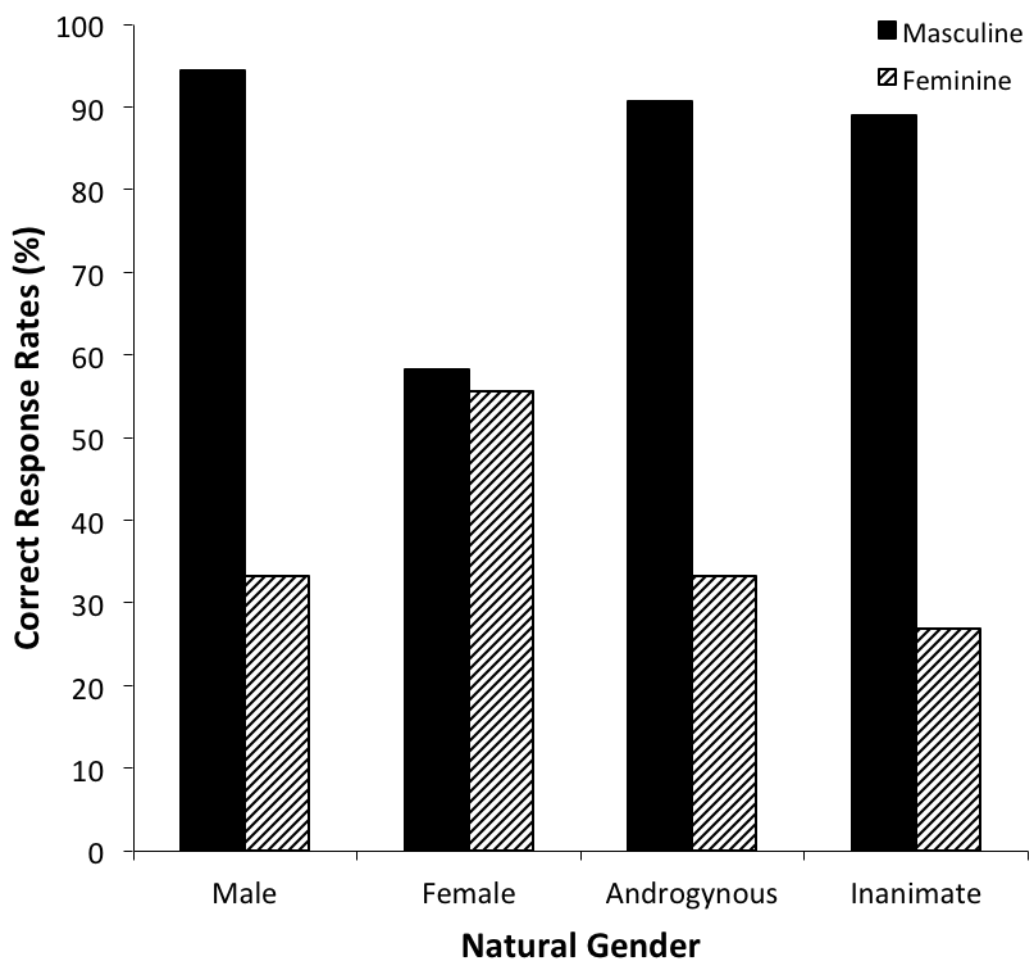


Figure 9.3. A significant interaction of grammatical gender with natural gender reflected differential patterns of responding across grammatical gender categories depending on the natural gender of noun referents.

Summary of adult data.

These observed patterns of responding indicated that adults were producing masculine numeral forms by and large, except when feminine natural gender information was conveyed. When female referents appeared, this led to adults producing feminine numeral forms significantly more often than in other natural gender conditions.

This effect of natural gender is consistent with the response patterns observed in the adult data for the real word numeral task (see **Chapter 8**). When responding to real words, adults showed better performance when referring to human noun referents. The same pattern was observed for numeral production in relation to novel nouns, when characters were depicted that expressed a clear biological sex.

However, for novel nouns there was a stronger tendency to produce masculine numeral forms than there was with real nouns. In the novel word task, adults produced masculine forms 73% of the time, and feminine forms 27% of the time. This contrasted with the proportion of masculine versus feminine forms observed in the real word task (63% masculine vs. 37% feminine).

In the real word numeral task, adults seemed to benefit from syntactic cues provided in prompt phases. This was not the case for the novel word version of the task. This may be because the unfamiliarity of the novel nouns made identification of mutation on these novel nouns more difficult.

Adults did, however, seem to benefit from the presence of gendered endings (i.e. *-wr* for masculine and *-es* for feminine) on novel nouns. This may be because these gendered endings are found for human nouns such as *dynes* ‘woman’ and *garddwr* ‘gardener (m.).’ Therefore, it may be possible that these gendered endings that mark for grammatical gender were particularly salient for these adults because they appear on words that contain semantic gender information.

The influence of the presence of absence of gendered endings on novel words does, however, appear to be secondary to the influence of natural gender. A significant interaction of Natural Gender x Word Form in feminine noun trials revealed how differences in performance for marked versus unmarked novel nouns were observed only for those trials in which androgynous or inanimate characters were depicted. That is, when male characters were depicted, adults tended to produce masculine numeral forms, regardless of the form of the novel noun. Likewise, for trials depicting female characters, feminine numeral forms tended to be produced, irrespective of the form of the accompanying novel nouns. When clear natural gender information was not available, adults turned to formal cues, (in the shape of gendered endings), to assist them in their gender assignment of unfamiliar nouns.

9.4.4 Qualitative Analyses.

9.4.4.1 Response Patterns.

The child data did not allow for statistical analysis due to the high volume of masculine numeral forms produced. This skewed the data and meant that statistical analyses were not appropriate. Qualitative analyses of the numeral data for the child participants are presented here. Comparisons across age and home language groups are made when appropriate. Individual response patterns were identified for each child, and then children were grouped into response pattern categories. Overall patterns both within and across groups are discussed. Data are reported for the masculine noun trials (24 trials) and the feminine noun trials (24 trials) separately. In each set of 24 trials, one third of these trials were allocated to each of three target numerals, (i.e. eight trials with 2, eight trials with 3, eight trials with 4).

4- and 5-year-olds.

Table 9.6 shows the response patterns for the OWH 4-year-olds and the 5-year-old children across all three home language groups. Patterns across age and home language groups were very similar. Fifty-eight out of 60 children produced masculine numeral forms in all 48 trials. One child from the WEH group (MKJ) produced one feminine numeral form, *tair* ‘three (f.)’ incorrectly in one masculine noun trial. The character depicted in this trial was female.

Another child, (RW), produced largely feminine forms for one numeral type (*dwy* ‘two (f.)’ and all masculine forms for other numeral types (*tri* ‘three (m.)’ and *pedwar* ‘four (m.)’). Overall, children produced even fewer feminine numeral forms than in the real word version of the task. This seemed to stem from an overall

tendency to produce more masculine forms (as observed in the real word version).

The unfamiliarity with the novel words only seemed to strengthen this tendency.

7-year-olds.

OWH 7-year-olds.

Table 9.7 shows the response patterns for the 7-year-olds across all three home language groups. Twelve out of fifteen children produced all masculine numeral forms. Three children produced both masculine and feminine numeral forms.

Masculine noun trials.

All but one child in the OWH 7-year-old group produced masculine numeral forms in all trials. The same child who produced feminine numeral forms in over 90% of cases in the real word version of the task (ROE) produced feminine numeral forms in all masculine noun trials in this task.

Table 9.6

Response patterns of 4- and 5-year old children divided by home language

Gender of target nouns	Response Patterns	OWH 4	OWH 5	WEH 5	OEH 5
M and F Targets	All M Forms Throughout	15	15	14	14
M Target					
	All M – <i>dau, tri, pedwar</i>	0	0	14	14
	> 80% M – <i>dau, tri, pedwar</i>	0	0	1	0
	M for some numerals, feminine for others (inconsistent across 2, 3, and 4)	0	0	0	1
	40-60% M and F	0	0	0	0
	80% > F	0	0	0	0
	All F forms - <i>dwy, tair, pedair</i>	0	0	0	0
F Target					
	All M – <i>dau, tri, pedwar</i>	15	15	15	14
	> 80% M - <i>dau, tri, pedwar</i>	0	0	0	0
	M for some numerals, feminine for others (inconsistent across 2, 3, and 4)	0	0	0	1
	40 – 60% M and F	0	0	0	0
	> 80 % F	0	0	0	0
	All F forms - <i>dwy, tair, pedair</i>	0	0	0	0

Feminine Noun Trials.

Twelve children incorrectly produced masculine numeral forms in all trials. ROE produced feminine numeral forms in all trials but one, where she produced *tri* ‘three (m.)’. Two children produced target feminine numeral forms twice (in relation to different novel noun and character combinations in each case). KUJ produced *pedair* ‘four (f.)’ in once in relation to a male picture character and once in relation to a female picture character. PDR produced *dwy* ‘two (f.)’ twice, once in relation to a male picture character, and once in reference to an inanimate object.

*WEH 7-year-olds.**Masculine noun trials.*

Eleven out of fifteen children produced masculine numeral forms in all trials. Four children produced both masculine and feminine numeral forms. BF showed differential use of feminine and masculine forms depending on the numeral type. She produced *dau* ‘two (m.)’ correctly in eight trials, but incorrectly produced *tair* ‘three (f.)’ in eight other trials, and *pedair* ‘four (f.)’ incorrectly in five of the remaining eight trials. ODH similarly showed differential response patterns by numeral type, producing *dwy* ‘two (f.)’ in 7/8 trials eliciting number two, but producing *tri* ‘three (m.)’ and *pedwar* ‘four (m.)’ in trials eliciting the other two numeral types. BN and OW each produced a small number of incorrect feminine numeral forms. BN produced *dwy* incorrectly once in relation to a neutral animate referent, while OW incorrectly produced *dwy* ‘two (f.)’ and *pedair* ‘four (f.)’ once each in relation to a female picture character and a male picture character respectively.

Table 9.7

Response patterns of 7-year-old children divided by home language

Gender of target nouns	Response Patterns	OWH 7	WEH 7	OEH 7
M and F Targets	All M Forms Throughout	12	11	14
M Target	All M – <i>dau, tri, pedwar</i>	14	11	14
	> 80% M – <i>dau, tri, pedwar</i>	0	1	0
	M for some numerals, feminine for others (inconsistent across 2, 3, and 4)	0	3	1
	40-60% M and F	0	0	0
	80% > F	1	0	0
	All F forms - <i>dwy, tair, pedair</i>	0	0	0
F Target	All M – <i>dau, tri, pedwar</i>	12	11	14
	> 80% M - <i>dau, tri, pedwar</i>	2	2	0
	M for some numerals, but not others [inconsistent across 2, 3, 4]	0	2	1
	40 – 60% M and F	0	0	0
	> 80 % F	0	0	0
	All F forms – <i>dwy, tair, pedair</i>	1	0	0

Feminine noun trials.

The same eleven children who correctly produced masculine forms in all masculine noun trials incorrectly produced masculine forms in all feminine noun trials. BF and ODH exhibited the same response patterns observed for masculine trials (as outlined above), but BF also produced *dwy* ‘two (f.)’ correctly once, in relation to a neutral animate picture character. BN produced four target feminine numeral forms. In all cases she produced *dwy* ‘two (f.)’. *Dwy* was produced in reference to two female picture characters, and two neutral picture characters. This child did not produce *tair* ‘three (f.)’ or *pedair* ‘four (f.)’ at any point. It appeared that BN was producing different gendered numeral forms depending on the numeral type (i.e. *dwy* ‘two (f.)’ vs. *tri* ‘three (m.)’ and *pedwar* ‘four (m.)’). Finally, OW produced *tair* ‘three (f.)’ correctly once when referring to a neutral animate picture character.

*OEH 7-year-olds.**Masculine noun trials.*

Fourteen out of fifteen children correctly produced target masculine numeral forms in all trials. OFH produced target masculine forms by and large, but incorrectly produced *dwy* ‘two (f.)’ in five trials.

Feminine noun trials.

Fourteen children incorrectly produced masculine numeral forms in all trials. OFH produced *dwy* ‘two (f.)’ correctly in seven trials, and produced *dau* ‘two (m.)’ incorrectly once. In all remaining trials, she incorrectly produced *tri* ‘three (m.)’ and

pedwar ‘four (m.)’ This child exhibited differential response patterns according to the numeral type involved. She favoured the feminine form *dwy* ‘two (f.)’ and the masculine forms *tri* ‘three (m.)’ and *pedwar* ‘four (m.)’

Summary of 7-year-old data.

Overall, very few children at this age produced both masculine and feminine numeral forms. There did not seem to be a pattern in terms of the natural gender of the picture characters that children referred to with feminine numeral forms, and some children showed different patterns of use based only on the type of numeral (i.e. *dwy* ‘two (f.)’ for two, but *tri* ‘three (m.)’ for three). This suggests that children of this age, unlike the adults, have not made a link between natural gender and formal grammatical gender distinctions.

9-year-olds.

OWH 9-year-olds.

Table 9.7 shows the response patterns for the 9-year-olds across all three home language groups. Ten out of 15 children in the OWH group produced masculine numeral forms in all trials. Five children produced both masculine and feminine numeral forms.

Masculine Noun Trials.

Eleven children correctly produced masculine numeral forms in all trials. EVJ produced target masculine forms in 14/24 masculine noun trials. EVJ produced different gendered numeral forms depending on the numeral type. He produced *dau*

‘two (m.)’ correctly in all trials eliciting this numeral, but produced *pedair* ‘four (f.)’ 7/8 times and *tair* ‘three (f.)’ 3/8 times. This child initially produced *tri* ‘three (m.)’, but later produced *tair* ‘three (f.)’. Similarly, VJP correctly produced *dau* ‘two (m.)’ in masculine trials, but there were some instances of incorrect feminine forms. He produced *tair* ‘three (f.)’ incorrectly 7/8 times, and produced *pedair* ‘four (f.)’ incorrectly 3/8 times. This also seemed to reflect a change in response patterns. All observed changes in response patterns are discussed in **Section 9.4.4.2** below.

MNB produced target masculine numeral forms in 20/24 trials. She incorrectly produced *dwy* ‘two (f.)’ in reference to a female picture character; produced *tair* ‘three (f.)’ incorrectly in relation to a different female picture character, and produced *pedair* ‘four (f.)’ incorrectly twice, once in relation to a female picture character, and once in relation to a neutral animate picture character. This child, like the adults, seemed to be aware of the potential overlap between grammatical gender and natural gender distinctions, and as a result assigned feminine gender incorrectly to three different masculine nouns when they were paired with female picture characters. Natural gender information had therefore overwritten grammatical gender information for this child.

HDP produced target masculine numeral forms in all but one trial, where he produced *tair* ‘three (f.)’ in reference to an androgynous animate picture character.

Feminine noun trials.

Ten children in this group incorrectly produced masculine numeral forms in all feminine noun trials. PG produced one target feminine numeral form (*pedair* ‘four

Table 9.8

Response patterns of 9-year-old children divided by home language

Gender of target nouns	Response Patterns	OWH 9	WEH 9	OEH 9
M and F Targets	All M Forms Throughout	10	10	14
M Target				
	All M – <i>dau, tri, pedwar</i>	11	11	14
	> 80% M – <i>dau, tri, pedwar</i>	2	1	0
	M for some numerals, feminine for others (inconsistent across 2, 3, and 4)	2	2	1
	40-60% M and F	0	0	0
	80% > F	0	1	0
	All F forms - <i>dwy, tair, pedair</i>	0	0	0
F Target				
	All M – <i>dau, tri, pedwar</i>	10	10	14
	> 80% M - <i>dau, tri, pedwar</i>	0	2	0
	M for some numerals, but not others [inconsistent across 2, 3, 4]	0	2	1
	40 – 60% M and F	0	0	0
	> 80 % F	0	1	0
	All F forms - <i>dwy, tair, pedair</i>	0	0	0

(f.)' in relation to an inanimate object. HDP produced *tair* 'three (f.)' correctly on four occasions. There did not seem to be a discernible pattern in terms of the natural

gender/animacy of the picture characters the numerals referred to (one was a male character, one was an inanimate object and two were neutral animate characters), nor did HDP show a pattern in terms of the order in which they produced *tair* ‘three (f.)’ on the one hand, and *tri* ‘three (m.)’ on the other.

MNB produced four target numeral forms. She produced *dwy* ‘two (f.)’ in relation to two female picture characters; *tair* ‘three (f.)’ in relation to a neutral animate character, and *pedair* ‘four (f.)’ once, also in relation to a neutral picture character. This suggests that when a character was depicted as female, or was not clearly male, this child sometimes produced feminine numeral forms based on clear female natural gender, or based on ambiguous natural gender (in the case of the androgynous animate characters).

EVJ and VJP both produced a mixture of target feminine numeral forms and incorrect masculine numeral forms. Their responses reflected the same response patterns observed in masculine noun trials, as described above.

WEH 9-year-olds.

Masculine noun trials.

Eleven children produced target masculine numeral forms in all trials. SF produced one incorrect feminine numeral form, (*tair* ‘three (f.)’), when referring to an inanimate object. TVF exhibited different response patterns depending on the numeral type. TVF correctly produced *dau* ‘two (m.)’ in 8/8 trials, but produced both masculine and feminine forms of three and four (i.e. *tri/tair*; *pedwar/pedair*). She initially produced *tair* ‘three (f.)’ and then appeared to switch to producing *tri* ‘three (m.)’, (see **Section 9.4.4.2** below).

TP and TR both produced very few target masculine numeral forms. This reflected a general tendency for both children to produce feminine numeral forms for all numeral types. When target masculine forms were produced by these two children, there did not seem to be a pattern in terms of the order of appearance of trials, or the natural gender/animacy of the picture characters/objects the children referred to in each case.

Feminine Noun Trials.

Ten children incorrectly produced masculine numeral forms in all trials. The four children whose response patterns are described below showed the same pattern of responding here. TP and TR produced target feminine numeral forms by and large, and only a small number of incorrect masculine forms. There was no apparent pattern to their production of masculine forms. TVF showed differential pattern of responding by numeral type – *dau* ‘two (m.)’ for two, *tri* ‘three (m.)’ for three and *pedair* ‘four (f.)’ for four.

SF produced three target feminine forms. These feminine forms occurred sequentially in a series of four trials in which *tair* ‘three (f.)’ was produced. This seemed to indicate a brief switch in response pattern (see **Section 9.4.4.2** below). Finally, TBW correctly produced *pedair* ‘four (f.)’ once in relation to a female picture character. In all remaining trials he produced masculine numeral forms incorrectly.

OEH 9-year-olds.

Masculine noun trials.

Thirteen out of 15 children produced target masculine forms in all trials. DR produced target masculine forms for two numeral types, namely *tri* ‘three (m.)’ and *pedwar* ‘four (m.)’, but produced *dwy* ‘two (f.)’ erroneously in all trials eliciting the number two.

TV showed different response types depending on the numeral type. She consistently produced *dwy* in all trials eliciting the number two, but showed changes in response patterns for numbers three and four. In both cases, she seemed to switch from initially producing *tair* ‘three (f.)’ and *pedair* ‘f.’ to later producing *tri* ‘three (m.)’ and *pedwar* ‘four (m.)’. These switches in response patterns are explored further in **Section 9.4.4.2** below.

Feminine noun trials.

The same patterns observed in masculine noun trials applied here.

Summary of 9-year-old data.

At age nine, children still showed a strong tendency to produce masculine numeral forms overall. In addition, at age nine, some children showed switches in response pattern for specific numeral types **Section 9.4.4.2** for details. This was not observed in the younger children for this task. The children who produced both masculine and feminine forms did not generally show differential patterns of use based on grammatical gender, nor based on natural gender, with the exception of one child. MNB showed a tendency to produce feminine numeral forms when

referring to female picture characters, or neutral/androgynous characters. That is, in the absence of natural gender cues indicating masculine gender, this child sometimes produced feminine numeral forms. She did not, however, differentiate based on grammatical gender, suggesting that the high performance of this child in the real word numeral task was based on her learning of numeral forms via exposure to exemplars, and not based on her assignment of gender by attending to syntactic cues in the task paradigm.

Summary of the child data.

Much like their numeral production patterns in relation to real words, young children largely produced masculine numeral forms. However, unlike in the real word version of the task, children aged 7-9 did not generally show selective use of feminine numeral forms in relation to feminine novel nouns only. This suggests that exposure to exemplars of feminine numeral forms co-occurring with specific nouns may be crucial for the acquisition of this gender structure.

One child in the 9-year-old OWH group, (MNB), produced feminine versus masculine numeral forms in a discriminative fashion based on natural gender information, but did not do so based on grammatical gender information. Furthermore, this child had exhibited productive use of feminine and masculine numeral forms in relation to real nouns (see **Chapter 8**). This suggests that correct numeral forms are acquired based on exposure to exemplars of specific nouns (and co-occurring numerals). That is, children do not assign gender based on formal information (such as the syntactic cues presented in prompt sentences), but rather

based on distributional information, which is heavily reliant on level of exposure, and will vary immensely across nouns.

As in the numeral elicitation task with real words, children’s numeral response patterns for novel nouns showed evidence of switches in response patterns mid-task. The next section explores whether there were differences in the type of switches that occurred, the level of perseveration in the children’s switches, and any differences in terms of the age/home language of the children who switched in this task, as opposed to the real word version of the task.

9.4.5 Response pattern switches.

Close examination of the data revealed that five children from the 9-year-old group exhibited mid-task changes in response patterns related to the numeral forms tri ‘three (m.)’ and tair ‘three (f.)’. The number of children per age/home language group who exhibited switches in response patterns is shown in *Table 9.9*.

Table 9.9

The number of children who exhibited switches in response patterns, divided by age and home language group

Age/Home Language	OWH	WEH	OEH
9-year-olds	2	2	1

Details of the direction (masculine to feminine or vice versa) and type (i.e. numeral type) of switches made are shown in *Table 9.10*. Note that switches move from both masculine to feminine, and from feminine to masculine, depending on the individual child.

To confirm the impression that these children were making an across-the-board switch in their choice of form, and that the impression was not an artefact of the particular words that were occurring, the level of perseveration of children's switches were measured by examining the number of uses of a new form once a child had made an initial switch. For example, if Child A produced *dau* in trials 1 to 5, but then produced *dwy* in trial 6, and subsequently produced *dwy* in trials 7 to 12 (out of twelve total trials), this child would have a post-switch percentage of 100%.

Table 9.10. Overall consistency of the 9-year-old children's response pattern switches, organised by numeral type and by home language

Switch Type	Participant ID	Age/Home Language	Post-switch %
Tri > Tair	VJP	OWH 9	100%
	TVF	WEH 9	92%
	SF	WEH 9	50%
Tair > Tri	EVJ	OWH 9	92%
	TV	OEH 9	90%

On average, children's post switch responses were at a level of 90% or more, except for one child. One child's post switch responding was less reliable (50%). For this task, only changes in response pattern involving *tri* 'three (m.)' and *tair* 'three (f.)' were observed. In the real word version of the task, switches involving *dau* 'two

(m.)’/dwy ‘two (f.)’ and *pedwar* ‘four (m.)’/pedair ‘four (f.)’ were also observed. It is unclear why only one type of numeral was involved in switches here.

These switches in response pattern seemed to be indicative, then, not of any solid grammatical knowledge about the gendered numeral system, but, rather, of a “presence” of feminine numeral forms in their vocabulary without knowledge of how and when to use the forms appropriately. These children did, however, exhibit more knowledge of masculine/feminine numeral forms than other children.

9.5 Discussion

The results of the adult and child data give further insights into the acquisition of the gender system, and specifically the productivity of the system. As in the real word numeral task, both adults and children produced more masculine than feminine numeral forms. The difference here, however, was the adults showed a greater tendency to produce the masculine forms in response to novel nouns (73% on average) than in response to real nouns (63% on average), while the children showed very similar rates of masculine forms across the two versions of the task (95% for real nouns vs. 96% for novel nouns).

Clear natural gender effects were present in the adults. When female picture characters were presented, adults were significantly more likely to produce feminine numeral forms. Adults showed this pattern of responding when female characters were paired with both masculine and feminine novel nouns. This suggests that even adults are not fully productive in their assignment of gender to novel nouns on the basis of distributional properties, and are still largely influenced by natural gender information more than by formal cues to gender.

The adults did show signs of benefitting from the presence of gendered word endings (i.e. *-wr* and *-es*), but, as these endings are more closely tied to semantic information (i.e. they tend to appear on nouns for humans, which contain semantic gender information), this again highlights that natural gender, rather than grammatical gender information seems to be more salient, even for adults.

In addition, the reduced productivity in the adults for novel nouns relative to real nouns suggests that they may not rely on syntactic cues (such as those presented in the task paradigm) when selecting which numeral form to produce with real nouns, and rather may produce numeral forms for nouns based on their accumulative experience with individual nouns. That is, their exposure to specific nouns appearing with specific numeral forms may determine their subsequent use of such forms.

Natural gender effects were not present in the children, with the exception of one 9-year-old in the OWH group. This child had shown a high level of productivity in her numeral production in the real word numeral task, and did show evidence of productive knowledge in the novel word task. The acquisition of these gendered numeral forms could be especially difficult due to the lack of availability of the gender distinction. That is, the distinction is defined only on these three numerals. The masculine forms are acquired as they are the default forms (used for mathematics, etc), but the feminine forms are used only when referring to feminine nouns. These gendered feminine numerals are lost in a large mass of non-gendered numerals. Gendered numeral forms also lack semantic load, in that producing *dwy* ‘two (f.)’ versus *dau* ‘two (m.)’ would not express anything different in terms of meaning.

In addition, there is no clear phonological pattern to detect in terms of the forms that the feminine numerals take. *Tair* ‘three (f.)’ and *pedair* ‘four (f.)’ share a common ending, but *dwy* ‘two (f.)’ does not. Therefore, there is not a designated form which expresses feminine gender on all three numerals, making the identification of the feminine feature that little bit more difficult.

Chapter 10

Global Productivity

10.1 Chapter Overview

In **Chapters 5, 7 and 8**, children's use of different elements of the Welsh gender system was explored via three experimental tasks. The same set of 48 nouns appeared in all three of the abovementioned experiments. This chapter merges these results and assesses these children's response patterns for this set of nouns. Their responses are compared across four different structures that make formal gender distinctions, namely: **numerals, nouns, adjectives, and pronouns**. First, the rationale behind this data exploration is presented, followed by a review and comparisons of some of the effects observed in quantitative analyses of the individual experimental tasks. A qualitative analysis of response patterns across the different experimental tasks and a discussion of these results follow.

10.2 Rationale

The primary aim of this data exploration was to investigate whether or not children at these ages link different forms of gender markers (e.g. understanding that *dwy* 'two (f.)' and *hi* 'her/it' both mark for feminine gender, while *dau* 'two (m.)' and *fo* 'him/it' both mark for masculine gender). Moreover, it was of interest to determine whether or not children showed different cross-element productivity patterns for different lexical items, as lexical effects had emerged from the results of the data in the individual experiments.

10.3 Results

Results are presented in two parts. First, data analyses from the individual experimental tasks are reviewed, so that common or differing patterns across the tasks could be identified. Then, qualitative analyses identify the response patterns of individual participants, and compared response patterns across individuals both within and across age/home language groups.

10.3.1 Tasks Overview

Gender effects.

Figure 10.1 illustrates the patterns of production reported above across gender categories for each of the gender structures. In each case, a bias for producing masculine forms more than feminine forms was evident. This effect varied across the different structures in terms of the degree to which correct response rates in relation to feminine nouns were affected.

Mutation rates for nouns were very low, resulting in a very low average success rate for feminine nouns, and a very high success rate for masculine nouns. A similar pattern of responses was observed for adjectives, only mutation rates were higher for adjectives (than for nouns) when paired with both masculine and feminine nouns. Numeral production was characterised by largely non-discriminative production of masculine numeral forms regardless of the gender of noun referents.

Levels of target pronoun production were more balanced across gender categories. We proposed that the higher proportion of correct responses for pronouns with feminine referents was due to the fact that pronouns have a higher level of semantic content than the other gender marker types, and the results of the

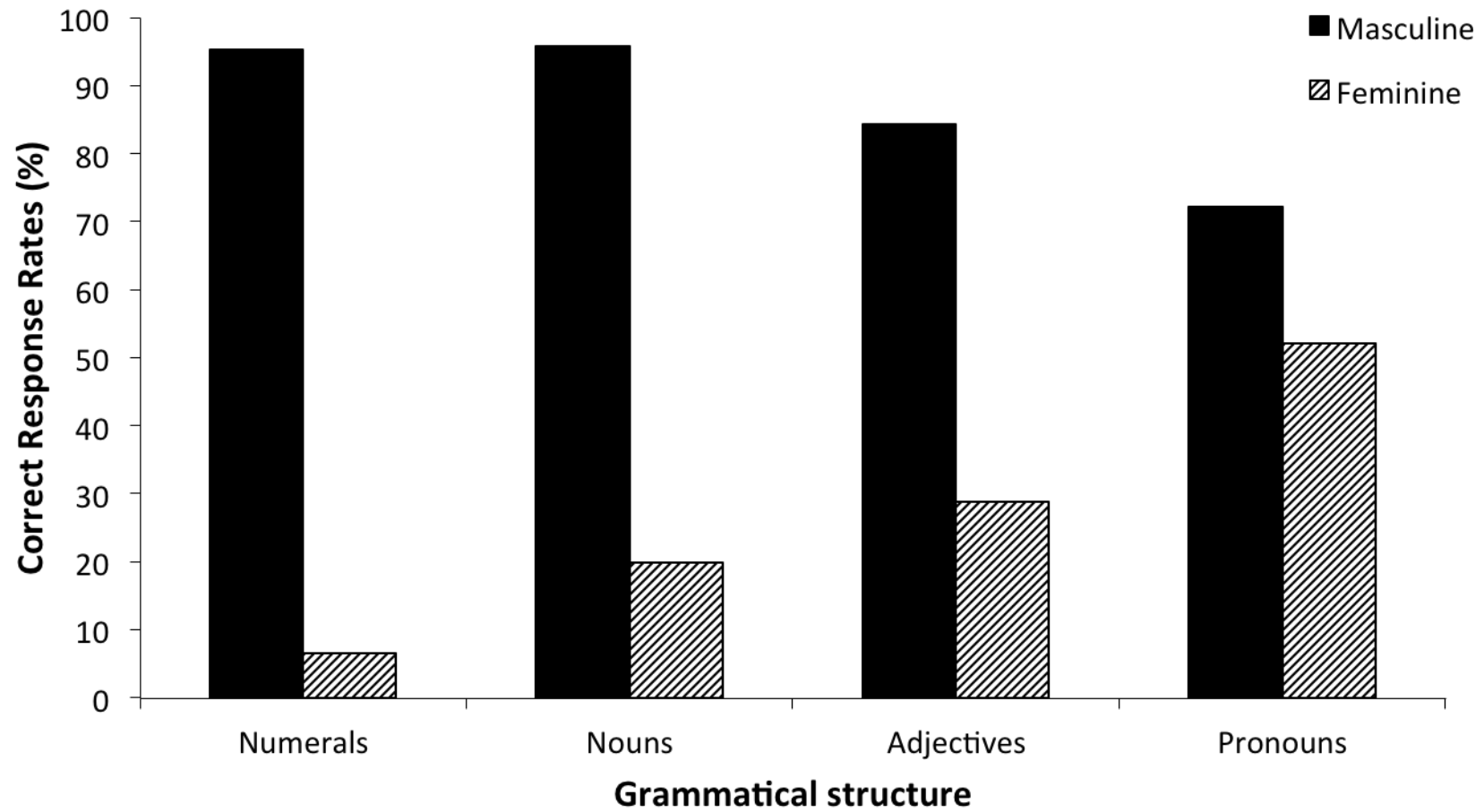


Figure 10.1. Performance Rates by gender across all four grammatical structures.

the pronoun task had shown that both children and adults used semantic information to inform their gender marking decisions.

Effects of language exposure.

In previous chapters, a main effect of home language was observed in analyses for the noun, adjective and pronoun data. For the noun data, differences across home language groups were only evident in feminine noun trials (i.e. when soft mutation was required).

For the adjective data, home language differences showed very low mutation rates in the OEH group, which meant that they performed better than the other groups for masculine adjective trials but worse than the other groups for feminine adjective trials.

For the overall performance for pronouns, a general home language effect reflected the fact that the OEH children's performance was significantly poorer than that of the WEH and OWH groups. Differences by home language also seemed apparent in the numeral task data, in that children from the OWH and WEH groups tended to show a greater general awareness of, and some (limited) productive use of both feminine and masculine numeral forms. *Figure 10.2* illustrates effects of home language across tasks. Given the overall effects of gender reported above, and in light of the fact that language exposure effects seemed to have more of an impact on production of feminine forms, the next section explores in more depth the patterns of production for data from feminine noun trials.

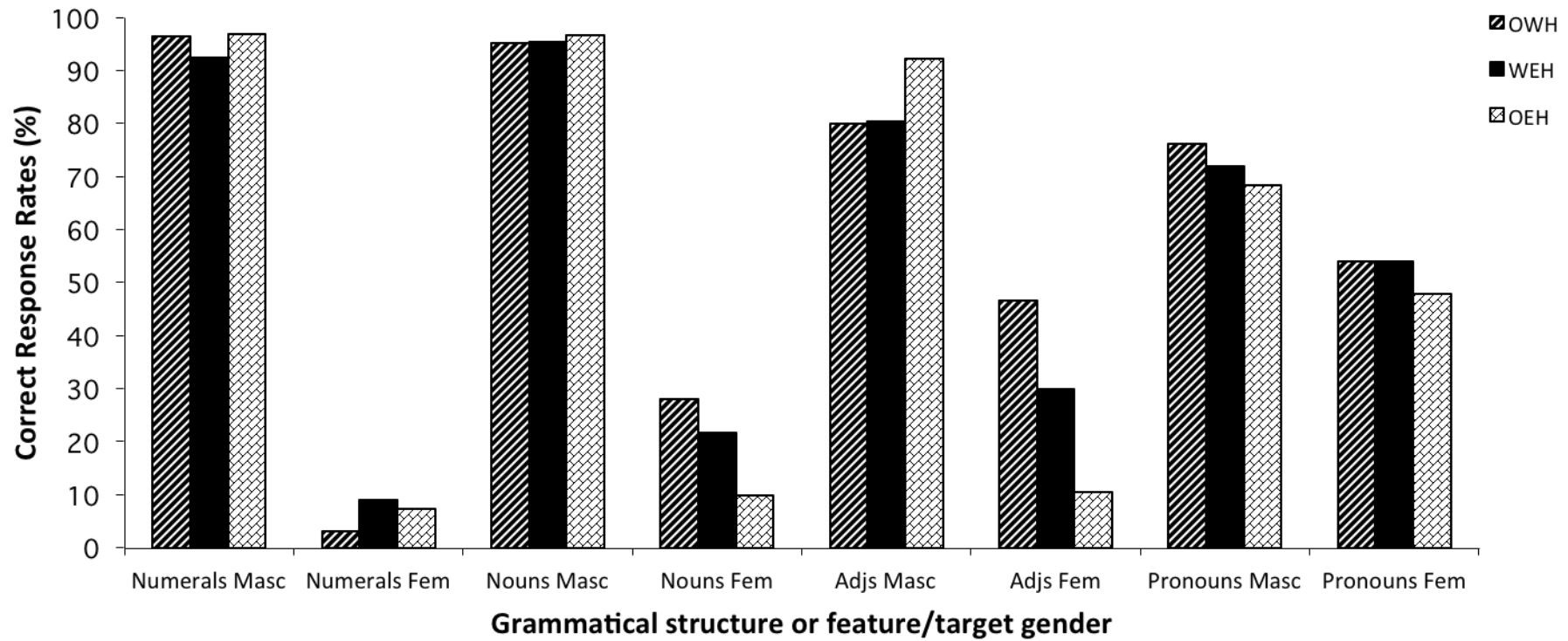


Figure 10.2. Patterns by home language group across all four grammatical structures, divided by gender.

10.3.2 Qualitative data analyses.

Qualitative analyses aimed to determine the patterns of acquisition of feminine forms across the four different modalities under study, and aimed to address the following questions:

- Were children operating under rule-based or lexically-based learning mechanisms?
- Which of the four grammatical rules were children applying most effectively?
- Was there a systematic progression in terms of acquisition of the elements?
- How did language exposure affect patterns of responding?

10.3.3.1 Dominant Response Pattern Analysis.

Qualitative analyses examined the how children dealt with every single feminine noun. That is, did a child know the correct form for: each noun? Only the correct pronoun? The noun form and the pronoun form? Etc. For each individual feminine noun, the cross-structure patterns exhibited by participants were identified. Twelve main response patterns were identified:

- 1) No feminine gender marking: A child tended to produce masculine forms and did not mutate feminine nouns and corresponding adjectives
- 2) Correct Feminine Pronoun: The correct feminine pronoun was produced, but all other structures did not mark for feminine gender
- 3) Correct Adjective: The adjective was correctly mutated, but all other structures did not mark for feminine gender
- 4) Correct Noun: The feminine noun was correctly mutated, but all other structures did not mark for feminine gender

- 5) Correct Numeral: The correct feminine numeral form was produced, but all other structures did not mark for feminine gender
- 6) Correct Pronoun and Adjective: The correct feminine pronoun was produced, and the adjective was correctly mutated, the other structures marked for masculine gender
- 7) Correct Noun and Adjective: Both the noun and adjective were correctly mutated, the other structures marked for masculine gender
- 8) Correct Pronoun and Noun: The correct feminine pronoun was produced, and the feminine noun was correctly mutated, other structures marked for masculine gender
- 9) Correct Pronoun and Numeral: The correct feminine pronoun and numeral forms were produced, other structures marked for masculine gender
- 10) Correct Pronoun, Adjective and Noun: All but the numeral form correctly marked for feminine gender
- 11) Correct Pronoun, Adjective and Numeral: All structures except the noun were produced correctly and marked for feminine gender
- 12) All Correct : All four structures marked for feminine gender

An overall **dominant** response pattern was then identified for each child. These dominant response patterns were calculated by identifying the response pattern that was common to the highest number of feminine nouns, and then calculating what proportion of response patterns overall (out of a total of 24 response patterns, one per feminine nouns) the most common response pattern accounted for. For example, if a child produced the correct noun form, adjective form and

pronoun form for 12/24 nouns, this response pattern accounted for 50% of their responses overall. The **dominant** response pattern was defined as the pattern that applied to the highest number of individual nouns for each child, and had to account for a minimum of 20% of a given child's responses to feminine nouns.

Depending on the child, the patterns common to the highest number of nouns could vary. The dominant response pattern could also vary in terms of the number of nouns that shared a common response pattern. For example, Child A could have produced only the pronoun correctly for 24/24 feminine nouns, and so their dominant response pattern accounted for 100% of their responses. Child B could have produced the correct pronoun and the appropriate mutated noun forms for 9/24 feminine nouns. However, then their responses for the remaining 15 nouns could have been varied, so that two nouns had the right adjective forms, one noun had the right numeral form, three nouns had the right noun form, etc. This would mean that the first pattern (i.e. correct pronoun form + correct noun form) was the response pattern that applied to the highest number of nouns. Therefore, Child B's dominant response pattern accounted for 9/24 nouns, which is equivalent to 37.5% of their responses overall. Although a dominant response pattern was counted as any pattern that accounted for children responses for at least 20% of all feminine nouns, children's dominant response patterns usually accounted for far more than 20% of a given child's nouns, (46% on average). The data for children's dominant response patterns are presented below in three groups, according to age group.

5-year-olds.

Figure 10.3 shows the dominant response pattern for all children at age five. Overall, the five year olds' dominant response patterns reflected a general lack of feminine forms and a lack of application of the SM rule. However, there were some children in all three home language groups whose dominant response pattern was to produce at least the appropriate feminine pronoun. A small number of children from the WEH group were also mutating post-nominal adjectives appropriately, while a few OWH children seemed to have progressed further and were successfully producing feminine pronoun and adjective forms in relation to the same nouns.

7-year-olds.

Figure 10.4 shows the dominant response patterns for children aged seven. Most children's dominant response pattern was to produce masculine forms of pronouns and numerals, and not apply soft mutation to feminine nouns and adjectives. However, more children at this age were producing appropriate feminine pronouns in relation to feminine nouns. A small number of children in all three home language groups showed dominant response patterns that involved marking for feminine gender via two different structures. They were not always the same two structures, but in all cases, either the pronoun or adjective was one of the two structures in each combination.

One OWH 7-year old (ROE) had progressed so that her dominant response pattern was to mark for feminine across all four structures. However, ROE produced feminine numeral forms not only for feminine nouns, but also for masculine nouns. For the other three structures however, this child's production of feminine forms

varied for masculine and feminine nouns. That is, with the noun, adjective and pronoun forms, she tended to accurately mark for feminine gender for feminine nouns, and didn't inappropriately mark for feminine gender for masculine nouns with great frequency.

Given that ROE seemed to be overextending the feminine numeral forms to referring to masculine noun as well as feminine nouns, but did not show overextension of the other structures, it seemed reasonable to make a more conservative interpretation of this child's data, and assume that she was beginning to link three of the four feminine structures (pronoun, noun and adjective), but was yet to master the gender distinction for numeral forms.

9-year-olds.

Figure 10.5 shows the dominant response patterns for children aged nine. By this age, even more children in the OWH and WEH groups were marking for gender via at least one structure, but the same number of OEH 7-year-old children and OEH 9-year-old children failed to mark for feminine gender across any of the four structures. By this age, 50% of the OWH children marked for feminine via at least two structures, with some children marking for feminine via three or even the maximum four structures. The child whose dominant response pattern was to mark for feminine across all four structures (MNB) had showed productive command of the gendered numerals in the experimental task. The dominant response pattern observed shows that this child had progressed well in her acquisition of the gender system as a whole, and had begun to link the different feminine structure

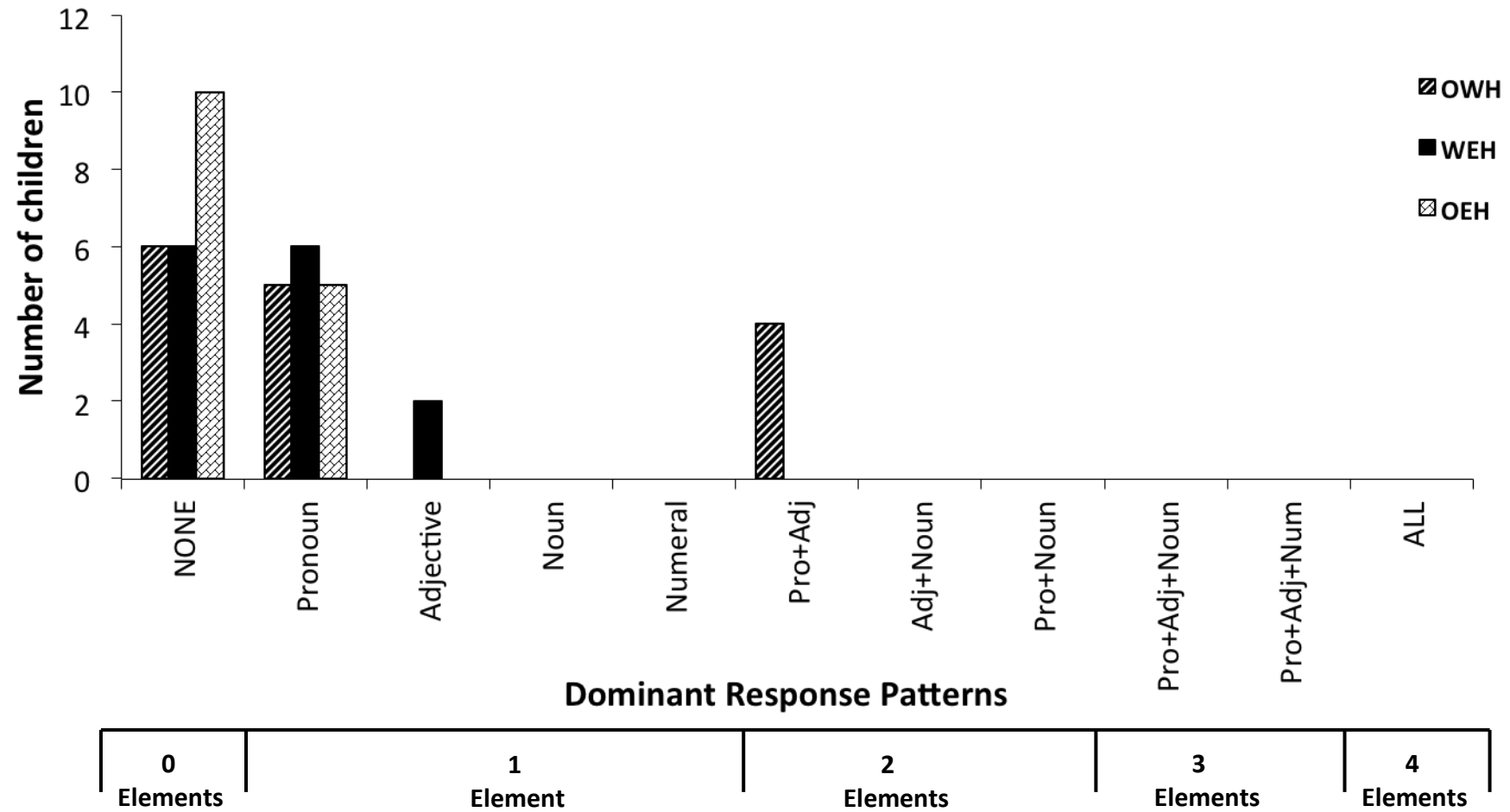


Figure 10.3. Dominant response patterns for children in the 5-year-old group, divided by home language.

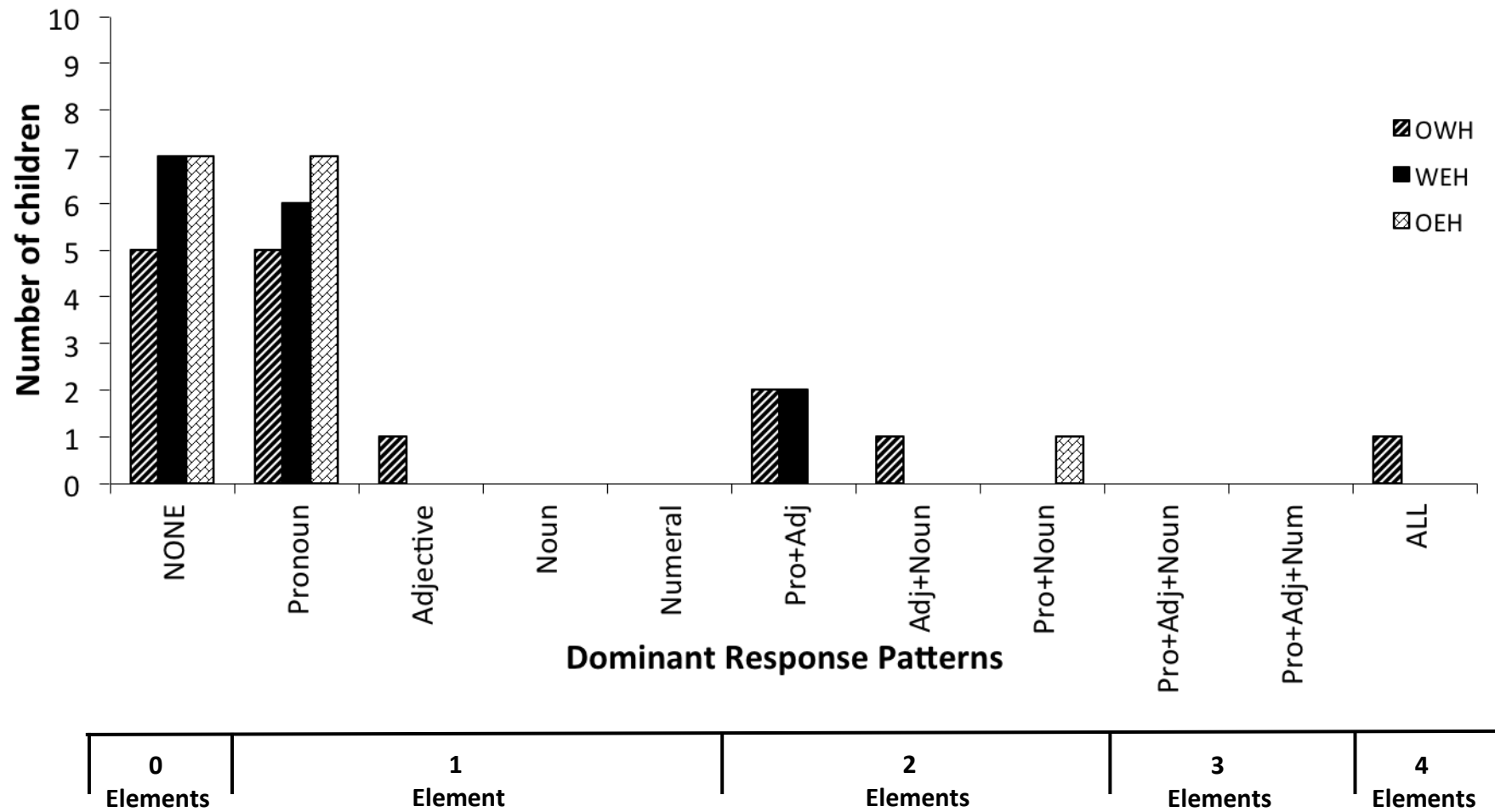
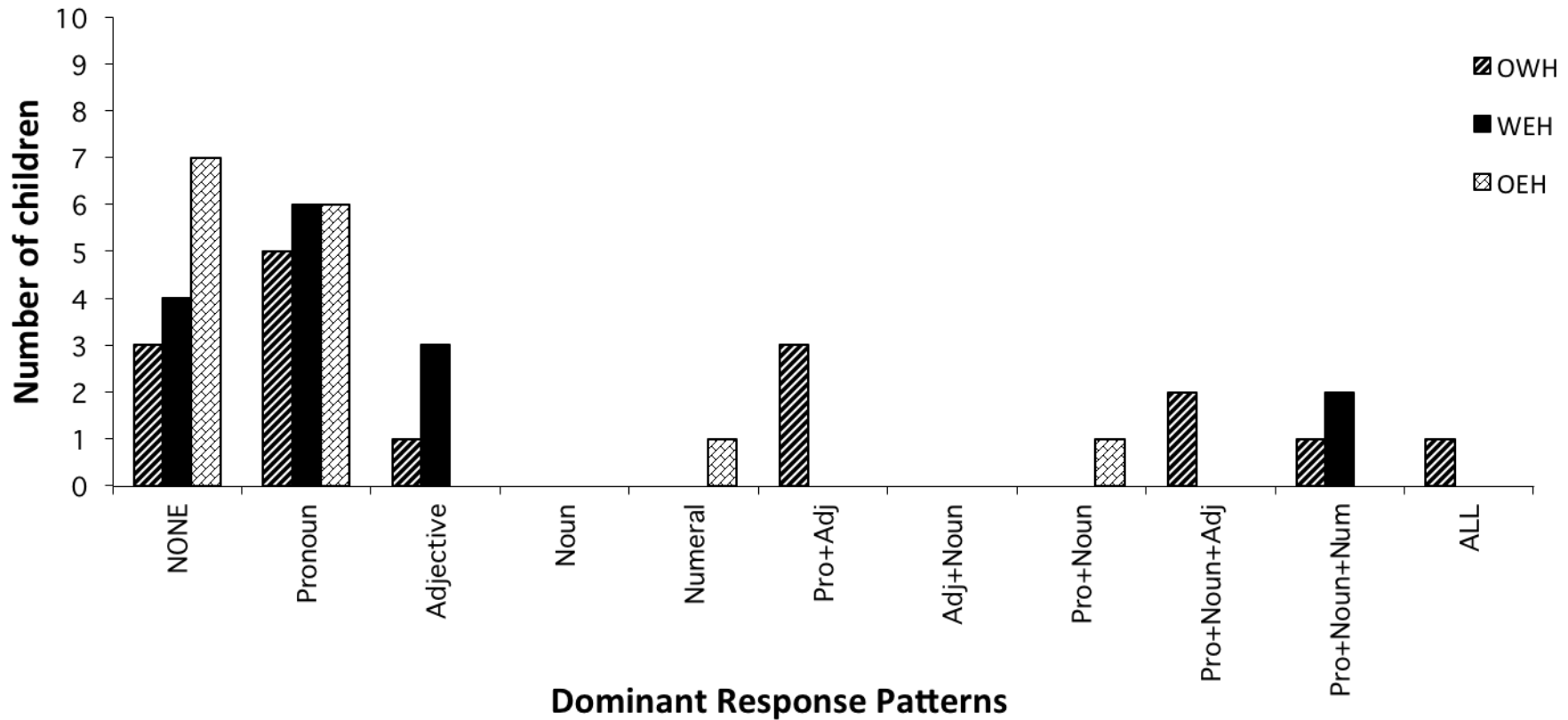


Figure 10.4. Dominant response patterns for children in the 7-year-old group, divided by home language.



0 Elements	1 Element	2 Elements	3 Elements	4 Elements
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Figure 10.5. Dominant response patterns for children in the 9-year-old group, divided by home language.

MNB does, however, seem to be an exceptional case, when compared to her peers.

Overall.

Across all three age groups, productivity across structures was, overall, quite low. Children showed variability in terms of the structures that they marked for feminine; even at age nine, variability was observed, and children still seemed to be far from integrating all four structures productively.

By age nine, a higher number of the OWH children appeared to be marking for feminine via more structures than the WEH and OEH group. Collectively, these patterns suggest language exposure effects, whereby the children who were exposed to more Welsh were more advanced in their development.

10.3.3.2 Variation in dominant response patterns.

Given the variability in children's gender marking for individual structures, it was of interest to determine whether these children were similarly variable in their dominant response patterns. That is, did children's dominant response patterns account for a high proportion of their responses, or did children exhibit a wide variety of response patterns? *Table 10.1* shows how children's dominant response patterns ranged from accounting for 20% up to 90% of their overall responses.

Very few children's dominant response patterns accounted for 90% or more of responses, and even 70% or more was quite uncommon. There was a lack of consistency both individually and across children within sub-groups. The children generally showed a wide range of different patterns across nouns and these patterns varied from child to child. Essentially, the data seemed to indicate that the children

were undergoing piecemeal learning, in which the acquisition of the system was very much individualized and idiosyncratic in nature.

10.3.3 Results Summary.

Overall, the investigation of the global productivity of children's gender marking revealed the following:

- Children varied in their level of productivity across structures
- Children were inconsistent in their gender marking across all four structures
- Patterns of progression were heterogeneous (i.e. the order in which features are acquired varied across children)
- There was a general, slow progression with age
- An effect of language exposure was evident based on differences observed across home language groups

10.4 Discussion

The above observations suggest that children acquire the Welsh gender system in a piecemeal fashion. Children did not appear to acquire the four different gender features in a systematic fashion, as evidenced by a high level of variability both within and across children. The patterns of acquisition certainly did not appear to be sequential. That is, there was no evidence of a default order in terms of which structure was acquired by children first, and which was acquired second, third and fourth. Some of the more advanced children had mastered both the feminine pronoun and adjective structures, but some less advanced children had mastered just the feminine noun structure. These children had therefore acquired a

Table 10.1

Accountability of dominant response patterns across age and home language groups

Language	Main Pattern			Main Pattern			Main Pattern			Main Pattern			Main Pattern					
Group	90% +			70% +			50% +			40% +			30% +			20% +		
Age -->	5	7	9	5	7	9	5	7	9	5	7	9	5	7	9	5	7	9
OWH	0	0	0	0	0	0	5	4	2	1	3	1	6	5	5	3	3	7
WEH	0	0	0	1	0	2	6	4	4	3	5	0	4	3	2	2	3	8
OEH	2	0	0	3	1	1	9	10	9	1	0	2	0	3	2	0	0	1
OVERALL	2			8			53			15			30			27		

different feminine structure first. If the structure acquisition had been sequential, then the least advanced children would have acquired the pronoun first, then the second stage children would have acquired the pronoun and the adjective, then the third stage children would have acquired the pronoun, adjective and noun. From looking at the data in *Figures 10.3, 10.4, and 10.5*, this was clearly not the case for all of the data, suggesting that children's acquisition of the separate gender structures was piecemeal. Essentially, different children picked up on different structures first. The knowledge that children acquire from these forms is not cumulative, i.e. they do not need to know how to mutate feminine nouns before they can mutate adjectives, nor do they need to know how to produce feminine pronoun forms before being able to mark for feminine with other structures.

The only consistent pattern that was found in the data was in terms of differences observed across home language groups. The timing of acquisition, if not the pattern of acquisition, seems to be very much affected by level of exposure to Welsh. In turn, performance of the OWH group was most advanced, the OEH group's performance was least advanced, and the WEH group fell in-between.

Chapter 11

General Discussion

The investigations outlined above have provided various insights into the factors involved in, and the processes that occur in children's acquisition and adults' knowledge of the Welsh gender system. The investigation of gender marking of nouns and adjectives illustrated how a complex form-function mapping can impede early acquisition. The multi-functionality of SM, both as a gender marker, and in general (due to its occurrence in multiple syntactic contexts unrelated to gender), makes the form-function mapping between SM and feminine gender especially opaque. This opacity does not promote rule-based learning, as the rule is not represented consistently in its form-function mappings leading to piecemeal learning mechanisms, which were observed in the child data. These data are consistent with constructivist theories (e.g Tomasello, 2003; Ambridge & Lieven, 2001) that have postulated that the relative complexity of form-function mapping affects the pace and trajectory of acquisition. Although the adults exhibited high mutation rates for feminine nouns, there was still some variation among the adults in terms of which feminine nouns they succeeded or failed to mutate appropriately. This variation may have an impact on children's acquisition patterns, as the input will not be consistent across adult models. It also suggests limitations on bilingual first language acquisition in terms of the end-state that is achievable for highly complex structures.

For adjectives, adults showed high target rates when producing adjectives paired with both masculine and feminine nouns. Piecemeal acquisition was observed

in children's adjective production. Adjective mutation rates were, however, higher here than for nouns. This may be because children notice that adjectives can mutate when they appear after nouns, but are yet to establish which nouns (i.e. feminine ones) trigger these mutations. Lexical effects were also evident, whereby some adjectives were mutated more extensively than others. This was taken to be an effect of the frequency of words that share the initial consonants of the different adjectives.

Results from the repetition task suggested that overall articulatory skill might not be the most important factor in children's mastery of mutation. Children who were able to reproduce cluster-initial novel nouns with a high level of accuracy did not appear to mutate nouns and adjectives any more frequently than children with lower articulatory skill. From this, it was proposed that each individual child's ability to pay attention to phonology, and specific phonological features, may aid them in their ability to pay attention to phonological changes (such as mutations). Children with superior attentional abilities would then, in theory, be better able to attend to, and subsequently acquire, mutation. This requires further investigation to determine whether this latter hypothesis holds.

In the numeral task, some children produced both masculine and feminine numeral forms, but their production of feminine forms was often limited to a specific numeral type (for example, Child A produced *dwy* 'two (f.)', but not *tair* 'three (f.)' and *pedair* 'four (f.)', while Child B produced *tair* 'three (f.)', but not *dwy* 'two (f.)' and *pedair* 'four (f.)'. Many of these occurred as a result of switches in response patterns from initial production of masculine forms to later production of feminine forms.

Just as the repetition task and mutation task data suggested that awareness has an impact on mutation, the switching patterns observed in the numeral task seemed to reflect an awareness of both masculine and feminine numeral forms, leading to production of both masculine and feminine forms (something which was lacking in many children). This initial awareness of feminine gender marking at a phonological level (in the case of mutation) and at a lexical level (in the case of numerals) may be considered to be a step required to be able to later achieve knowledge of the productive rules that govern feminine gender marking.

The numeral data results also illustrated how a gender feature that is expressed in only a limited number of cases (i.e. on only three numerals), and is lacking in both salience and frequency, is acquired late, and in an apparently piecemeal fashion (consistent with Bates and MacWhinney's (1989) concept of "cue availability" and with some of Slobin's (1973) key operating principles). The feminine numeral forms *dwy* 'two (f.)', *tair* 'three (f.)' and *pedair* 'four (f.)' are underrepresented in terms of their frequency, and the gender distinction they make may be overlooked due to the large number of other numeral forms that do not make a gender distinction (i.e. they have one form). This has an impact on level of exposure, in that children simply cannot be exposed to a high number of exemplars of feminine numeral forms, as they are too infrequent. This will affect their representational strength (c.f. Bates & MacWhinney, 1989).

The above-mentioned effect of language exposure observed for the feminine numeral forms is a specific one, related to the specific structure under study, and differs from the more general language exposure effects observed across groups of children from different home language backgrounds, with the OEH children (who

were exposed to the least Welsh from day to day, and have been exposed to Welsh from a later age) lagging behind their WEH and OWH peers in all of the experimental tasks conducted. This suggests that level of exposure matters both at a local level, and at a global level.

The masculine numeral forms, *dau* ‘two (m.)’, *tri* ‘three (m.)’ and *pedwar* ‘four (m.)’, due to their use in counting etc., appear in the input more often. Their use is also stressed in an educational setting. Therefore, unlike the feminine forms, it is likely that the level of exposure to masculine numeral forms is not as impoverished, resulting in their earlier acquisition. Combined with the low level of exposure, the feminine numeral forms (as a set) also lack a common phonological sub-part (such as a common suffix, for example). This lack of a consistent phonological sub-part may mean that they lack a certain level of salience. Though *tair* ‘three (f.)’ and *pedair* ‘four (f.)’ do have some phonological overlap, *dwy* ‘two (f.)’ does not overlap phonologically with the other feminine forms. This may make it more difficult to link the forms together as a set.

There was, however, some evidence of use of all three numeral types by some of the older children, and by adults. The feminine forms may eventually be acquired as a set by virtue of the knowledge that *dau* ‘two (m.)’, *tri* ‘three (m.)’ and *pedwar* ‘four (m.)’ “go together”, and thus, by default, their feminine counterparts must also “go together.”

Children did not make errors with the numerals in terms of number at any point. That is, they did not produce *tair* ‘three (f.)’ when the target form was *dau* ‘two (m.)’. And so, the children have at least determined that, (e.g. *dau* ‘two (m.)’ and *dwy* ‘two (f.)’, in terms of meaning, are equivalent). These data show that the

children have tapped into part of the meaning of the numeral forms, at least in terms of the number that each numeral form expresses.

The adults showed evidence of use of linking formal gender features with real-world sex distinctions to inform their gender marking decisions for numerals, as they exhibited higher levels of accuracy when referring to human noun referents, suggesting that they have linked the feminine and masculine gendered numeral forms with semantic gender information in a way that the children are yet to achieve.

Children's pronoun use, however, showed evidence of an established link between grammatical gender and semantic gender distinctions. Both children and adults showed evidence of benefitting from the presence of biological sex information on some nouns, and utilised it to guide their gender marking decisions. It can be argued that this effect was observed for both children and adults as pronouns carry a high level of semantic load. Referring to a female entity as *fo* 'him' is inaccurate both at a grammatical and semantic level. Referring to two girls as *dau ferch* 'two (m.) girl(s) (f.)', or failing to mutate the word *merch* 'girl (f.)' after the definite article, does not change the meaning. Children were better able to mark grammatical gender with pronouns, due to the representational strength of the semantic content of pronoun. The lack of semantic load in the feminine numeral, noun and adjective forms, however, means that children have to rely purely on formal distributional cues.

Evidence of the semantic load of the pronouns was further illustrated by the observation that the OEH children showed a greater tendency to produce feminine preposition + pronoun combinations. It is proposed that this is due to the fact that

the Welsh feminine subjective pronoun *hi* 'she/3rd p sg feminine' and the English masculine subjective pronoun 'he' are homophones. Due to the semantic weight that each form carries, and the fact that the OEH children are exposed to English more than Welsh, it appears that the meaning of 'he' may be having an impact on the children's understanding of the meaning of *hi* 'she/3rd p sg feminine'

The semantic load that pronouns carry also seems to have an impact on decisions made in terms of the types of co-occurring prepositional forms produced by children. That is, due to the clear semantic meanings that pronouns express, the additional gender information that gendered suffixes express on prepositions may be somewhat redundant at a semantic level. Children tended to omit gender suffixes, opting instead to produce (when possible) neutral compound prepositions (e.g. choosing to say *wrth ymyl fo* 'next to him/it' as opposed to *wrtho fo* 'next to him/it'). Though adults did not exhibit this behaviour, questioning post-testing confirmed that these types of forms were commonly used by all of the adult participants.

The variable prepositional forms produced by the children may also have been due to lack of salience of the suffixes. This idea was proposed based on observation of vowel reduction processes in the adults and the children, (i.e. they produced forms such as *wrthy fo* 'next to him/it' as opposed to *wrtho fo* 'next to him/it').

Some children produced the schwa apart from the stem of the preposition (e.g. *wrth y fo* as opposed to *wrthy fo*), suggesting that children might have confused the schwa suffix with the definite article, *y* 'the', as they may have simply segmented the elements of preposition + pronoun structures differently, separating the suffix form from the stem of the preposition, as opposed to processing the stem and suffix

as one lexical item. Given the co-occurrence of definite articles with pronouns, or even with proper nouns, in other languages, (e.g. *la Eva* ‘the (f.) Eva’ in Spanish), the segmental distribution these children are assuming is a plausible one.

Finally, the results of the novel word numeral task tapped into the productivity of children’s and adults’ gender marking with numerals. The results showed that some children showed a similar awareness, but a lack of understanding of the rules behind selection of masculine/feminine numeral forms, while the adults showed a marked reduction in levels of successful gender marking with novel Welsh nouns when compared to their performance with real Welsh nouns.

These results have also shown that when Welsh speakers are required to mark for gender relying solely on formal distributional cues, even adults fail to mark for gender productively, suggesting that exposure to specific noun-numeral combinations is integral to the acquisition process and points again in the direction of piecemeal learning. The adults showed an effect of natural gender indirectly, in the form of their use of gendered endings (-*wr* for masculine and -*es* for feminine) that occur on some nouns. The endings on these nouns are an extra way of encoding for gender (e.g. *dynes* ‘woman (f.)’ and *myfyriwr* ‘student (m.)’). Further, the adults’ responses were influenced by real-world sex directly, as female picture characters elicited more feminine numeral forms than neutral animate characters or inanimate objects, and male picture characters consistently elicited masculine numeral forms.

In terms of the theoretical implications of this investigation, the results observed are most consistent with constructivist accounts of language acquisition. Piecemeal acquisition patterns were observed both at a local level (for individual

gender structures), and at a global level (when observing patterns across structures).

The piecemeal acquisition of these features varied depending on the structure in question, and in each case reflected properties of each structure as presented in the input, (e.g. properties of the distribution of formal cues, availability of gender features, etc). In relation to studies that have observed distributional learning processes (e.g. Saffran & Thiessen, 2009; St.Clair, Monaghan & Christiansen; Van Heugten & Johnson, 2010), these data suggest that distributional learning mechanisms are constrained by the nature of the distribution itself.

The distribution of SM as a cue to feminine gender is inconsistent, (in that SM cannot encode for gender on all nouns), and is confounded to some extent by its distribution across other grammatical contexts (some of which are related to gender, others that are not). Therefore, as a distribution, SM marking for feminine is not an extremely apparent distribution, making it difficult to detect and decipher. This suggests limitations in terms of the pattern finding abilities that children possess, in that they need a certain level of consistent material to work with in order to identify a distributional pattern.

Frequency effects were observed across individual nouns, with noun forms that appeared in corpora data more frequently appearing to receive mutation more productively than less frequent nouns. This result is in line with other evidence suggesting a role for item frequency (e.g. Goodman, Dale & Li, 2008; Theakston, 2004). The data also appear to suggest that in the absence of transparent distributional patterns, item frequencies may play a more decisive role.

Constructivist approaches can account for the piecemeal learning patterns, effect of input frequency and language exposure, and importantly, can also account

for the non-systematic fashion with which the Welsh gender system as a whole is acquired. There was lack of a consistent pattern in terms of order of acquisition of the different gender structures in these children. This variation derives from the variation in the input that different individual children are exposed to. This non-systematic pattern of acquisition goes against rule-based theories of language acquisition, which postulate that structures are acquired sequentially, and that sequences should be common across individuals.

Conclusions

Collectively, the results of all of the experimental tasks have led to the following conclusions:

- Exposure matters – both at a global level, in terms of exposure to the ambient language as a whole, and at a local level in terms of exposure to specific forms to be acquired
- Awareness matters – whether it is phonological or lexical, it appears that a certain level of awareness is important for subsequent acquisition of gender structures
- Semantics matters – clear evidence of real-word sex to guide grammatical gender marking was evident for adults across multiple structures, and for children in the case of pronouns. The latter observation was attributed to the semantic load that pronouns possess
- The consistency of form-function mappings matters – SM, as a process, is linked to so many functions that the identification of SM as a marker

for feminine gender after the definite article is very difficult, leading to very gradual, and highly piecemeal acquisition

Finally, some limitations of the study must be noted. Firstly, all of the tasks were productive tasks. Preparing comprehension tasks for the same gender structures could provide new insights into young children's working knowledge, and adults' end-state knowledge of the Welsh gender system. Further investigation is required to assess children's awareness of forms, and how this awareness could be tested under experimental conditions. In addition, developing tasks appropriate for eye-tracking, EEG or fMRI experiments could allow access to information regarding the neural correlates of children's and adults' knowledge of the Welsh gender system.

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Appendices

Appendix 1

Background Questionnaire (English and Welsh alternating pages)

If you consent for your child to participate in this study, please provide the following information:

Questionnaire

Child's Name: _____

1. Is your child: Male Female ?

2. Child's birthday: _____

3. Child's age: _____

4. Child's place of birth: _____

Has your child always resided in North Wales?

Yes

No

If your child was born outside of North Wales, or spent some time living outside the area, where did s/he live, and at what age did s/he come to North Wales?

Languages spoken by the child:

5. Child speaks:

Welsh S/he began speaking Welsh at age: _____

At present, s/he speaks Welsh approximately _____% of the time

English S/he began speaking English at age: _____

At present, s/he speaks English approximately _____% of the time

Other language(s): _____ S/he began speaking this language at
age: _____

At present, s/he speaks _____ approximately _____% of the time

Os ydych yn caniatáu i'ch plentyn gymryd rhan yn yr astudiaeth yma, byddwn yn ddiolchgar iawn petaech yn cyflwyno'r wybodaeth ganlynol os gwelwch yn dda:

Holiadur

Enw'r plentyn: _____

1. A yw eich plentyn yn: wryw fenyw ?

2. Dyddiad geni'r plentyn: _____

3. Oed y plentyn: _____

4. Lle ganwyd y plentyn: _____

A yw eich plentyn wedi byw yng Ngogledd Cymru drwy'r amser?

- Ydyw
 Nac ydyw

Os ganed eich plentyn y tu allan i Ogledd Cymru, neu os ydyw wedi treulio peth amser yn byw mewn ardal arall, nodwch ymhle oedd hynny, a beth oedd ei (h)oed pan ddaeth i Ogledd Cymru?

leithoedd y mae'r plentyn yn eu siarad:

5. Mae'r plentyn yn siarad (ticiwch bob un sy'n berthnasol) :

Cymraeg Dechreuodd siarad Cymraeg yn: _____ oed

Ar hyn o bryd mae'n siarad Cymraeg tua _____% o'r amser

Saesneg Dechreuodd siarad Saesneg yn: _____ oed

Ar hyn o bryd mae'n siarad Saesneg tua _____% o'r amser

Iaith/Ieithoedd eraill (nodwch): _____ Dechreuodd siarad yr
iaith
yma yn
: _____
oed

Ar hyn o bryd mae'n siarad _____ tua _____% o'r amser

6. Child speaks: Welsh everyday
 English everyday

7. Languages spoken **by** the child to the mother:

- Virtually 100% Welsh
 About 80% Welsh, 20% English
 About 60% Welsh, 40% English
 About 50% Welsh, 50% English
 About 40% Welsh, 60% English
 About 20% Welsh, 80% English
 Virtually 100% English
 Other languages. Please specify: _____

8. Languages spoken **by** the child to the father:

- Virtually 100% Welsh
 About 80% Welsh, 20% English
 About 60% Welsh, 40% English
 About 50% Welsh, 50% English
 About 40% Welsh, 60% English
 About 20% Welsh, 80% English
 Virtually 100% English
 Other languages. Please specify: _____

Languages spoken to the child:

9. Languages spoken by the mother and father to the child in the home **from birth until two years of age:**

- Virtually 100% Welsh
 About 80% Welsh, 20% English
 About 60% Welsh, 40% English
 About 50% Welsh, 50% English
 About 40% Welsh, 60% English
 About 20% Welsh, 80% English
 Virtually 100% English
 Other languages. Please specify: _____

10. Languages spoken by the mother and father to the child in the home **from two to four years of age:**

- Virtually 100% Welsh
 About 80% Welsh, 20% English
 About 60% Welsh, 40% English
 About 50% Welsh, 50% English
 About 40% Welsh, 60% English
 About 20% Welsh, 80% English
 Virtually 100% English
 Other languages. Please specify: _____

6. Mae eich plentyn yn siarad: Cymraeg pob diwrnod
 Saesneg pob diwrnod

7. Ieithoedd y mae'r plentyn yn eu siarad **gyda'r fam**:

- Bron 100% Cymraeg
- Tua 80% Cymraeg, 20% Saesneg
- Tua 60% Cymraeg, 40% Saesneg
- Tua 50% Cymraeg, 50% Saesneg
- Tua 40% Cymraeg, 60% Saesne
- Tua 20% Cymraeg, 80% Saesneg
- Bron 100% Saesneg
- Ieithoedd eraill. Nodwch: _____

8. Ieithoedd y mae'r plentyn yn eu siarad gyda'r **tad**:

- Bron 100% Cymraeg
- Tua 80% Cymraeg, 20% Saesneg
- Tua 60% Cymraeg, 40% Saesneg
- Tua 50% Cymraeg, 50% Saesneg
- Tua 40% Cymraeg, 60% Saesneg
- Tua 20% Cymraeg, 80% Saesneg
- Bron 100% Saesneg
- Ieithoedd eraill. Nodwch: _____

Ieithoedd sy'n cael eu siarad wrth y plentyn:

9. Iaith/ieithoedd a siaredir gan rieni/gwarcheidwaid wrth y plentyn yn y cartref o **enedigaeth hyd at ddwyflwydd oed**:

- Bron 100% Cymraeg
- Tua 80% Cymraeg, 20% Saesneg
- Tua 60% Cymraeg, 40% Saesneg
- Tua 50% Cymraeg, 50% Saesneg
- Tua 40% Cymraeg, 60% Saesneg
- Tua 20% Cymraeg, 80% Saesneg
- Bron 100% Saesneg
- Ieithoedd eraill. Nodwch: _____

10. Iaith/ieithoedd a siaredir gan rieni/gwarcheidwaid wrth y plentyn yn y cartref o **ddwyflwydd oed hyd at bedair oed**:

- Bron 100% Cymraeg
- Tua 80% Cymraeg, 20% Saesneg
- Tua 60% Cymraeg, 40% Saesneg
- Tua 50% Cymraeg, 50% Saesneg
- Tua 40% Cymraeg, 60% Saesneg
- Tua 20% Cymraeg, 80% Saesneg
- Bron 100% Saesneg
- Ieithoedd eraill. Nodwch: _____

11. Languages spoken by the mother and father to the child in the home from **four to six years of age:**

- Virtually 100% Welsh
- About 80% Welsh, 20% English
- About 60% Welsh, 40% English
- About 50% Welsh, 50% English
- About 40% Welsh, 60% English
- About 20% Welsh, 80% English
- Virtually 100% English
- Other languages. Please specify: _____

12. Languages spoken to the child by the mother:

- Virtually 100% Welsh
- About 80% Welsh, 20% English
- About 60% Welsh, 40% English
- About 50% Welsh, 50% English
- About 40% Welsh, 60% English
- About 20% Welsh, 80% English
- Virtually 100% English
- Other languages. Please specify: _____

13. Languages spoken to the child by the father:

- Virtually 100% Welsh
- About 80% Welsh, 20% English
- About 60% Welsh, 40% English
- About 50% Welsh, 50% English
- About 40% Welsh, 60% English
- About 20% Welsh, 80% English
- Virtually 100% English
- Other languages. Please specify: _____

14. Languages spoken to the child by younger siblings:

- Virtually 100% Welsh
- About 80% Welsh, 20% English
- About 60% Welsh, 40% English
- About 50% Welsh, 50% English
- About 40% Welsh, 60% English
- About 20% Welsh, 80% English
- Virtually 100% English
- Other languages. Please specify: _____

11. Iaith/ieithoedd a siaredir gan rieni/gwarcheidwaid wrth y plentyn yn y cartref o **bedair oed hyd at chwech oed**:

- Bron 100% Cymraeg
- Tua 80% Cymraeg, 20% Saesneg
- Tua 60% Cymraeg, 40% Saesneg
- Tua 50% Cymraeg, 50% Saesneg
- Tua 40% Cymraeg, 60% Saesneg
- Tua 20% Cymraeg, 80% Saesneg
- Bron 100% Saesneg
- Ieithoedd eraill. Nodwch: _____

12. Iaith/ieithoedd y mae'r **fam** yn siarad efo'r plentyn ar hyn o bryd:

- Bron 100% Cymraeg
- Tua 80% Cymraeg, 20% Saesneg
- Tua 60% Cymraeg, 40% Saesneg
- Tua 50% Cymraeg, 50% Saesneg
- Tua 40% Cymraeg, 60% Saesneg
- Tua 20% Cymraeg, 80% Saesneg
- Bron 100% Saesneg
- Ieithoedd eraill. Nodwch: _____

13. Iaith/ieithoedd y **mae'r tad** yn siarad efo'r plentyn ar hyn o bryd:

- Bron 100% Cymraeg
- Tua 80% Cymraeg, 20% Saesneg
- Tua 60% Cymraeg, 40% Saesneg
- Tua 50% Cymraeg, 50% Saesneg
- Tua 40% Cymraeg, 60% Saesneg
- Tua 20% Cymraeg, 80% Saesneg
- Bron 100% Saesneg
- Ieithoedd eraill. Nodwch: _____

14. Iaith/ieithoedd y mae brodyr a chwiorydd **iau** yn siarad efo'r plentyn:

- Bron 100% Cymraeg
- Tua 80% Cymraeg, 20% Saesneg
- Tua 60% Cymraeg, 40% Saesneg
- Tua 50% Cymraeg, 50% Saesneg
- Tua 40% Cymraeg, 60% Saesneg
- Tua 20% Cymraeg, 80% Saesneg
- Bron 100% Saesneg
- Ieithoedd eraill. Nodwch: _____
- Dim yn berthnasol

15. Languages spoken to the child by older siblings:

- Virtually 100% Welsh
- About 80% Welsh, 20% English
- About 60% Welsh, 40% English
- About 50% Welsh, 50% English
- About 40% Welsh, 60% English
- About 20% Welsh, 80% English
- Virtually 100% English
- Other languages. Please specify: _____

16. Are there any other significant adults (grandparents, aunts, uncles...) with whom your child has frequent contact?

- Yes
- No

If yes, please specify their relation to your child: _____

What language(s) do they speak to your child?

- Virtually 100% Welsh
- About 80% Welsh, 20% English
- About 60% Welsh, 40% English
- About 50% Welsh, 50% English
- About 40% Welsh, 60% English
- About 20% Welsh, 80% English
- Virtually 100% English
- Other languages. Please specify: _____

Education and hobbies:

17. Has your child ever attended any school other than the one s/he is attending at present? Please indicate:

Which school(s): _____

When: _____

Language of instruction:

- Virtually 100% Welsh
- About 80% Welsh, 20% English
- About 60% Welsh, 40% English
- About 50% Welsh, 50% English
- About 40% Welsh, 60% English
- About 20% Welsh, 80% English

- Virtually 100% English
 Other languages. Please specify: _____

15. Iaith/ieithoedd y mae brodyr a chwiorydd **hŷn** yn siarad efo'r plentyn:

- Bron 100% Cymraeg
 Tua 80% Cymraeg, 20% Saesneg
 Tua 60% Cymraeg, 40% Saesneg
 Tua 50% Cymraeg, 50% Saesneg
 Tua 40% Cymraeg, 60% Saesneg
 Tua 20% Cymraeg, 80% Saesneg
 Bron 100% Saesneg
 Ieithoedd eraill. Nodwch: _____
 Dim yn berthnasol

16. A oes unrhwy oedolion eraill arwyddocaol (nain, taid, modryb, ewythr ayyb...) y mae'r plentyn mewn cysylltiad aml â hwy?

- Oes
 Nag oes

Os oes, nodwch eu perthynas gyda'r plentyn: _____

Pa iaith/ieithoedd y maen nhw'n eu siarad gyda'r plentyn?

- Bron 100% Cymraeg
 Tua 80% Cymraeg, 20% Saesneg
 Tua 60% Cymraeg, 40% Saesneg
 Tua 50% Cymraeg, 50% Saesneg
 Tua 40% Cymraeg, 60% Saesneg
 Tua 20% Cymraeg, 80% Saesneg
 Bron 100% Saesneg
 Ieithoedd eraill. Nodwch: _____

Addysg a hobiau

17. A yw eich plentyn erioed wedi mynd i unrhyw ysgol heblaw'r un y mae'n mynd iddi ar hyn o bryd? Os ydyw, nodwch pa ysgol(ion) a phryd os gwelwch yn dda:

Pa ysgol(ion): _____

Pryd: _____

Iaith y hyfforddiant:

- Bron 100% Cymraeg
 Tua 80% Cymraeg, 20% Saesneg
 Tua 60% Cymraeg, 40% Saesneg
 Tua 50% Cymraeg, 50% Saesneg

- Tua 40% Cymraeg, 60% Saesneg
- Tua 20% Cymraeg, 80% Saesneg
- Bron 100% Saesneg
- Ieithoedd eraill. Nodwch: _____

18. What is the normal **language of instruction** in your child's **school**?

- Virtually 100% Welsh
- About 80% Welsh, 20% English
- About 60% Welsh, 40% English
- About 50% Welsh, 50% English
- About 40% Welsh, 60% English
- About 20% Welsh, 80% English
- Virtually 100% English
- Other languages. Please specify: _____

19. What **language(s)** does your child speak **outside the school**?

- Virtually 100% Welsh
- About 80% Welsh, 20% English
- About 60% Welsh, 40% English
- About 50% Welsh, 50% English
- About 40% Welsh, 60% English
- About 20% Welsh, 80% English
- Virtually 100% English
- Other languages. Please specify: _____

20. Overall, what **language(s)** does your child speak with his or her friends at school?

- Virtually 100% Welsh
- About 80% Welsh, 20% English
- About 60% Welsh, 40% English
- About 50% Welsh, 50% English
- About 40% Welsh, 60% English
- About 20% Welsh, 80% English
- Virtually 100% English
- Other languages. Please specify: _____

21. Overall, what **language(s)** does your child speak with his or her friends outside the school?

- Virtually 100% Welsh
- About 80% Welsh, 20% English
- About 60% Welsh, 40% English
- About 50% Welsh, 50% English
- About 40% Welsh, 60% English
- About 20% Welsh, 80% English

- Virtually 100% English
 Other languages. Please specify: _____

18. Beth yw'r iaith hyfforddiant arferol yn ysgol bresennol eich plentyn?

- Bron 100% Cymraeg
 Tua 80% Cymraeg, 20% Saesneg
 Tua 60% Cymraeg, 40% Saesneg
 Tua 50% Cymraeg, 50% Saesneg
 Tua 40% Cymraeg, 60% Saesneg
 Tua 20% Cymraeg, 80% Saesneg
 Bron 100% Saesneg
 Ieithoedd eraill. Nodwch: _____

19. Pa **iaith/ieithoedd** mae eich plentyn yn siarad y **tu allan i'r ysgol**?

- Bron 100% Cymraeg
 Tua 80% Cymraeg, 20% Saesneg
 Tua 60% Cymraeg, 40% Saesneg
 Tua 50% Cymraeg, 50% Saesneg
 Tua 40% Cymraeg, 60% Saesneg
 Tua 20% Cymraeg, 80% Saesneg
 Bron 100% Saesneg
 Ieithoedd eraill. Nodwch: _____

20. Ar y cyfan, pa **iaith/ieithoedd** mae eich plentyn yn siarad gyda'i ffrindiau yn yr ysgol?

- Bron 100% Cymraeg
 Tua 80% Cymraeg, 20% Saesneg
 Tua 60% Cymraeg, 40% Saesneg
 Tua 50% Cymraeg, 50% Saesneg
 Tua 40% Cymraeg, 60% Saesneg
 Tua 20% Cymraeg, 80% Saesneg
 Bron 100% Saesneg
 Ieithoedd eraill. Nodwch: _____

21. Ar y cyfan, pa **iaith/ieithoedd** mae eich plentyn yn siarad gyda'i ffrindiau y tu allan i'r ysgol?

- Bron 100% Cymraeg
 Tua 80% Cymraeg, 20% Saesneg
 Tua 60% Cymraeg, 40% Saesneg
 Tua 50% Cymraeg, 50% Saesneg

- Tua 40% Cymraeg, 60% Saesneg
- Tua 20% Cymraeg, 80% Saesneg
- Bron 100% Saesneg
- Ieithoedd eraill. Nodwch: _____

22. What types of activities does your child participate in **outside of regular school activities**? Please tick all that apply:

A. Yr Urdd: _____

Average hours per week:

- Less than 1 hour
- 1 to 2 hours
- 2 to 5 hours
- Over 5 hours

B. Competes in local or national Eisteddfodau: _____

C. Cubs/Scouts or Brownies/Girl Guides:

- In Welsh mostly
- In English mostly
- In Welsh and English about equally

D. Sports activities (e.g., tennis, football, rugby, etc.):

- In Welsh mostly
- In English mostly
- In Welsh and English about equally

E. Other (please specify):

-
- In Welsh mostly
 - In English mostly
 - In Welsh and English about equally

Views on education and languages:

23. How important is it to you that your child pass his/her GCSE's?

- Extremely important
- Very important
- Somewhat important
- Not important

24. How important is it to you that your child do well on A-level exams?

- Extremely important
- Very important
- Somewhat important
- Not important

22. Pa fath o weithgareddau y mae eich plentyn yn cymryd rhan ynddynt y tu allan i weithgareddau arferol yr ysgol? Ticiwch pob un sy'n berthnasol os gwelwch yn dda:

A. Yr Urdd: _____

Oriau yr wythnos ar gyfartaledd:

- Llai nag 1 awr
- 1 i 2 awr
- 2 i 5 awr
- Dros 5 awr

B. Cystadlu mewn Eisteddfodau lleol neu genedlaethol: Ydi Nac ydi

C. Cybiaid/Sgowtiaid neu Brownies/Geidiau:

- Cymraeg rhan fwyaf
- Saesneg rhan fwyaf
- Cymraeg a Saesneg yn gyfartal

D. Chwaraeon (e.e., tenis, pê-droes, rygbi, ayyb.):

- Cymraeg rhan fwyaf
- Saesneg rhan fwyaf
- Cymraeg a Saesneg yn gyfartal

E. Eraill (nodwch yma):

-
- Cymraeg rhan fwyaf
 - Saesneg rhan fwyaf
 - Cymraeg a Saesneg yn gyfartal

Barn am addysg ac ieithoedd:

23. Pa mor bwysig ydyw i chi fod eich plentyn yn pasio ei arholiau TGAU?

- Hynod bwysig
- Pwysig iawn
- Gweddol bwysig

Ddim yn bwysig

24. Pa mor bwysig ydyw i chi fod eich plentyn gwneud yn dda mewn arholiadau lefel A?

- Hynod bwysig
- Pwysig iawn
- Gweddol bwysig
- Ddim yn bwysig

25. How important is it to you that your child attend university?

- Extremely important
- Very important
- Somewhat important
- Not important

26. How important is it to you that your child obtain a further degree after university?

- Extremely important
- Very important
- Somewhat important
- Not important

27. How likely is it that your child will pass his/her GCSE's?

- Extremely important
- Very important
- Somewhat important
- Not important

28. How likely is it that your child will do well on A-level exams?

- Extremely important
- Very important
- Somewhat important
- Not important

29. How likely is it that your child will attend university?

- Extremely important
- Very important
- Somewhat important
- Not important

30. How likely is it that your child will obtain a further degree after university?

- Extremely important
- Very important
- Somewhat important
- Not important

25. Pa mor bwysig ydyw i chi fod eich plentyn yn mynd i brifysgol?

- Hynod bwysig
- Pwysig iawn
- Gweddol bwysig
- Ddim yn bwysig

26. Pa mor bwysig ydyw i chi fod eich plentyn yn cael gradd bellach ar ôl prifysgol?

- Hynod bwysig
- Pwysig iawn
- Gweddol bwysig
- Ddim yn bwysig

27. Yn eich barn chi pa mor debygol ydyw y bydd eich plentyn yn pasio ei arholiadau TGAU?

- Hynod debygol
- Tebygol iawn
- Gweddol debygol
- Ddim yn debygol

28. Yn eich barn chi pa mor debygol ydyw y bydd eich plentyn yn gwneud yn dda mewn arholiadau lefel A?

- Hynod debygol
- Tebygol iawn
- Gweddol debygol
- Ddim yn debygol

29. Yn eich barn chi pa mor debygol ydyw y bydd eich plentyn yn mynd i brifysgol?

- Hynod debygol
- Tebygol iawn

- Gweddol debygol
- Ddim yn debygol

30. Yn eich barn chi pa mor debygol ydyw y bydd eich plentyn yn cael gradd bellach ar ôl prifysgol?

- Hynod debygol
- Tebygol iawn
- Gweddol debygol
- Ddim yn debygol

31. How important is it to you that your child know **Welsh**?

- Extremely important
- Very important
- Somewhat important
- Not important

32. How important is it to you that your child know **English**?

- Extremely important
- Very important
- Somewhat important
- Not important

33. How important is it for your child's future job prospects that s/he know **Welsh**?

- Extremely important
- Very important
- Somewhat important
- Not important

34. How important is it for your child's future job prospects that s/he know **English**?

- Extremely important
- Very important
- Somewhat important
- Not important

General information

35.

Please indicate the highest level of education completed by the child's mother :	For each school level, please indicate the language of instruction : (A) Primarily through the medium of Welsh (B) Partially through the medium of Welsh (C) Entirely in English (D) Other. Please specify: _____
<input type="checkbox"/> Primary education: <input type="checkbox"/> Secondary education: <input type="checkbox"/> University or college education: <input type="checkbox"/> Post-graduate education: <input type="checkbox"/> Other:	_____ _____ _____ _____ _____

31. Pa mor bwysig ydyw i chi yn gyffredinol fod eich plentyn yn siarad **Cymraeg**?

- Hynod bwysig
 Pwysig iawn
 Gweddol bwysig
 Ddim yn bwysig

32. Pa mor bwysig ydyw i chi yn gyffredinol fod eich plentyn yn siarad **Saesneg**?

- Hynod bwysig
 Pwysig iawn
 Gweddol bwysig
 Ddim yn bwysig

33. Yn eich barn chi pa mor bwysig yw bod yn siarad **Cymraeg** ar gyfer cyfleoedd swyddi ar gyfer eich plentyn yn y dyfodol?

- Hynod bwysig
 Pwysig iawn
 Gweddol bwysig
 Ddim yn bwysig

34. Yn eich barn chi pa mor bwysig yw bod yn siarad **Saesneg** ar gyfer cyfleoedd swyddi ar gyfer eich plentyn yn y dyfodol?

- Hynod bwysig
 Pwysig iawn
 Gweddol bwysig
 Ddim yn bwysig

Gwybodaeth gyffredinol

35.

Nodwch y lefel uchaf o addysg a gwblhawyd gan y fam os gwelwch yn dda:	Ar gyfer pob lefel addysg nodwch ym mha gyfrwng y cafodd ei dysgu: (A) Yn bennaf trwy gyfrwng y Gymraeg (B) yn rhannol trwy gyfrwng y Gymraeg (C) Yn gyfan gwbl yn Saesneg (D) Arall. Nodwch yma:
<input type="checkbox"/> Addysg Cynradd: <input type="checkbox"/> Addysg Uwchradd: <input type="checkbox"/> Prifysgol neu Coleg: <input type="checkbox"/> Ol-radd: <input type="checkbox"/> Arall:	_____ _____ _____ _____ _____

36.

Please indicate the highest level of education completed by the child's father :	For each school level, please indicate the language of instruction : (A) Primarily through the medium of Welsh (B) Partially through the medium of Welsh (C) Entirely in English (D) Other. Please specify: _____
<input type="checkbox"/> Primary education: <input type="checkbox"/> Secondary education: <input type="checkbox"/> University or college education: <input type="checkbox"/> Post-graduate education: <input type="checkbox"/> Other:	_____ _____ _____ _____ _____

37. What is the child's **mother's** current occupation? _____38. What is the child's **father's** current occupation? _____

39. Do you rent or own your current residence?

- Rent
 Own

40. How many persons over the age of 21 are currently part of your household (include yourself and your spouse)?

1 ___ 2 ___ 3 ___ 4 ___ more ___

List relationship(s) to the child:

41. How many children under the age of 21 (including this child) currently live with you?

1 ___ 2 ___ 3 ___ 4 ___ more ___

List ages at last birthday: _____

42. Has your child ever undergone speech or language therapy?

Yes

No

36.

Nodwch y lefel uchaf o addysg a gwblhawyd gan y tad os gwelwch yn dda:	Ar gyfer pob lefel addysg nodwch ym mha gyfrwng y cafodd ei dysgu: (A) Yn bennaf trwy gyfrwng y Gymraeg (B) yn rhannol trwy gyfrwng y Gymraeg (C) Yn gyfan gwbl yn Saesneg (D) Arall. Nodwch yma:
<input type="checkbox"/> Addysg Cynradd: <input type="checkbox"/> Addysg Uwchradd: <input type="checkbox"/> Prifysgol neu Goleg: <input type="checkbox"/> Ôl-radd: <input type="checkbox"/> Arall:	_____ _____ _____ _____ _____

37. Beth yw gwaith presennol **y fam**? _____38. Beth yw gwaith presennol **y tad**? _____

39. A ydych yn rhentu neu'n berchen ar eich cartref presennol?

- Rhentu
 Perchen

40. Faint o bobl dros 21 oed sy'n byw yn eich cartref ar hyn o bryd (yn cynnwys chi a'chymar)?

1 ___ 2 ___ 3 ___ 4 ___ mwy ___

Rhestrwch berthynas(au) yr unigolion gyda'r plentyn:

41. Faint o blant dan 21 oed (yn cynnwys y plentyn dan sylw) sy'n byw gyda chi ar hyn o bryd?

1 ___ 2 ___ 3 ___ 4 ___ mwy ___

Rhestrwch eu hoedrannau pan yn derbyn eu plenblwydd diweddaraf:

42. A yw eich plentyn erioed wedi derbyn therapi iaith neu leferydd?

- Do
 Naddo

43. Has your child ever been treated for a hearing problem?

Yes

No

44. Has your child ever been treated for a vision problem?

Yes

No

Thank you very much for your time and co-operation

43. A yw eich plentyn erioed wedi cael triniaeth am broblem clyw?

- Do
 Naddo

44. A yw eich plentyn erioed wedi cael triniaeth am broblem golwg?

- Do
 Naddo

*Diolch yn fawr iawn am eich amser ac am eich
cydweithrediad*

Appendix 2

Bilingual Consent Form

Annwyl Riant / Gwarcheidwad

Eleni byddwn yn cynnal astudiaeth yn ysgol eich plentyn sy'n ymwneud â'r iaith Gymraeg. Bydd yr astudiaeth bresennol yn cael ei chynnal gan dîm o ymchwilyr dan oruchwyliaeth Yr Athro V.C. Gathercole o'r Ganolfan ESRC dros ymchwil i Ddwyieithrwydd ym Mhrifysgol Bangor.

Mae'r astudiaeth yma yn sail ar gyfer prosiect ymchwil ryngwladol. Nod yr astudiaeth yw ymchwilio arferion trosglwyddo iaith ar draws dwy iaith siaradwyr dwyieithiog. Gwneir hyn trwy gymharu siaradwyr sy'n ddywieithiog mewn gwahanol barau o ieithoedd – sef Cymraeg-Saesneg yma yng Nghymru, Cymraeg-Sbaeneg ym Mhatagonia a Sbaeneg-Saesneg yn Miami. Trwy gymharu'r parau hyn, gallwn weld, er enghraifft os yw trosglwyddo'n fwy tebygol pan mae dwy iaith yn rhannu strwythurau tebyg yn hytrach na phan mae'r ddwy iaith yn wahanol iawn i'w gilydd.

Bydd yr astudiaeth yma yn archwilio perfformiad plant ar sawl tasg iaith. Mewn un dasg bydd ymchwilydd yn gofyn i blant ymateb ar lafar i nifer o luniau o anifeiliaid, pobl ac eitemau cyffredin (teledu, cwmwl, blodyn, ayyb). Mewn achosion eraill bydd angen i blant ddewis llun y maent yn meddwl sy'n disgrifio orau y frawddeg y maent yn ei clywed. Bydd y tasgau yma yn cael eu cynnal ar sail un-i-un gyda'r ymchwilydd. Bydd y tasgau yn syml, diddorol, ac ni fyddant yn gystadleuol. Er enghraifft, gofynnir i'r plentyn edrych ar lun o lygoden binc a gofyn iddo/iddi ei disgrifio.

Rydym yn gofyn am eich caniatâd i'ch plentyn gymryd rhan yn yr astudiaeth hon. Os ydych yn rhoi eich caniatâd, byddwn yn gwahodd eich plentyn i gymryd rhan. Ni fydd eich plentyn yn cael ei (g)orfodi i gymryd rhan, ac os ydyw'n dymuno gadael unrhyw bryd, bydd ef/hi yn rhydd i wneud hynny.

Byddwn yn ymrannu'r tasgau dros 3 neu 4 sesiwn er mwyn er mwyn cadw'r sesiynau yn fyr ac yn hwyliog i'r plant. Byddwn yn gweld y plant yn yr ysgol. Bydd cyfrinachedd yn cael ei barchu drwy gydol yr astudiaeth – ni fydd enwau'n cael eu rhoi ynghlwm wrth y data, ac ni fydd dim yn yr un adroddiad yn datgelu pwy ydych chi na'ch plentyn.

Yn ogystal, os caniatewch i'ch plentyn gymryd rhan, byddwn yn gofyn ichi lenwi holiadur ynglŷn â chefnidir iaith eich plentyn. Mae hyn er mwyn i ni allu adnabod pa iaith/ieithoedd mae eich plentyn yn eu defnyddio o ddydd i ddydd.

Ar ôl cwblhau'r astudiaeth, gallwn drefnu bod crynodeb byr o'r canfyddiadau ar gael ichi. Os hoffech i ni anfon y crynodeb hwn atoch, byddem yn ddiolchgar pe byddech yn gallu rhoi eich cyfeiriad isod.

Diolch ymlaen llaw am ganiatâu i'ch plentyn gymryd rhan yn yr astudiaeth hon. Os oes arnoch angen rhagor o wybodaeth, naill ai yn y cam hwn neu yn ystod unrhyw gam o'r astudiaeth, mae pob croeso ichi gysylltu â'r Athro Gathercole ar 01248 382624 neu'r Dr Enlli Thomas ar 01248 383962. Os oes gennych unrhyw gwynion yn ystod yr astudiaeth, a fyddech cystal â chyfeirio'r rhain at Dr Oliver Turnbull, Pennaeth yr Ysgol, Ysgol Seicoleg, Prifysgol Cymru, Bangor, Gwynedd, LL57 2DG.

Diolch unwaith eto. Edrychwn ymlaen at eich ymateb.

Yn gywir,



Yr Athro Virginia C. Mueller Gathercole
Dr Enlli Thomas

Llenwch y ffurflen yn y modd priodol a'i dychwelyd cyn gynted ag y bo modd i'r ysgol (neu i'r cyfeiriad uchod).

Enw'r Plentyn: _____ Dyddiad geni: _____

Enw'r Rhiant / Gwarcheidwad: _____

Rhif Ffôn: _____

Cyfeiriad (heb fod yn orfodol): _____

- Rwyf yn rhoi caniatâd i'm plentyn gymryd rhan yn yr astudiaeth
- Nid wyf yn rhoi caniatâd i'm plentyn gymryd rhan yn yr astudiaeth

Llofnod y Rhiant / Gwarcheidwad: _____ Dyddiad: _____

Gawn ni gysylltu â chi eto yn y dyfodol i ofyn am eich cyfraniad posib i ymchwil pellach ar y materion hyn?

Cewch ____ Na chewch ____

Dear Parent / Guardian

We are writing to inform you of a study on bilingualism that is being conducted by a team of researchers under the supervision of Prof. V.C. Gathercole from the ESRC Centre for Research on Bilingualism at Bangor University.

This study is part of a large-scale international project. Its aim is to investigate potential language transfer across a bilingual's two languages by comparing speakers with different pairs of languages - namely Spanish-Welsh bilinguals in Patagonia, Welsh-English bilinguals in Wales, and Spanish-English bilinguals in Miami, so that we can identify, e.g., if transfer is more likely when two languages share similar structures that when they do not.

The current study will assess children's performance on several language tasks. In one task children will be asked to produce simple sentences in response to pictures of animals, people and everyday objects (television, cloud, flower, etc). In other cases children will be required to select a picture that they think best describes a sentence they hear. The tasks your child will be engaged in (on a one-to-one basis with the researcher), will be simple, interesting and non-competitive. For example, the child will see a picture of a pink mouse and will be asked to describe it.

We are requesting your permission for your child to participate in this study. If you grant your permission, we will invite your child to participate in the study. Your child will not be forced into participating, and if at any stage he or she wishes to withdraw, he or she will be free to do so.

The tasks will be divided in their distribution across 3 or 4 separate sessions in order to keep sessions short, entertaining and fun for the children. Children will be seen at the school. Confidentiality will be respected throughout the study – no names will be attached to the data, and all reports will respect both yours and your child's anonymity.

Also if you give permission for your child to participate, we would ask that you complete the follow-up questionnaire concerning your child's language background. This is to determine which language(s) your child uses on a daily basis.

After the completion of the study, we can make available to you a short summary of the findings. If you would like us to send you this summary, we would appreciate it if you could supply your address below.

Thank you in advance for allowing your child to participate in this study. If you should have any need for further information, either at this stage or at any stage during the course of the study, please feel free to contact Professor Gathercole at 01248 382624 or Dr Thomas at 01248 383962. If you should have any complaints during the course of the study, please direct these to Dr Oliver Turnbull, Head of School, School of Psychology, University of Wales, Bangor, Gwynedd, LL57 2AS.

Thank you once again. We look forward to your response.

Yours sincerely,



Prof. Virginia C. Mueller Gathercole
Dr. Enlli Thomas (Lecturer in Education)
Bangor University

Please complete this slip as appropriate and return as soon as possible to the school or to the address shown above.

Child's name: _____

Date of birth: _____

Parent's / Guardian's name: _____
Telephone number: _____
Address (optional): _____

- I consent for my child to participate in the study
- I do not consent for my child to participate in the study

Parent's / Guardian's signature: _____ Date: ____

May we contact you at a later date for possible participation in further research on these issues?
Yes___ No___

Appendix 3

Noun and Adjective Task – Task Instructions + Pre-Task Instructions

General Information

Cues – word forms

Masculine word endings: -wr and -yn

Feminine word endings: -es or -en

Cues – mutations

Masculine words do not mutate – absence of mutation serves as cue

Feminine words:

Soft mutation of **both** noun and adjective after *Dyma'r* 'Here is the' (2 cues)

SM of adjective **only** after *Dyma lun* 'Here is a picture of' (1 cue)

No mutation of noun or adjective after *Dyma lun* 'Here is a picture of' when the adjective has a non-mutable onset, (e.g. any vowel), (0 cues)

Practice Items:

2 cue example – Mutation of noun and adjective

Rwan dwi am ddangos lluniau i ti ar y cyfrifiadur, oce?

'Now I am going to show you some pictures on the computer screen, OK?'

Basic form of cue stimulus – *pel coch*

Wnai ddeud wrtho ti beth ydi'r llun cyntaf. Felly am yr un yma, (yn son am llun o pel goch) wnai ddweud, "Dyma'r bel goch"

'I will tell you what the first picture is, so for this one (referring to example picture of a red ball) I will say, "Here's the red ball."

Basic form of target stimulus – *tylluan glas*

Wedyn, wnai ofyn i ti ddweud beth sydd yn y llun nesaf. Felly, am y llun yma (yn son am llun o dylluan las) fyddet ti yn dweud, “Dyma’r dylluan las”

Then, I’ll ask you to say what’s in the next picture. So, for this picture (referring to picture of a blue owl) you will say, “Here’s the blue owl”

Prif dasg – Main task

Rwan wnawn ni chwarae’r gem go wir! Wnawn ni chwarae y ffordd ryda ni newydd wneud efo pob llun oce? Yr unig beth rhaid i ti wneud ydi dweud wrthaf beth ydi’r peth yn y llun pan dwin gofyn, iawn?

“Now we can start the game for real. So we will do it the way we have just done it for each picture. All you have to do is tell me what the picture is when I ask you, OK?”

Felly, pan mae’r llun nesaf yn dod rwyf ti am ddweud be sydd yna. Felly am y llun yma (yn son am llun o ty glas) rwyf ti am ddweud “Dyma’r ty glas”.

So, when the next picture comes up you’re going to say what’s there. So, for this picture, (referring to a picture of a blue house) you are going to say “Here’s the blue house (m.).”

Pre-Task

If a participant struggled to name an image, the experimenter described the image using careful language, i.e. making sure that there is no use of words that can be indicative of gender such as *hwn/hon*, (‘this’ - m/f) *o/hi* (‘him/her’), etc.

Example

Child says: *Dwi ddim yn gwybod beth ydi’r enw am y llun yma* - ‘I don’t know what the name for this word is.’

Experimenter asks: *Beth wyt ti'n feddwl mae'r peth yn y llun yma yn gwneud fel arfer?* – What do you think that the thing in this picture normally does?

Child says: *Mae o'n hedfan* – 'It flies'

Experimenter says: *Sut fath o bethau sydd yn hedfan?* - 'So what sort of things fly?'

Child says: *Adar* – 'Birds'

Experimenter says: *Da iawn. A ydi'r llun yma yn llun o aderyn?* – Very good. And is this picture a picture of a bird?

Child says: *Yndi/Ydi* – 'Yes it is'

Experimenter says: *A beth mae'r math yma o aderyn yn gwneud?* – 'And what does this sort of bird do?'

Child says: *Mae o'n cysgu yn y dydd ac yn ddeffro yn y nos.* – It sleeps in the day and is awake at night.

Experimenter says: *Ydi wir. Felly wyt tin cofio beth ydi enw'r aderyn yma rwan?* – 'Yes indeed. So, do you remember what this kind of bird is called now?'

Child says: *ummmm....tylluan!* – 'Uuummm – an owl!'

Experimenter says: *Da iawn chdi!!* – Well done you!!

Appendix 4

Noun and Adjective Task – Randomisations

No.	TASK RANDOMISATIONS		TASK 1		NUMERAL TASK	
	ORIGINAL ORDER	RAND 1	RAND 2	RAND 3	RAND 4	RAND 5
1	101	108	602	402	107	407
2	102	302	501	508	404	201
3	103	503	201	306	301	508
4	104	402	307	407	305	303
5	105	602	408	102	402	107
6	106	606	107	506	306	603
7	107	205	102	104	304	402
8	108	207	601	608	501	505
9	201	204	302	408	605	207
10	202	406	504	403	102	608
11	203	306	205	101	505	302
12	204	505	202	603	506	504
13	205	308	605	505	401	404
14	206	304	204	604	603	101
15	207	408	402	106	405	108
16	208	106	505	201	607	306
17	301	508	607	205	308	506
18	302	102	206	107	105	507
19	303	301	604	502	503	308
20	304	104	208	204	608	301
21	305	203	405	302	207	403
22	306	206	103	105	101	305
23	307	501	108	503	606	502
24	308	506	304	504	601	605
25	401	401	401	301	204	401
26	402	407	301	202	202	607
27	403	607	404	404	208	204
28	404	201	403	601	508	601
29	405	504	406	208	604	205
30	406	101	105	607	203	405
31	407	305	506	308	103	203
32	408	303	101	206	106	104
33	501	404	508	203	302	102
34	502	502	203	606	201	103
35	503	107	308	307	407	202
36	504	608	502	305	408	604
37	505	307	507	304	307	408
38	506	405	306	507	108	501
39	507	507	606	108	602	406
40	508	105	608	405	205	602
41	601	603	603	602	104	304
42	602	601	303	207	406	105
43	603	202	407	103	206	307
44	604	604	305	401	504	606
45	605	403	104	605	502	208
46	606	605	207	501	403	503
47	607	103	503	406	507	206
48	608	208	106	303	303	106

Appendix 5

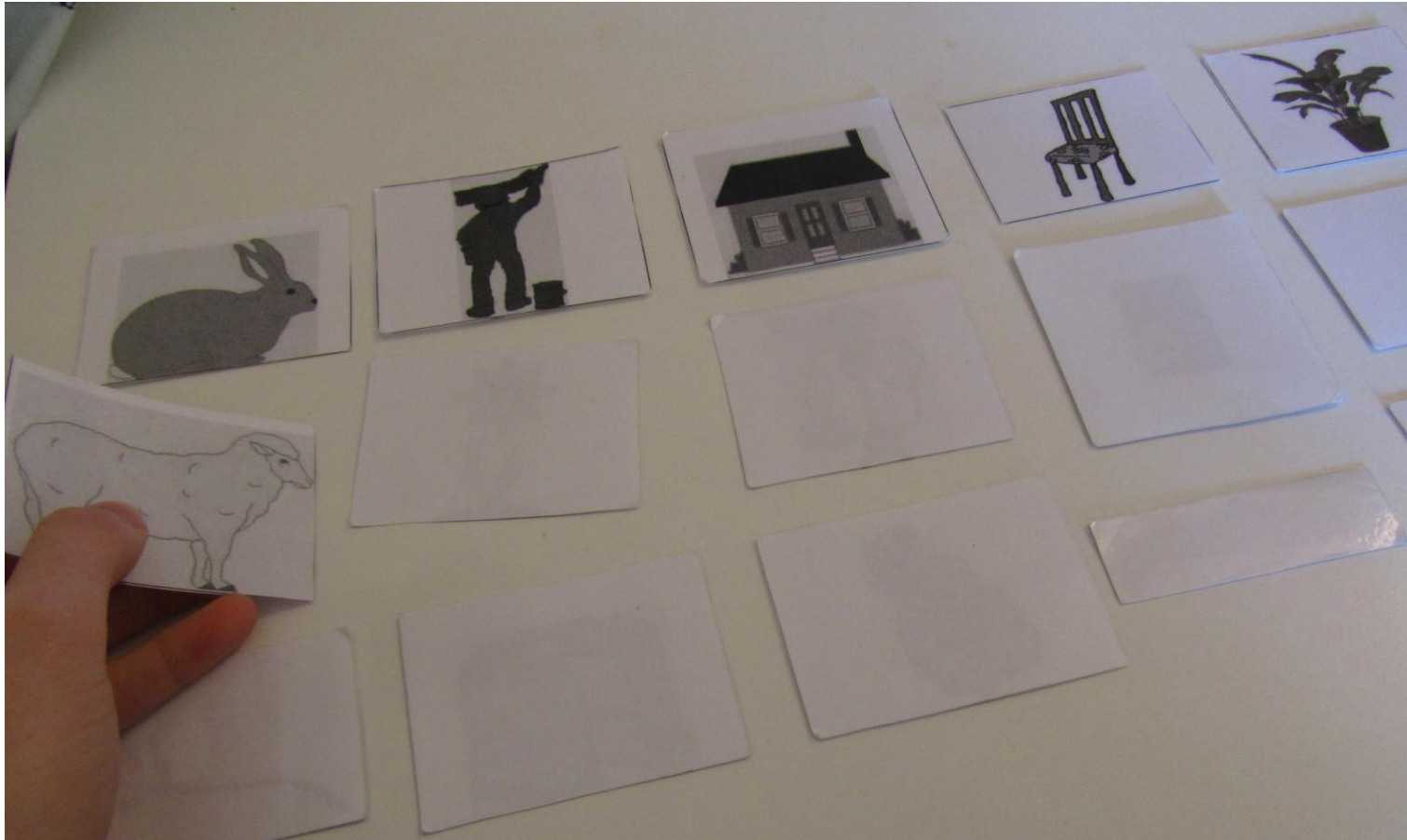
Noun and Adjective Task – Extract from marking sheet

ID: **MARKING SHEET TASK****2****RAND ORDER 3**

	Response	N + A	DIM	N	A	Arall	NR
TRIAL							
603	tarw brown, cath ddu						
503	adeiladwr glas, brenhines goch						
408	traeth coch, troed binc						
502	bwthyn coch, brigyn piws						
101	cant aur, peint glas						
508	rhosyn glas, coeden goch						
204	ceg arian, gardd las						
407	draig streipiog, buwch las						
207	nain aur, merch binc						
103	garddwr oren, dynes binc						
606	coes goch, twll glas						
501	dewines goch, canwr glas						
104	bric streip, pluen goch						
402	teledu arian, cwmwl du						
205	baban oren, taid glas						
504	taten frown, mellten biws						
406	pel oren, bwrdd glas						
405	dewin streipiog, meddyg brown						
303	morgrug oren, cwning ddu						

Appendix 6

Image of some of the cards used in pre-task



Appendix 7

Repetition Task - Novel Word List

WORD-INITIAL	BOARD GAME		POSTING GAME	
	PHONE	ITEMS	ITEMS	ITEMS
/p/	PINWR	PURN	PARNEL	PEB
/k/	CYFEL	CILL	COLDYN	CWF
/t/	TONIL	TIRN	TARBEL	TYLF
/b/	BYDRIB	BIWD	BEFRYN	BWRCH
/d/	DYBRID	DELF	DULEG	DARM
/g/	GOFEB	GWP	GYRRED	GUB
/v/	FAGDDYN	FUNT	FODDEL	FELL
/ð/	DDOREN	DDAF	DDIFRO	DDELLT
/m/	MYGED	MWLL	MURSELL	MORLL
/tʃ/	LLELRI	LLIR	LLASEN	LLWTH
/l/	LEDD	LWRFA	LYSU	LUG
/r/	RHOGA	RHUB	RHIDDYLL	RHWLC
/r/	RASEG	ROLF	RIMEN	RWLL
/pr/	PRYLLEB	PRAL	PLIRYN	PLYNT
/pl/	PLODEN	PLURN	PRWNES	PRELF
/kn/	CNAFIL	CNOD	CNIDELL	CNUB
/kl/	CLWFOL	CLURD	CLEDDO	CLARF
/kr/	CRYDELL	CRID	CROLES	CRYLL
/tl/	TLWDDIL	TLEDD	TLYDA	TLIDD

WORD-INITIAL	BOARD GAME		POSTING GAME	
PHONE	ITEMS		ITEMS	
/tr/	TRWLEM	TRAWR	TROLFIL	TRUN
/br/	BRELWN	BRACH	BRWNTWR	BROEL
/bl/	BLIGO	BLYLL	BLUNEG	BLELL
/dr/	DRUMEDD	DROEN	DRALWR	DRAIB
/dl/	DLYRRU	DLIN	DLECHYN	DLWYN
/gr/	GRUBIL	GRAEDD	GRIMOG	GREW
/gl/	GLYFEN	GLEDDF	GLYDDEST	GLARM
/gn/	GNOFED	GNELLT	GNYME	GNWLL

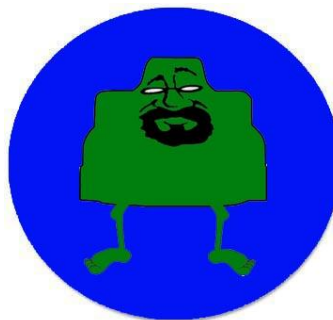
Appendix 8

Example images – Repetition Task

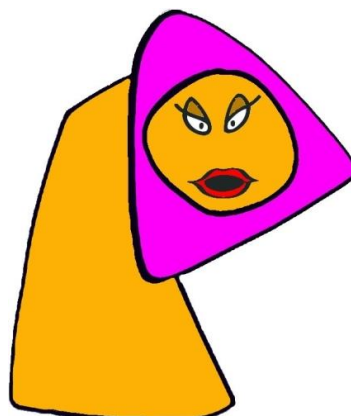
ITEM NO.1
PINWR
MASCULINE MARKED
WORD ENDING *-wr*
IMAGE PORTRAYS
NEUTRAL GENDER
BOARD GAME



ITEM NO. 64
CLARF
UNMARKED
WORD ENDING
IMAGE PORTRAYS
MASCULINE GENDER
CARD GAME



ITEM NO. 22
GWP
UNMARKED
WORD ENDING
IMAGE PORTRAYS
FEMININE GENDER
BOARD GAME

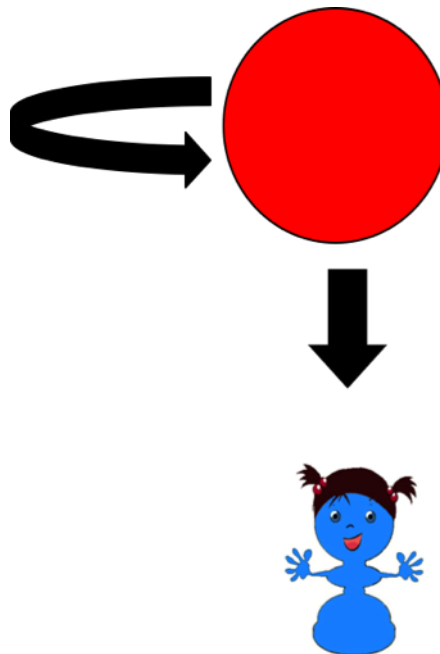


Appendix 9

Visual breakdown of board game and card game

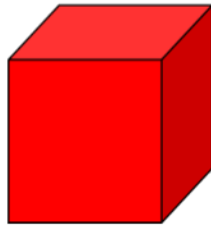


One of the two boards used in the game (above)



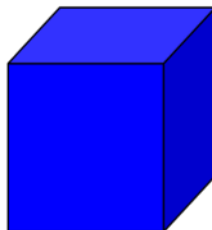
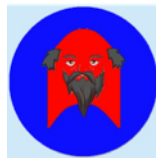
Each character on the board was hidden behind a circle – the participant was required to reveal each character by removing each circles one by one (as illustrated above)

“CLEDDO”



Characters appeared on cards that were posted in one of two boxes that matched their colour. Red counters were posted in the red box (above), and blue counters were posted in the blue box (below).

“BWRCH”



Appendix 10

Repetition task - Marking sheet (extract)

ID:
AGE:

DATE OF TESTING:

RHIF EITEM ITEM NO.	ENW NAME	CYWIR CORRECT	AMNEWIDYN SUBSTITUTION	DILEU DELETION	AM. CLWSTWR CLUSTER SUB.
48	DLIN		[d] [t] [b] [p] [g] [k] [n] Other:		dw dr tl tr bl br pl pr gl gr gn kl kr kn Other:
35	CRID		[k] [g] [t] [d] [p] [b] [r] [r.] Other:		kl kn gn gl gr tl tr dl dr pr pl bl br Other: Voiced Voiceless
19	LLELRI		[l] [x] [θ] [k] [sh] [s] [r] Other:		xl fl θl sl kl Other:
24	RHUB		[r] [h] [l] [n] [d] [b] Other:		hl hj

**RAND 4 - MARKING SHEET
BOARD GAME**

ID:
AGE:

DATE OF TESTING:

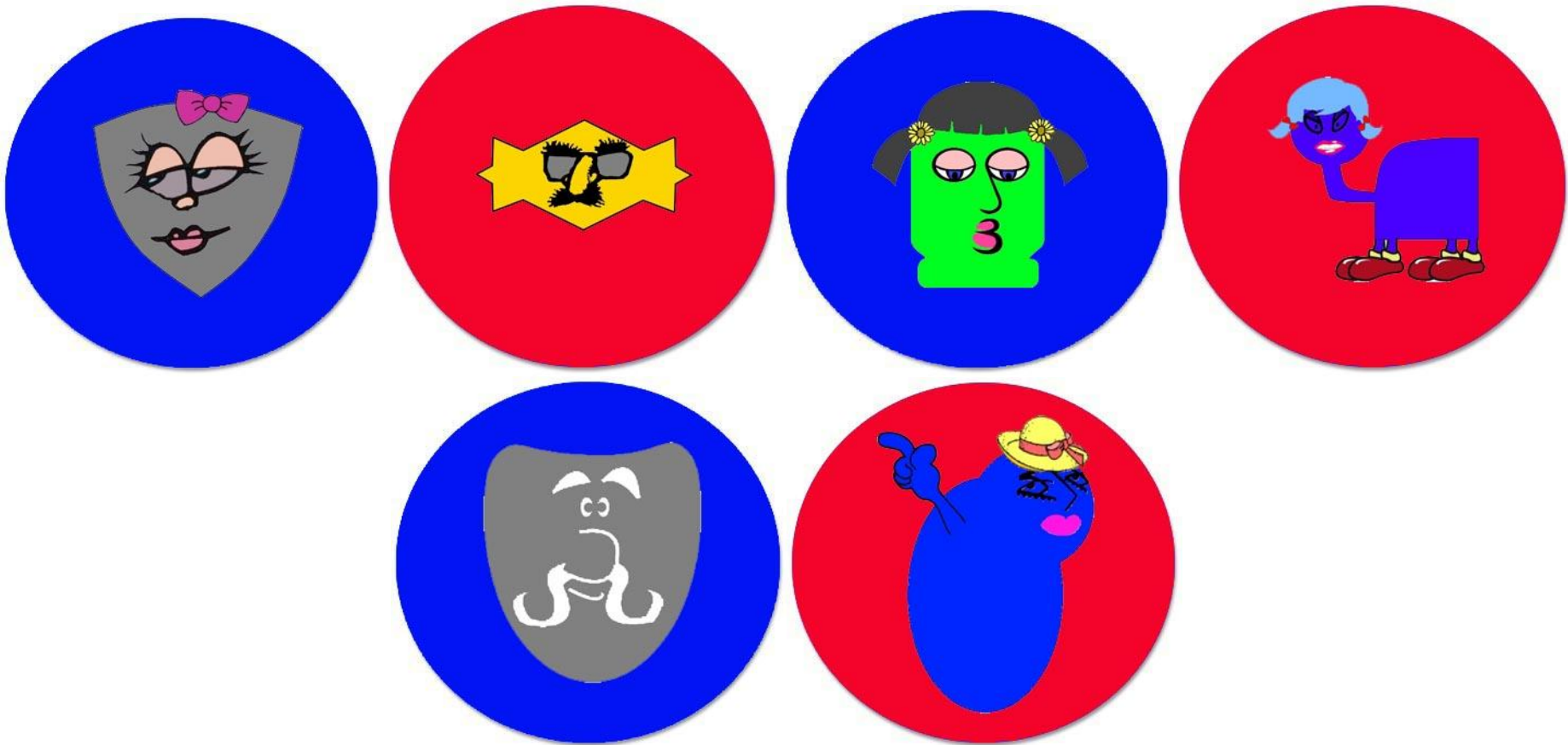
RHIF EITEM ITEM NO.	ENW NAME	CYWIR CORRECT	AMNEWIDYN SUBSTITUTION	DILEU DELETION	AM. CLWSTWR CLUSTER SUB.
51	GLARM		[g] [k] [d] [t] [b] [p] [v] [r] [l] [m] Other:		gr gn gw kl kr kn dl dr tl tr bl br pl pr Other:
21	LUG		[j] [w] [n] [d] [ð] [g] Other:		dl
16	DDIFRO		[d] [θ] [v] [b] [g] [t] [p] [k] [r] [n] Other:		ðr ðl dr dl θr θl fr fl br bl gr gl gn kr kl kn Other:
24	RHWLC		[r] [h] [l] [n] [d] [b] [l] [k] Other:		hl hj

RAND 2 MARKING SHEET

CARD GAME

Appendix 11

Example of some of the cards used in the posting game



Appendix 12

Board Game – Task Instructions

Mae’r ymchwilydd yn cyflwyno’r gem i’r plentyn:

The researcher introduces the game to the child:

Ymchwilydd: “Iawn, rwan ‘da ni am chwarae gêm ar y bwrdd yma. Mae yna lwyth o ‘aliens’ yn cuddio tu ol i’r cylchau” (coch neu glas – dibynnu ar y bwrdd).

Researcher: “OK, now we are going to play a board game. There are lots of aliens hiding behind these circles” (blue or red – depending on the board).

Ymchwilydd: “Mi gei dynnu un cylch o’r bwrdd ar y tro. Pan ti’n gweld yr ‘alien’ tu ol i’r cylch wnai ddweud enw nhw.”

Researcher: “You can take one circle from the board at a time. When you see the alien behind the circle I will say their name.”

Ymchwilydd: “Mae hyn yn gem copio – felly bob tro dwi’n dweud enw, ti am ddweud yr enw hefyd.”

Researcher: “This is a copying game – so every time I say a name, you say the name too.”

Ymchwilydd: “Felly os dwi’n dweud cath . ti’n dweud...”

Researcher: “So, if I said *cath*, then you would say...”

Plentyn: “Cath!”

Child: “Cath!”

Ymchwilydd: “Ag oes dwi’n dweud ci, ti’n dweud...”

Researcher: “And if I say *ci* then you say...”

Plentyn: “Ci!”

Child: "Ci!"

Ymchwilydd: "Da iawn! Ia, yn union fel 'na ryda ni am wneud yn y gem. Reit, wyt ti'n barod i ddechrau?"

Researcher: "Very good! Yes, we will play the game exactly like that. Right, are you ready to start?"

Plentyn: "Yndw!"

Child: "Yes I am!"

Appendix 13

Card Game – Task Instructions

Mae'r ymchwilydd yn cyflwyno'r gem i'r plentyn:

The researcher introduces the game to the child:

Ymchwilydd: "Iawn, rwan 'da ni am chwarae gêm postio. Mae yna lwyth o 'aliens' a y cardiau yma (ymchwilydd yn rhoi nifer o gardiau i'r plentyn).

Researcher: "OK, now we are going to play a posting game. There are lots of aliens on these card (researchers hands many cards to the child).

Ymchwilydd: "Rwyd ti am roi'r cardiau yma yn y bocys (nôl y bocsys) ond mae rhai yn mynd i fynd yn y bocs glas, a rhai yn y bocs coch.

Researcher: "You are going to post these cards in the boxes (takes the two boxes out) but some of the cards will go in the blue box and some will go in the red box."

Ymchwilydd: "Wyt ti'n gweld bod rhai o'r cardiau efo cefndir glas? Lle ti'n meddwl mae rheini yn mynd?"

Researcher: "Do you see that some of cards have a blue background? Where do you think those go?"

Plentyn: "Yn y bocs glas!"

Child: "In the blue box!"

Ymchwilydd: "A'r rhai coch?"

Researcher: "And the red ones?"

Plentyn: "Yn y bocs coch!"

Child: "In the red box!"

Ymchwilydd: “Da iawn! Rwan, da ni am rhoi’r cardiau i fewn i’r bocsys un ar y tro. Pan ti’n dewis cerdyn wnai ddweud enw yr alien sydd ar y cerdyn.

Researcher: “Very good! Now, we are going to put the cards in the boxes one by one. When you choose a card I’ll say the name of the alien that’s on the card.”

Ymchwilydd: “Ond, hefyd, mae hyn yn gem copio fel y gem arall...felly, os dwi’n dweud cath . ti’n dweud...”

Researcher: “But...this is a copying game too, like the other game...so, if I said *cath*, then you would say...”

Plentyn: “Cath!”

Child: “Cath!”

Ymchwilydd: “Ag oes dwi’n dweud ci, ti’n dweud...”

Researcher: “And if I say *ci* then you say...”

Plentyn: “Ci!”

Child: “Ci!”

Ymchwilydd: “Da iawn! Ia, yn union fel ‘na ryda ni am wneud yn y gem. Reit, wyt ti’n barod i ddechrau?”

Researcher: “Very good! Yes, we will play the game exactly like that. Right, are you ready to start?”

Plentyn: “Yndw!”

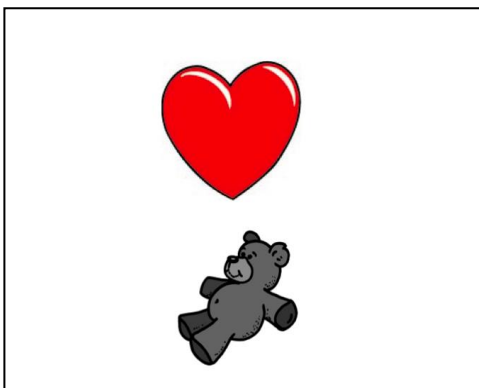
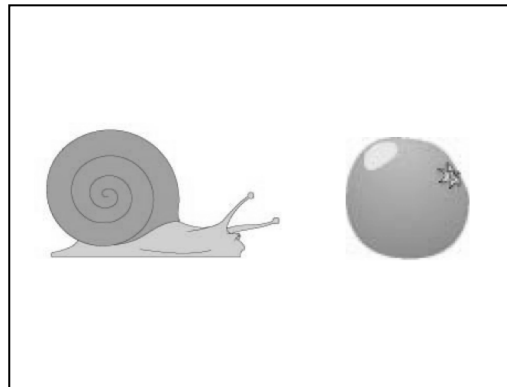
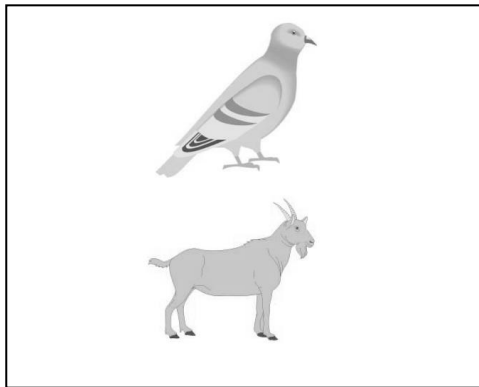
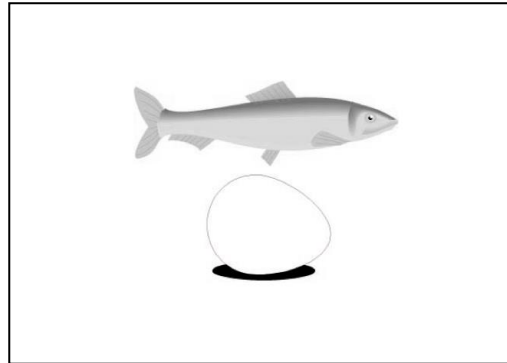
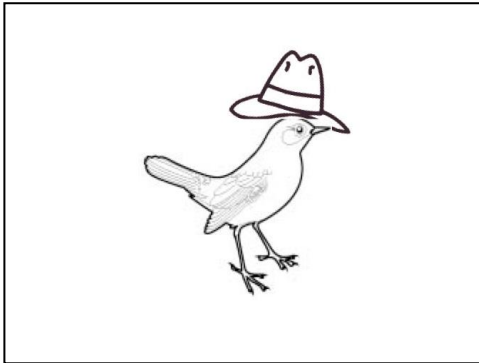
Child” “Yes I am!”

Appendix 14

Preposition and Pronoun Task – Example Images

PROMPT IMAGES

ELICITING IMAGES



Appendix 15

Preposition and Pronoun Task - Instructions

Experimenter directs the child's attention to the computer screen and says:

Rwan 'da ni'n mynd i chwarae gem newydd ar y cyfrifiadur. Yn y gem yma, wnawn ni weld llawer o luniau. Ym mhob llun, mi fydd 'na ddau beth/berson yna.

Now we're going to play a new game on the computer. In this game, we'll be seeing a lot of things. In every picture, there'll be two things/people.

Dwi yn mynd I ofyn i ti ddweud ble mae un o'r pethau yn y llun pob tro. Gawn ni chwarae efo'n gilydd, yn mynd bob yn ail. Wnai ddweud lle mae'r pethau yn y llun cyntaf, wedyn mi gei di ddweud lle mae'r pethau yn yr ail lun, wedyn wnai ddweud eto, a wedyn chdi, ac yn y blaen.

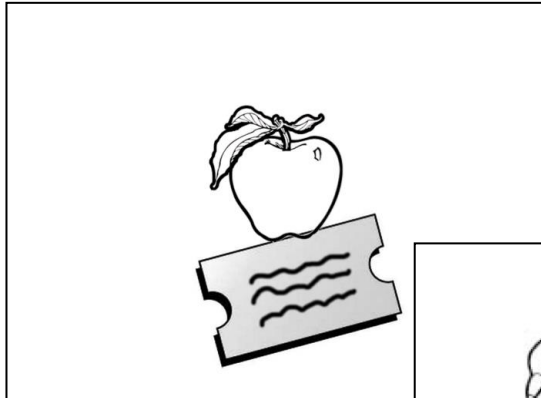
I'm going to ask you to say where one of the things in the picture is each time. We can play together, taking turns. I'll say where the things are in the first picture, then you can say where they are in the second one, then I'll go again, and then you, and so on.

Wnawn ni ymarfer yn gyntaf gyda lluniau gwahanol i mi gael dangos i ti sut wnawn ni ddweud lle mae'r pethau. Mi fydd un peth pob tro ar, dan, neu wrth y peth arall yn y llun.

We'll practise first with some different pictures so that I can show you how we're going to say where the things are. One thing will always be on top of, under or next to the other thing in the picture.

Appendix 16

Preposition and Pronoun Task - Examples of practice trials



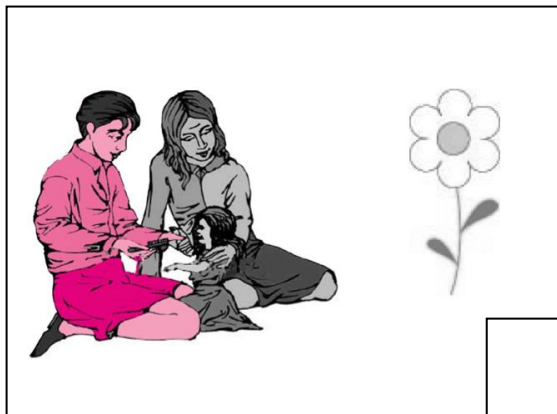
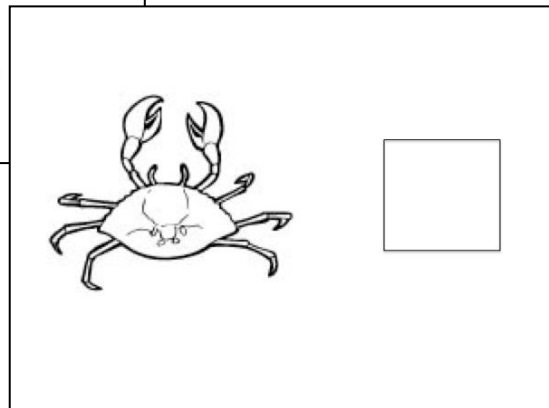
Dyma lun tocyn efo afal arno fo

'Here's a ticket (m.)' with an
apple on it(him).'

Dyma lun cranc efo sgwar...

Here's a crab (m.)' with a
square...

...wrtho fo "on it(him)."



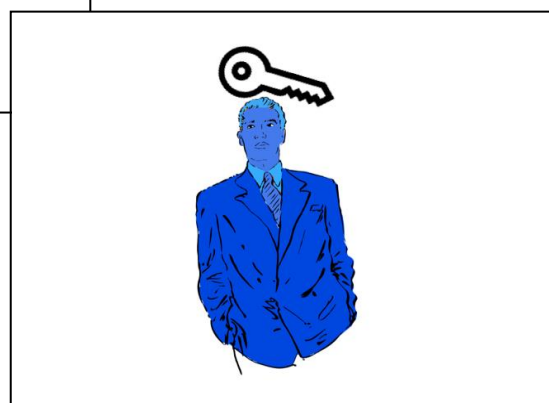
*Mae'r fodryb binc efo blodyn
wrthi hi*

"The aunt has a flower next to
her."

Ond mae'r dyn glas efo goriad...

"But the blue man (m.) has a
key..."

...arno fo "on him."



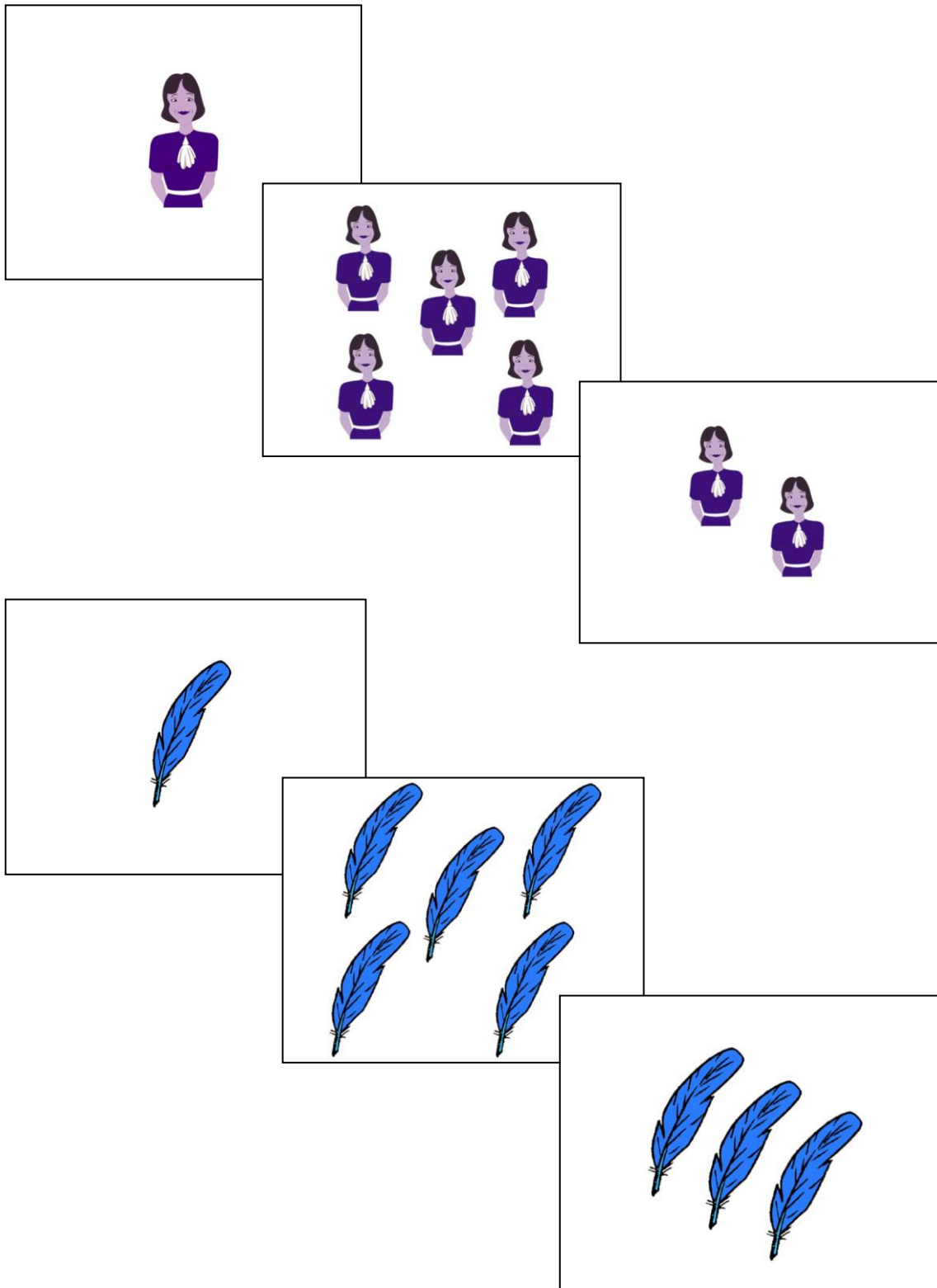
Appendix 17

Preposition and Pronouns Task – Randomisations

TASK RANDOMISATIONS		TASK 3 Prepositions and Pronouns Task				
No.	ORIGINAL ORDER	RAND 1	RAND 2	RAND 3	RAND 4	RAND 5
1	101	402	102	601	506	507
2	102	506	107	302	502	204
3	103	602	402	304	501	303
4	104	208	505	101	204	208
5	105	503	602	308	401	506
6	106	202	308	208	101	207
7	107	306	204	508	105	403
8	108	604	401	408	207	608
9	201	108	207	204	306	108
10	202	203	306	401	602	504
11	203	507	202	606	405	105
12	204	605	101	605	304	405
13	205	405	504	503	508	404
14	206	204	603	108	407	306
15	207	608	508	403	201	107
16	208	504	303	405	607	101
17	301	603	507	102	104	603
18	302	406	406	607	507	606
19	303	307	301	105	601	502
20	304	408	103	506	108	408
21	305	304	201	203	103	102
22	306	601	105	305	404	402
23	307	107	106	303	603	205
24	308	205	605	507	203	503
25	401	207	203	505	308	605
26	402	404	307	407	403	508
27	403	201	403	502	408	407
28	404	305	304	404	303	308
29	405	607	404	604	205	203
30	406	401	501	608	307	501
31	407	106	606	602	604	305
32	408	606	407	201	406	406
33	501	403	604	402	208	302
34	502	101	608	107	202	201
35	503	206	408	603	605	103
36	504	102	205	104	505	106
37	505	502	607	207	504	607
38	506	505	208	205	606	505
39	507	407	108	106	206	304
40	508	308	206	504	301	307
41	601	104	506	306	402	104
42	602	301	405	202	608	602
43	603	501	302	501	106	604
44	604	508	305	103	305	401
45	605	303	601	301	102	202
46	606	103	502	307	107	601
47	607	302	503	206	302	206
48	608	105	104	406	503	301

Appendix 19

Numerals Elicitation Task – Example image sets



Appendix 20

Numeral Elicitation Task – Instructions

The experimenter begins by directing the child's attention to the computer:

Rwan dwi am ddangos lluniau i ti ar y cyfrifiadur.

"Now I'm going to show you some photos on the computer."

***Wnai enwi'r peth yn y llun cyntaf. Felly, enw'r peth yma (yn edrych ar lun o lwy),
wnai ddweud: "Dyma lun llwy."***

I'll name the thing in the first picture. So, the name of this thing (referring to a picture of a spoon), I'll say "Here's a picture of a spoon."

***Wedyn, yn y llun nesaf, mi fydd 'na fwy ohonyn nhw, fel hyn (dangos llun o bump
llwy). Wnai ddweud, Rwan mae 'na 5 llwy.***

"Then, in the next picture there will be more of them, like this (showing a picture of five spoons). I'll say, "Now there are five spoons.""

***Am y trydydd llun, byddai'n gofyn i TI ddweud faint sydd yna. Felly am yr un yma,
(yn cyfeirio at llun o dri llwy), dyllet to ddweud, "Rwan mae 'na dri llwy."***

"For the third picture, I'll ask YOU to tell me how many there are. So for this one, (referring to a picture with three spoons), you would say, "Now there are three spoon.""

***Rwan wnawn ni ymarfer efo mwy o luniau, a wedyn gawn ni fynd ymlaen I
chwarae'r gem yn iawn. Yr unig beth rwyd ti angen wneud ydy dweud faint o
bethau sydd yny trydydd llun pob tro. Barod?***

“Now we'll practice with some more pictures, and then we can go on to play the game properly. The only thing you need to do is say how many things are in the third picture each time. Ready?”

Appendix 21

Numeral Elicitation Task – Randomisations

No.	TASK RANDOMISATIONS		TASK 1		NUMERAL TASK		
	ORIGINAL ORDER	RAND 1	RAND 2	RAND 3	RAND 4	RAND 5	
1	101	108	602	402	107	407	
2	102	302	501	508	404	201	
3	103	503	201	306	301	508	
4	104	402	307	407	305	303	
5	105	602	408	102	402	107	
6	106	606	107	506	306	603	
7	107	205	102	104	304	402	
8	108	207	601	608	501	505	
9	201	204	302	408	605	207	
10	202	406	504	403	102	608	
11	203	306	205	101	505	302	
12	204	505	202	603	506	504	
13	205	308	605	505	401	404	
14	206	304	204	604	603	101	
15	207	408	402	106	405	108	
16	208	106	505	201	607	306	
17	301	508	607	205	308	506	
18	302	102	206	107	105	507	
19	303	301	604	502	503	308	
20	304	104	208	204	608	301	
21	305	203	405	302	207	403	
22	306	206	103	105	101	305	
23	307	501	108	503	606	502	
24	308	506	304	504	601	605	
25	401	401	401	301	204	401	
26	402	407	301	202	202	607	
27	403	607	404	404	208	204	
28	404	201	403	601	508	601	
29	405	504	406	208	604	205	
30	406	101	105	607	203	405	
31	407	305	506	308	103	203	
32	408	303	101	206	106	104	
33	501	404	508	203	302	102	
34	502	502	203	606	201	103	
35	503	107	308	307	407	202	
36	504	608	502	305	408	604	
37	505	307	507	304	307	408	
38	506	405	306	507	108	501	
39	507	507	606	108	602	406	
40	508	105	608	405	205	602	
41	601	603	603	602	104	304	
42	602	601	303	207	406	105	
43	603	202	407	103	206	307	
44	604	604	305	401	504	606	
45	605	403	104	605	502	208	
46	606	605	207	501	403	503	
47	607	103	503	406	507	206	
48	608	208	106	303	303	106	

Appendix 22

Numeral Elicitation Task – Marking sheet

	ID:		DATE:					
	RANDOMISATION 1							
	TRIAL		dau	dwy	tri	tair	pedwar	pedair
1	108	mellten, meltt pump, meltt dwy						
2	302	mochyn, mochyn 5, mochyn 4						
3	503	llinyr coch, llin coch 5, llin coch 4						
4	402	taid, taid 5, taid 2						
5	602	llyffant glas , llyff glas 5, llyff glas 4						
6	606	dafad biws, daf biws 5, daf biws 3						
7	205	mam, mam 5, mam 2						
8	207	troed, troed 5, troed, 3						
9	204	bwrdd, bwrdd 5, bwrdd 4						
10	406	cath, cath 5, cath 4						
11	306	malwen, mal 5, mal 3						
12	505	dynes biws, dynes biws 5, dynes biws 2						
13	308	teisen, teis 5, teis 4						
14	304	bodyn, bodyn 5, bodyn 2						
15	408	braich, braich 5, braich 2						
16	106	llygoden, llygod pump, llygod pedair						
17	508	pluen las , plu glas 5, plu glas 3						
18	102	pel droediwr, pel-droed pump, pel-droed dau						
19	301	canwr, canwr 5, canwr 4						
20	104	planhigyn, plan pump, plan tri						
21	203	cylch, cylch 5, cylch 4						
22	206	buwch, buwch 5, buwch 2						
23	501	pry cop glas, pc glas 5, pc glas 3						
24	506	cwningen binc, cwning binc 5, cwning binc 2						
25	401	ci, cwn 5, cwn 2						
26	407	cadair, cad 5, cad 2						
27	607	dinas goch, din goch 5, din goch 4						
28	201	ceffyl, ceff pump, ceff tri						
29	504	brigyn du, brig du 5, brig du 4						
30	101	pysgodyn, pysgod pump, pysgod dau						
31	305	tywysoges, tyw 5, tyw 3						
32	303	polyn, polyn 5, polyn 2						
33	404	ty, tai 5, tai 3						
34	502	peintiwr glas, peint glas 5, peint glas 3						
35	107	cneuen, cnau pump, cnau dwy						
36	608	cloch las, cloch las 5, cloch las 4						
37	307	coeden, coed 5, coed 4						
38	405	merch, merch 5, merch 4						
39	507	deilen goch , dail coch 5, dail coch 3						
40	105	brenhines, brenh pump, brenh pedair						
41	603	cwmwl coch, cwm coch 5, cwm coch 2						
42	601	meddyg coch, medd coch 5, medd coch 4						
43	202	brenin, brenin pump, brenin tri						
44	604	twll glas, twll glas 5, twll glas 2						
45	403	poppy, pop 5, pop 3						
46	605	gwrach binc, gwrach binc 5, gwrach binc 3						
47	103	blodyn, blodau pump, blodau tri						
48	208	qardd, qardd 5, qardd 3						

Appendix 24

Individual Response Patterns – Numeral Elicitation Task – 7-year-olds

		TARGET NUMERAL = DAU 'TWO (M.)'							
Age + HL	Child	Taid 'Grandfather'	Pel-droediwr 'Footballer'	Pysgodyn 'Fish'	Ci 'Dog'	Polyn 'Pole'	Bodyn 'Toe'	Twll 'Hole'	Cwmwl 'Cloud'
OWH 7	<i>SPE</i>	F	F	F	F	F	F	F	F
WEH 7	<i>AF</i>	M	M	M	M	M	M	M	M
WEH 7	<i>MP</i>	M	M	M	M	M	M	M	M
WEH 7	<i>ES</i>	M	M	M	M	M	M	M	M
WEH 7	<i>CR</i>	M	F	F	F	M	F	F	F
WEH 7	<i>NCH</i>	F	F	F	F	M	F	F	F
OEH 7	<i>PEH</i>	M	M	F	M	M	M	M	M

TARGET NUMERAL = TRI 'THREE (M.)'									
Age + HL	Child	Peintiw'r 'Painter'	Brenin 'King'	Pry Copyn 'Spider'	Ceffyl 'Horse'	Planhigyn 'Plant'	Blodyn 'Flower'	Popty 'Oven'	Tŷ 'House'
OWH 7	<i>SPE</i>	F	F	F	F	F	F	F	F
WEH 7	<i>AF</i>	M	F	M	M	M	M	M	M
WEH 7	<i>MP</i>	M	M	M	M	M	M	M	F
WEH 7	<i>ES</i>	M	M	M	M	M	M	M	F
WEH 7	<i>CR</i>	M	M	M	M	M	M	M	M
WEH 7	<i>NCH</i>	M	M	M	M	M	M	M	M
OEH 7	<i>PEH</i>		F	M	F	F	F	F	M

		TARGET NUMERAL = PEDWAR 'FOUR (M.)'							
Age + HL	Child	Canwr 'Singer'	Meddyg 'Doctor'	Mochyn 'Pig'	Broga 'Frog'	Brigyn 'Twig'	Llinyn 'String'	Bwrdd 'Table'	Cylch 'Circle'
OWH 7	<i>SPE</i>	F	F	F	F	F	F	F	F
WEH 7	<i>AF</i>	M	M	M	M	M	M	M	M
WEH 7	<i>MP</i>	M	M	M	M	M	F	M	M
WEH 7	<i>ES</i>	M	M	M	M	M	M	M	M
WEH 7	<i>CR</i>	M	M	M	M	M	M	M	M
WEH 7	<i>NCH</i>	M	M	M	M	M	M	M	M
OEH 7	<i>PEH</i>	M	F	F	F	F	M	F	M

		TARGET NUMERAL = DWY 'TWO (F.)'							
Age + HL	Child	Dynes 'Woman'	Mam 'Mother'	Buwch 'Cow'	Cwningen 'Rabbit'	Mellten 'Lightning'	Cneuen 'Nut'	Braich 'Arm'	Cadair 'Chair'
OWH 7	<i>SPE</i>	F	F	F	F	F	F	F	F
OWH 7	<i>TCAR</i>	M	M	M	M	M	F	M	M
OWH 7	<i>OCR</i>	M	M	M	M	M	F	M	M
OWH 7	<i>SO</i>	M	M	M	M	M	M	M	M
OWH 7	<i>SHW</i>	F	M	M	M	M	M	M	M
WEH 7	<i>MP</i>	M	M	M	M	M	M	M	M
WEH 7	<i>CR</i>	F	M	M	F	M	M	F	M
WEH 7	<i>NCH</i>	F	F	F	F	F	F	F	M
WEH 7	<i>MW</i>	M	M	M	M	F	F	M	M
OEH 7	<i>PEH</i>	M	F	M	M	F	M	M	M

		TARGET NUMERAL = TAIR 'THREE (F.)'							
Age + HL	Child	Tywysoges 'Princess'	Gwrach 'Witch'	Dafad 'Sheep'	Malwen 'Snail'	Deilen 'Leaf'	Pluen 'Feather'	Gardd 'Garden'	Troed 'Foot'
OWH 7	<i>SPE</i>	F	F	F	F	F	M	F	M
OWH 7	<i>TCAR</i>	M	M	M	M	M	M	M	M
OWH 7	<i>OCR</i>	M	M	M	M	M	M	M	M
OWH 7	<i>SO</i>	M	M	M	M	M	M	M	M
OWH 7	<i>SHW</i>	M	M	M	M	M	M	M	M
WEH 7	<i>MP</i>	M	M	M	F	M	M	M	M
WEH 7	<i>CR</i>	M	M	M	M	M	M	M	M
WEH 7	<i>NCH</i>	M	M	M	M	M	M	M	M
WEH 7	<i>MW</i>	M	M	M	F	M	M	M	M
OEH 7	<i>PEH</i>	F	M	F	M	F	F	F	F

		TARGET NUMERAL = PEDAIR 'FOUR (F.)'							
Age + HL	Child	Brenhines 'Queen'	Merch 'Girl'	Llygoden 'Mouse'	Cath 'Cat'	Coeden 'Tree'	Teisen 'Cake'	Dinas 'City'	Cloch 'Bell'
OWH 7	<i>SPE</i>	F	F	F	F	F	F	F	F
OWH 7	<i>TCAR</i>	M	M	M	M	M	M	M	M
OWH 7	<i>OCR</i>	M	M	M	M	M	M	M	M
OWH 7	<i>SO</i>	F	M	M	M	M	M	M	F
OWH 7	<i>SHW</i>	M	M	M	M	M	M	M	M
WEH 7	<i>MP</i>	F	F	M	M	M	M	F	F
WEH 7	<i>CR</i>	M	M	M	M	M	M	M	M
WEH 7	<i>NCH</i>	M	M	M	M	M	M	M	M
WEH 7	<i>MW</i>	M	M	M	M	M	M	M	M
OEH 7	<i>PEH</i>	M	M	M	F	F	M	M	M

Appendix 26

Novel word numeral task – Instructions

Stori cefndirol – Background story

Dyma long ofod o’r blaned Targon. Mae’r llong ofod yma wedi hedfan uwchben y ddaear , ond wnaeth y drws agor a mae ‘na lawer o greaduriaid a gwrthrychau/pethau sydd ddim yn symud wedi disgyn allan!

“Here’s a spaceship from the planet Targon. The spaceship has flown above the Earth, but the door opened and lots of people, creatures and still objects have fallen out!”

Rŵan ryda ni am weld rhai o’r creaduriaid a pethau yma. Mae pob un efo enw arbennig dwi wedi rhoi iddyn nhw. Rwyd ti am gyfarfod nhw rŵan, a fyddai yn gofyn i ti ddweud faint ohonyn nhw fydd yn bob llun, fel yn y gêm arall. Iawn, rwyd ti’n barod i weld nhw?

“Now we’re going to see some of these people and things. Every one has a special name that I’ve given them. You’re going to meet them all now, and I’ll be asking you to tell me how many of them are in the last picture, like we did in the other game. OK, are you ready to see them?”

Instructions for this task were the same as for the numeral task – the above paragraphs were added so that there was an interesting context in which the children could play the game.

