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Morphosyntactic complexity and exposure in the acquisition of gender in Welsh

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Morphosyntactic Complexity and Exposure in

The Acquisition of Gender in Welsh

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Gracias a todos!

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List of abbreviations

SM – Soft Mutation

AM – Aspirate Mutation

NM- Nasal Mutation

CDS – Child-directed speech

CCs – Conversational Contingencies

SES – Socio-Economic status

GG – Grammatical Gender

DRP – Dominant Response Pattern

Summary

The aim of this investigation was to observe both children's and adults' knowledge of grammatical gender in Welsh, and assess the role of exposure, structure complexity and form-function mapping in acquisition. Four different elements of the gender system were examined: local gender marking via SM of nouns and adjectives, local gender marking via production of gendered numeral forms, and distant gender marking via production of gendered prepositions and their pronominal objects. Participants' knowledge was assessed with various controlled elicitation tasks. One additional task tested the productivity of one gender construct by assessing gender marking in relation to novel nouns. Participants (aged four, five, seven, nine and adult) came from one of three home language backgrounds, based on level of exposure to Welsh and English in the home: only Welsh at Home, Welsh and English at home or only English at home. Patterns of responding for individual tasks revealed piecemeal acquisition that seemed to be influenced by frequency effects, resulting in higher levels of productivity in relation to more frequent nouns and lower productivity for less frequent ones. Further probing of the productivity of gender marking across the different gender constructs also revealed piecemeal acquisition patterns, as shown by a lack of uniformity in gender marking in relation to the same lexical items (nouns). The results suggest effects of the varied complexity of the different gender constructs, and the role of semantic or natural gender information in relation to grammatical gender assignment. Overall, a role of relative language exposure seemed evident, as marked differences were observed across home language groups, with OWH children showing the most productive

command of the gender system. The adult data revealed incomplete acquisition of some aspects of the system, suggesting that there are limits to bilinguals' acquisition of highly complex grammatical features.

Chapter 1

Introduction

The current study investigated both children's and adults' knowledge of the grammatical gender system of Welsh. Multiple elements of the Welsh gender system were investigated, each via a different controlled elicitation task. The rate and order of acquisition in children were scrutinized and the role of factors such as language exposure, structure complexity, and the relative transparency of form-function mapping were investigated. The adult data were scrutinised to determine approximately what kind of input children are exposed to by adult models, and to determine the nature of the end-state of the acquisition of the Welsh gender system.

The thesis is structured as follows. Chapter 2 presents a literature review discussing previous research investigations of child language acquisition in general. Studies investigating both monolingual and bilingual language acquisition are presented. Various key factors in the language acquisition process are identified and discussed.

Chapter 3 is a more focussed literature review, summarising findings to date regarding the acquisition of grammatical gender cross-linguistically, and discussing which factors appear to play key roles in the acquisition of gender, and how these factors can result in differing acquisition patterns across languages.

In Chapter 4, a short literature review presents findings to date regarding the use of mutation in Welsh-speaking adults and children, and the use of and acquisition of aspects of the Welsh grammatical gender system, including the use of soft mutation. This is followed by a short description of the elements of the Welsh gender system investigated in this thesis. Then the hypotheses and predictions for the current investigation are presented, taking into account the results of previous investigations of language acquisition, and acquisition of grammatical gender specifically.

Chapter 5 presents the results of a controlled elicitation task that elicited nouns and adjectives from participants in a gender context. The patterns of use of soft mutation (which marks locally for feminine gender on nouns and adjectives), in both children and adults were scrutinised. Data from Welsh corpora were analysed to determine whether the patterns of mutation observed in the experimental data are related to the frequency of occurrence of mutated and basic forms of the target nouns as they occur in corpora of both written and spoken Welsh.

In Chapter 6, the results of a controlled repetition task are presented. The task involved asking children to repeat novel Welsh nouns. These novel nouns began with the consonants that participate in soft mutation in Welsh. This task served as a checking procedure, to ensure that the youngest children's mutation patterns in the experimental mutation task, (reported in Chapter 5), were not influenced by a lack of articulatory skill in producing any of the consonants that participate in the soft mutation process.

Chapter 7 presents the results of a second controlled elicitation task in which gendered prepositions and their pronominal objects were elicited from participants. The same set of nouns elicited in the noun and adjective task were used to elicit preposition and pronoun forms here. A methodological description of the task is presented. Then the pronoun data results are presented, followed by the preposition data. The results for each dataset are first discussed separately. Then agreement patterns between the two structures are scrutinised and discussed.

Chapter 8 presents data from a third controlled elicitation task. Gendered numeral forms were elicited in relation to the same set of 48 nouns that featured in the other elicitation tasks. A methodological description of the task is presented, followed by the presentation and discussion of the results.

In Chapter 9, a second numeral elicitation task is presented. This version of the task involved novel nouns, and tested the productivity of children's and adults' gender marking. In addition to the development of novel nouns, novel characters/objects were created for the task. The animacy and natural gender of these novel characters/objects were manipulated to assess the impact (if any) of natural gender information on this form of gender marking. A methodological description of the task is presented first, followed by the presentation and discussion of the results.

In Chapter 10, the productivity of participants' gender marking across all four of the gender constructs investigated (i.e. noun and adjective mutation, gendered numeral production and gendered pronoun production) is investigated. This was done to determine how the gender system as a whole is represented in both children and adults.

Finally, Chapter 11 brings together the findings of all of the abovementioned experimental studies. The results of each task are discussed in relation to one another and the theoretical ramifications of the investigation as a whole are discussed.

Chapter 2

Language Acquisition

"Children learn language from their language

experiences – there is no other way."

Elena Lieven and Michael Tomasello

2.1 Chapter Overview

This chapter provides an overview of recent cross-linguistic investigations of language acquisition in monolinguals and bilinguals, and the theoretical implications of these investigations. Key factors in language acquisition are discussed, including structure complexity, language exposure and item frequency.

2.2 Approaches to Language Acquisition

Language acquisition is a highly complex multi-faceted process, which is subject to variation in terms of the language(s) acquired, the speed of the process and variation even at the level of the individual. Over the years linguists have collectively managed to extract information about some of the specific processes that contribute to language acquisition as a whole, though there is still much to debate as to which factors play the most significant role in the acquisition process. Moreover, the manner and extent to which different factors interact with one another is still being discovered.

The nature of language, in terms of the way in which it's represented in the adult mind, and subsequently how children go about acquiring adult language is a topic of great debate. There are two main theoretical camps that have endeavoured to define how language is represented, and in turn how it is acquired. Chomsky (1957) first surmised that grammar could not be acquired based on the input, as any given collection of input that an average child would be exposed to:

a) Lacks explicit, organised presentation of the information needed to derive its underlying structure and

b) Is so vast that it offers far too many potential options for a child to be able to ascertain the language "rules" (i.e. grammar) of the language in question.

This is the seminal "poverty of the stimulus" argument (c.f. Chomsky, 1957). Various generativist theorists (e.g. Meisel, 1995), have also postulated that language could not be wholly based on the input as the input can be contradictory or ambiguous in some cases, and some of the input provided can be ungrammatical, which would (arguably) lead to the acquisition of non-target structures.

To address this perceived "problem", Chomsky (1965) later suggested that humans possess an innate, "Language Acquisition Device" (LAD) that includes abstract knowledge of grammar. Importantly, he postulated that this innate system contained knowledge of universal features of language, what is now widely known as a Universal Grammar (UG). This knowledge gives children a starting point to work from. That is, they have some knowledge of language at their disposal that allows them to "rule out" many hypotheses, giving them a smaller pool of possibilities from which to select the target hypotheses.

The structure of this innate language system was based on Chomsky's earlier descriptions of a "generative grammar", (c.f. Chomsky, 1957; 1959). Generative grammar is proposed to include knowledge of grammatical/syntactic categories, (e.g. NOUN, ADJECTIVE, DETERMINER) and knowledge of phrase structure, (e.g. NOUN PHRASE, ADJECTIVAL PHRASE, DETERMINER PHRASE) in which each phrase type is made up of a head, which is the syntactic category that heads the phrase (e.g. the NOUN is the head of a NOUN PHRASE).

The system is seen as generative in that it allows individuals to produce, (or generate), novel utterances, (i.e. they possess knowledge of language on an abstract level that allows them to produce new utterances of their own creation). This theory was further developed to include a feature called "structure dependence", by which the rules of the system (i.e. the categories that the system is made up of and their relation to one another) make reference to the phrase structure in which they appear (Chomsky, 1980).

Whilst generativist theory postulates that the grammar system is innate, it does not, however, postulate that children have a fully formed adult grammar from the outset. Rather they have an abstract system that approximates the adult system, but the system requires input from the ambient language for the features of the system to be fully specified. That is, generativist theory does take into account the fact that languages vary in the way in which they express grammatical concepts, and so if an innate system is present, it can only specify features up to a point: "…certain parameters are left unspecified to be filled in by the child according to the language he is exposed to." (Williams, 1987, pg.8) These "parameters" are unlocked and acquire settings as a child is exposed to the ambient language, and it is with the guidance of these parameters that a child is able to acquire language. These parameters are assigned "settings" and when the settings are first established they are adaptable based on the language(s) to be learned (Hyams, 1986; Chomsky, 1981).

In contrast, constructivist approaches to language stipulate that the adult language system is made up of a large network of constructions. A construction is simply a form-meaning mapping in which a given form is linked to a given function (c.f. Goldberg, 1995; Bybee, 1999; Tomasello, 2003). An example of the English transitive construction is illustrated in Ambridge and Lieven's (2011) book:

Form (Pattern): NOUN1 VERB NOUN2

Function (Meaning): A acts upon B, causing B to be affected in some way

Components: kicked, Bill, John

Insertion of components into construction = John kicked Bill

(Adapted example from Ambridge & Lieven, 2011)

The construction itself denotes an extra meaning that the component parts alone do not express. Alone, the components *kicked, Bill* and *John* each hold their own meaning, but when they appear within the construction a whole other meaning is expressed (Ambridge & Lieven, 2011, p.124). These constructions can be formed at a sentence level, at a lexical level, or at something between the two (e.g. a sub-part of a sentence or phrase). A form-function mapping is a linguistic representation, in that the construction represents a real world concept. Lieven and Tomasello (2008) define three different types of representations:

- Whole constructions – i.e. whole form-function representations that are fully specified
- Slots in constructions – within which different lexical items may be inserted – all of which serve the same function
- Patterns of distribution between items or whole constructions

In terms of acquisition, these constructions and the representations they form are built via form-meaning mappings that are acquired by the child as they learn to associate given linguistic utterances (forms) with real-word events (and their associated meanings). Early constructions are of a more functional nature (i.e. more tied to meaning), in that they tend to be initially lexically specified, and are tied to specific communicative functions, "…the variable slot (e.g. ACTION) does not contain an adult like syntactic category (e.g. VERB) but a simpler functional category (e.g. 'actions that I can perform')." (Ambridge & Lieven, 2011, pg.126) Children can later achieve the acquisition of more adult-like abstract schemas when they have been exposed to enough manifestations of different combinations of components that fit a given construction. They can then identify a common linguistic function, and in turn develop an abstract category that represents that function.

Saxton (2010) suggests a slightly alternative view, in that one should not think of children's earlier constructions as being less abstract than later ones, but rather that constructions start out as more specific (i.e. tied to specific lexical items) and later grow to become more general schematic representations. Essentially it is "… a shift in knowledge from linguistically specific to linguistically general…this process includes the ability to insert an increasingly wide range of items into a particular slot in an item-based construction" (Saxton, 2010, p.221).

Essentially, constructivist approaches stipulate that children construct their language, integrating bits and pieces of information together as they learn. Once some constructions are acquired, these constructions can be used to assist the child in their acquisition of more complex constructions, as there may be basic level forms in the existing constructions that overlap partially with yet to be acquired constructions, thus giving the child a partial understanding of the new, more complex constructions to be acquired (see Lieven, Behrens, Speares & Tomasello, 2003).

Importantly, constructivist approaches hold that constructions are acquired solely based on the input – by the input, (as it's referred to here) is meant the language that is spoken in the presence of the child, be it directed at them personally or at others in the vicinity, in a context in which the child is able (i.e. has the opportunity) to fully interpret the meaning of the utterance within a given communicative context.

Tomasello's (2003) usage-based constructivist approach, for example, argues that constructions are acquired in the same way that humans acquire a whole of host of non-linguistic skills, via advanced learning mechanisms, which allow children to observe behaviour and identify distinct categories leading to extraction of information from an apparently haphazard and complex mass of input. Children acquire key pieces of information that they will gradually learn to integrate and combine into one mass of functional knowledge. Among the two types of key skills that Tomasello argues that children have at their disposal are:

1) The ability to share attention with adult models and learn the intentions of adults based on these shared attention events
2) The ability to extract information from the linguistic input they are exposed to via various pattern extraction and knowledge co-ordination processes

With these skills at their disposal young children are able to acquire language with apparent facility, and do so in a strikingly homogeneous fashion (when one compares acquisition patterns across individuals).

2.3 The Role of the Input

Constructivist and generativist approaches differ in the extent to which input plays a role in language acquisition. Whilst generativist accounts consider the input only in so far as they serve to assign settings to innate parameters, constructivist accounts postulate that the input itself, as the source of grammar, will shape the acquisition process both on a local level and on a global level.

Distributional learning.

How then does the input shape the acquisition of language? Which features of the input contribute to the acquisition process? Saffran and Thiessen (2007) discuss “domain-general learning capacities” that humans are equipped with, and the extent to which these capacities can account for language acquisition (p.69). These domain general learning capacities refer to “statistical learning mechanisms…more broadly construed as attention to regularities in the environment.” (Saffran & Thiessen, 2007, p.74) These statistical learning mechanisms involve distributional learning techniques. The desired interpretation of distribution in this framework is essentially:

a) What does a given feature co-occur with?

b) Is there a pattern to these co-occurrences?

c) What is the feature's functional significance?

Such distributional learning mechanisms have been observed at various language levels, including early categorical perception of speech by young infants, (Eimas, Siqueland, Jusczyk & Vigorito, 1971), speech segmentation of fluent speech by young infants (Jusczyk & Aslin, 1995), successful identification of word boundaries in both children and adults (Saffran, Aslin & Newport, 1996), and children's identification of syntactic categories (Naigles & Hoff-Ginsberg, 1995).

St Clair, Monaghan and Christiansen (2010) outline an example of one type of distributional information, "flexible frames", that show evidence of children's acquisition of grammatical categories. They define these "flexible frames" as being structures in which a linguistic slot may be identified either by a consistent preceding element (e.g. aX) or a succeeding element (e.g. Xb), (p.342). These are contrasted with "frequent frames" (c.f. Mintz, 2003), which are frames in which both a consistent preceding and succeeding element are present (e.g. aXb). They argued that the distributions of flexible frames are more accessible due to their higher frequency, as they require the presence of only one consistent element (either preceding or succeeding) as opposed to two (in the case of frequent frames), resulting in their wider distribution across the language as a whole.

In addition, they are no less informative, as it is well within the capability of a child to link information – (e.g. linking construct aX with Xb and coming up with aXb (p.343)). This is fundamentally the way in which we acquire language, by extracting information from the input and linking different pieces of information gradually, via continuing exposure to the language, before eventually achieving a level of coherence that allows us to acquire a fully productive system.

St. Clair et al.'s various computational modelling procedures showed that flexible frames (as opposed to frequent frames) and their distributions proved more informative in terms of their scope, (i.e. they had wider coverage than frequent frames) and led to more successful grammatical categorisation by their models; though combined frames e.g Xa + bX resulted in better performance than individual flexible frames. (p.351). Whether flexible frames are used as a more accurate source of information by children as a function of their frequency distribution is unclear, but seems plausible based on the researchers' computational modelling techniques.

Van Heugten and Johnson (2010) explored infants' head-turn responses to two types of non-adjacent dependencies in Dutch. They used corpora data to determine the input frequencies of the material presented to the infants, in order to discover whether or not infants' response patterns reflected these input frequencies. The researchers emphasized the importance of using distributional information to determine how different linguistic elements are related to one another, and further, that distributional learning abilities could be a vital tool for young infants and children as they learn to categorise words into different types (p.2).

The two types of non-adjacent dependencies scrutinized, namely *het* + noun + -*je* and *de* + noun + -*en* differ in their reliability, in that –je more consistently marks for the diminutive whilst –*en* is more multi-functional and serves as a marker for plural in the context studied, but also appears frequently in other contexts, serving different functions. The authors scrutinized child-directed speech (CDS) corpus data to determine whether this unreliability was reflected in the overall distribution of this type of non-adjacent dependency in Dutch.

The reliability of *–je* as a marker of the diminutive versus the reliability of *–en* as a plural marker, (in the corpus data), was significantly higher (99% vs. 9%). In addition, the frequency of occurrence of the dependency *het* + noun + *-je* vs. *de* + noun + *-en* indicated an advantage for the former (82% vs. 18%). Furthermore, the probability of encountering *–je* if *het* was given or vice versa, vs. the probability of encountering *–en* if *de* were given, and vice versa, again reflected a distributional advantage for the *het* + *-je* dependency vs. the *de* + *-en* dependency (p.9)

As well as the fact that *–en* is a less reliable cue for the plural, "…the distributional patterns of infants' typical input provide more reliable cues for the diminutive than for the plural dependency" (Van Heugten & Johnson, 2010, p.10). These two factors are not necessarily unrelated. Distributional patterns are bound to be determined by the nature of the linguistic material itself, and the functional reliability of a linguistic unit such as *–en* in Dutch, will ultimately affect the distribution, in that it will appear across multiple contexts, and so will be distributed more sparsely in one specific context, due to its occurrence in other contexts, (see Naigles & Hoff Ginsberg, 1998, for similar distributional effects).

Commented [s1]: Naigles and Hoff-Ginsberg paper – this has similar findings – will add this in

Ambridge, Theakston, Lieven and Tomasello (2006) have gone one step further and have suggested that learning based on distributional patterns may occur not only based on the distribution of cues within the linguistic input but also by the distribution of that input across time. They observed this effect in a controlled study in which English-speaking children were exposed to multiple exemplars of a certain type of construction (namely, an object-cleft construction) in which the structure remained consistent, but the content words changed from trial to trial. Children were exposed to various exemplars with this format all at once, or distributed in pairs across several different points in time, or distributed individually at different time points.

Children who were exposed to completely distributed or partially distributed (paired) input were more productive in the use of the target construction in elicited trials. Significant differences between the pairs distributed condition and distributed condition were not found. The authors take from this that it must be the spacing of the input that is at the root of the benefit, and not the amount of material that was presented at each point in time. It seems then that the key is "…not the number of presentations per se, but the number of different days (or perhaps, sittings) on which at least one presentation is given" (Ambridge et al., 2006, p.187).

The latter point made by Ambridge et al. does not sound unlike a real-life situation, whereby a child will hear the same word/the same grammatical construction/the same sentence structure many times, but in different contexts, and from different people. Their task is to decipher the common element in these distributed linguistic events and realise that they share a linguistic feature, and identify the function of that feature.

It seems logical that children respond well to input that is distributed in a way that resembles a real linguistic situation, and that their learning strategy is shaped to the nature of the input they receive. In addition, the finding that children did not respond as well to massed input is not surprising if one considers that there are limits to a young child's processing abilities, and that being presented with less material enables children to pay attention to and identify specific elements of that material more easily.

In light of such findings, Gathercole and Hoff (2007) have postulated that language acquisition can be viewed as a pattern-extraction process, whereby the structure of a language, and the cues within that structure are extracted directly from the input. Essentially, input serves as "...data for distributional learning." (Gathercole & Hoff, 2007, p.111) Constructivist accounts can allow for the so-called "poverty of the stimulus argument", as these accounts do not deny that language is complex, and that the amount of linguistic input that a child receives is overwhelming in its volume and unstructured in its presentation.

However, constructivist approaches do offer an alternative, and plausible way as to which children are able to cope with this input. Children may derive meaning from input via selective attention, in which they extract patterns and contrasts via the distribution of features in the input. Logically, a child cannot entertain all the possible associations that could be derived from the input, or else their task would be immense. Instead, the child attends to and identifies only the connections that they need to fulfil their own, or understand others', communicative intentions.

In line with these theories, a large body of research evidence has grown in support of more input-driven approaches to language acquisition. Input effects have been shown across a wide variety of linguistic domains from verb acquisition (Naigles & Hoff-Ginsberg, 1995, 1998; Tardif, Gelman & Xu, 1996; Tardif 1996; Choi & Gopnik, 1995; Choi, 1999; Tardif, Shatz & Naigles, 1997) to acquisition of inflection (Hsieh, Leonard & Swanson, 1999 to adjective acquisition (Blackwell, 2005). In all cases, patterns in the adult input correlate strongly with patterns in children's responses. In addition, cross-linguistic differences in acquisition have been shown to reflect differing input patterns in the ambient language (Tardif, Shatz & Naigles,1997; Gelman &Tardif 1998; Choi & Gopnik, 1995).

2.4 Frequency

Item Frequency.

Related to this notion of distributed information as a source of linguistic knowledge, is the frequency with which such distributional patterns occur. Various researchers have argued for the need of a “critical mass” of exposure to a given linguistic construct to ensure full acquisition, and that this critical mass functions in relation to the frequency with which a child needs to be exposed to given linguistic structures or constructions (Gathercole &Hoff, 2007; Schwartz, Kozminsky & Leikin, 2009; Oller & Eilers, 2002; Gathercole, 2007). Essentially, a child must consolidate a large enough body of information in order to be able to detect patterns within that mass of information, and this is mediated by the frequency with which a given linguistic representation is presented.

Some researchers suggest that item frequency can function as a mediator for representational strength (e.g. Lieven, 2010; Bates & MacWhinney, 1989). In Bates and MacWhinney’s (1989) Competition Model framework, linguistic performance is determined by various interacting factors that are determined by frequencies of individual linguistic items. Among the definitions of the model is “cue strength.” This definition of cue strength is defined partly in terms of the frequency of a given cue or representation in a given task domain (pg. 164). That is, the more often an item is heard in the input in a given context, the stronger that representation (i.e. the form and its associated function) of that item becomes. They further elaborate that the strength of a form is "…a function of the relative validity or information value of those cues in each language" (pg. 167). This information value will relate to the meaning associated with the form-function mapping, and its importance on a communicative basis in the real world.

Similarly, Clahsen and Neubauer (2010), in their study of language processing in adult L1 and L2 speakers of German, suggest that higher item frequencies assist storage and memorisation of forms, and as such frequency mediates processing costs of accessing a given representation, as it is more likely to be pre-stored in memory (pg.2628). Clahsen and Neubauer based this idea on findings that both L1 and L2 speakers of German demonstrated slower reaction times in a lexical decision task on items with lower surface frequencies than on items with higher surface frequencies. By surface frequencies they referred to the frequency of the whole word representations as opposed to the frequency of the sub-parts of the word, (e.g. individual morphemes).

Further, Abbot-Smith and Tomasello (2010) suggest that both adults and children may store "actual exemplars" in memory, based on previous language exposure; and that such a mechanism may account for how lexically based learning may play a role at a more abstract level (e.g. grammatical processing (pg.80)), as stored exemplars of specific lexical items could be used to generalize to new grammatically and functionally identical words.

Commented [s2]: Could this apply to mutated forms of nouns and adjectives perhaps??

Clahsen and colleagues (2010) further suggest that the presence of surface frequency effects may be indicative of processing at a whole-word level, as opposed to decomposition of the input via segmental parsing (pg. 2631). These findings are most consistent with an usage-based account of language acquisition, whereby constructions may initially be acquired on a lexical item-by-item basis, before sufficient exposure to lexical items of the same syntactic category results in the acquisition of a more general, functional category (c.f. Tomasello, 2003).

In support, Largy, Cousin, Bryant and Fayol (2007) showed how in a controlled experiment, more frequent exposure to individual plural and singular nouns in training sessions directly predicted earlier production of these forms in later testing phases. In French, the plural ending –*s* is often not phonologically realised, as such children struggle to acquire the appropriate spellings for singular and plural nouns. Children were trained to write highly uncommon French nouns either in singular form, or in plural form. Some words were trained over multiple sessions, others in only one training session.

It was discovered that children wrote both singular and plural forms more successfully when they had undergone more frequent exposure to these words in training (i.e. training with multiple sessions as opposed to one session). From this, it seems that these children were storing these nouns as whole forms as opposed to parsing them on a rule-based basis into separate morphological components. If the latter had been the case, then the pattern for plurals versus singular nouns should have been detected in both the frequent and infrequent training procedures. Instead, what the results seem to suggest is an early reliance on lexical learning based on whole-form storage in memory, and only later, when sufficient exposure to numerous nouns has occurred, can the child pick out the rule from the input and apply it productively.

Abbot-Smith and Tomasello (2010), have postulated a role of item frequency in the acquisition of verbs. In this study, they explored the role of frequency and semantic analogy in children's acquisition of a "miniature language". By semantic analogy, they refer to the semantics of a grammatical category in terms of its real world function. For example, some verbs involve a transfer of something from one person or thing to another person or thing (see Tomasello, 2003). Young German-speaking children were exposed to a controlled snapshot of English – namely a small sub-set of verbs of two types – motion verbs and psychological state verbs. The frequency with which each verb was presented to children in training phases was carefully manipulated so that certain verbs were presented significantly more often.

Results indicated a role of frequency, as the more frequent verbs were produced and comprehended significantly better compared to lower frequency words. However, some items that shared the same frequency showed varied levels of successful acquisition in the children, seemingly indicating lexically specific effects that may be influenced by something other than frequency, though the researchers express uncertainty as to what this other factor may be (pg. 93). In terms of the role of semantic analogy, the different semantic classes of verbs seemingly did not affect children's responses (i.e. children seemingly treated the two types of semantic classes of verbs – motion verbs vs. psychological state verbs indiscriminately, although the experimenters suggested this may in part due to a lack of understanding on the part of the children of the clear semantic representations of the words (as judged by a post-test translation procedure).

Further evidence from grammaticality judgement tasks and from experimental studies of children's productive language performance, points in the direction of input frequency effects. The former evidence illustrates performance variability across items which were grammatically, syntactically and even semantically matched (c.f. the prototypical example of *He disappeared it vs. *He vanished it), but varied in their input frequency (Theakston, 2004; Ambridge, Pine, Rowland & Young, 2008), while the latter evidence illustrates better performance for items with higher frequencies, (Brandt, Lieven & Tomasello, 2010), and even for items that shared semantic and formal properties with high frequency items (see Brandt, Kidd, Lieven and Tomasello, 2009).

Commented [s3]: I have seen this example in various places, but where does it originate from? Do I need to reference the first paper that it featured in?

Further, Matthews, Lieven, Theakston and Tomasello (2007) demonstrated effects of word frequency in a group of French-speaking children's correction of weird word orders. Corrections to canonical word order were most consistent for the high frequency words, suggesting that frequency of individual lexical items is important in establishing early "…lexically specific representations" (pg. 393), that later become abstracted into more general grammatical constructions of a more functional nature.

With regards to item frequency, Lieven and Tomasello (2008) importantly distinguish between token frequency – literally the number of times a given linguistic item appears in the child's input – and type frequency – the number of different items that appear in the same functional "slot". These frequency types interact with one another, and contribute differently to the acquisition process. High token frequencies encourage entrenchment of forms – resulting in *frozen forms* such as "Lemme see", whereby parsing of the different elements of the construction is delayed/thwarted by the strength of its wholistic representation (Lieven & Tomasello, 2008, Lieven, 2010; Matthews et al. 2005).

Countering the effects of token frequencies, high type frequencies promote abstraction and productivity. The occurrence of many items featuring in the same "slot" and fulfilling the same function gives the child the opportunity to decipher what these items have in common and identify the "slot" that they fill. Once identification of the function of the slot occurs, the child may insert new items into the slot and utilise that particular slot productively (Tomasello, 2003).

Evidence for the role of token frequency is shown in Goodman Dale and Li's (2008) study, in which children acquired nouns that consistently, and frequently, appeared in the same types of linguistic frames earlier, seemingly as a result of their function being more easily identifiable. Tardif et al. (1997) also highlight the importance of taking both token and type frequencies into account as both variables correlated with children's response patterns for verb and noun acquisition. Token and type frequencies instil different results, and the interaction of the two seems to play a significant role in determining acquisition patterns.

Various studies have found evidence for item frequency effects derived from child-directed speech (CDS). Goodman et al. (2008) explored the role of CDS in vocabulary development, and more specifically, whether each word's item frequency in CDS was a predictor of its subsequent acquisition. Strong correlations between individual word frequency in multiple corpora and individual word acquisition were evident, and this was most so in the corpus that was made up of CDS as opposed to adult-to-adult speech. They also noted a developmental trend, in that frequency effects were more evident when children were acquiring their first 100 words, as opposed to when they had already acquired 100 words.

The researchers suggested that once a child has acquired 100 words or more, the language acquisition process might have stepped up a notch, as the child's processing capabilities increase. Consequently, one factor, such as frequency, may not play such a large role (p.525). In addition, perhaps because children are bombarded with more and more nouns as their linguistic experience progresses (on top of the ones that they have already acquired) and as they become able to process more words, they may become somewhat saturated with so many words, and so an individual word must be that much more frequent in order to "stand out" and be able to promote its own earlier acquisition.

Veneziano and Parisse's (2010) study explored the role of CDS on verb acquisition in French. In addition to this they assessed the role of a concept they refer to as "Conversational Contingencies" (p.289). These Conversational Contingencies (CCs) are the contexts in which specific constructs are spoken by both the child and the adult. That is, "…when the child's verbal form preceded, followed or both preceded and followed the adult's production of that verb" (p.288). These CCs operate on a real-time basis, taking the communicative context into consideration in each case, much like Tomasello's (2003) proposed "joint attentional frames", whereby adult and child share attention and the child can derive meaning of linguistic forms based on the communicative context.

Two children's verbal production of sub-sets of verb forms, each of which shared a phonological form, but had multiple morphological forms, was assessed in relation to the occurrence of these verb forms in CDS overall and in CCs specifically. Results reflected an effect of both the item frequency of forms in CDS and the frequency of CCs, with each factor accounting for a large amount of the variation in the verb forms produced by the children.

The authors also mention that the pattern of production of verb forms differed significantly in a corpus of CDS when compared to a corpus of adult-to-adult speech, and that the former accounted far better for the children's variation than the latter. This highlights the importance of selecting appropriate sources of information with which to make comparisons. CDS is intuitively different from adult-directed speech in terms of the amount of content, and the nature of the content in terms of complexity, variation (e.g. number of word categories), its distribution, etc. The researchers in this study for example point out that there was a reduction in the number of different morphophonological forms produced by adults in CDS as opposed to in adult-directed speech (p.298), (see also Lee, Davis & MacNeilage, 2008 – for evidence of differences in adult-directed vs. child-directed phonology).

Crucially, CCs seemed to account for a larger proportion of the children's responses than CDS, and the researchers surmised from this that CCs "…provide temporally close reinforcing relations at a time when the child's attention is focused on the verb form either because he/she has just uttered it or because he/she is in the process of uttering it after the partner's production.." (p.307). Essentially, CCs have high communicative salience, and as such, the content within these are processed more accurately and with more ease. The role of salience will be returned to in a later section of this chapter, but here it is simply noted that these CCs form part of the input that a given child receives, and once again reflect the role of input on the timing, pace and trajectory of language acquisition.

Hsieh, Leonard and Swanson (1999) noted that the pattern of acquisition of two different types of English inflections correlated highly with patterns of occurrence of these inflections in child-directed speech, again highlighting the importance of child-directed speech as an important source of information for child language learners. Cameron-Faulkner, Lieven and Tomasello (2003) observed effects of token frequencies in mothers' speech to their children, in that those forms that had the highest token frequencies in mothers' speech emerged first in their children's speech, while Matthews, Lieven, Theakston and Tomasello (2007) observed lower rates of object realisations in French-speaking children when compared to English-speaking children. This pattern was consistent with patterns of object realisation in CDS of French-speaking versus English-speaking adults.

Input Frequency.

Frequency may also be viewed in terms of overall input frequency also, (i.e. the overall frequency with which a child is exposed to language). Gathercole and Hoff (2007) in their review of the role of input on language acquisition summarised the ways in which input frequency can be influential:

- more input means more occurrence of the same structure which will promote learning and storage of forms – i.e. a given distributional relation of elements will be presented to the child more often,
- more input means presentation of structures in more distinct contexts – allowing the child to detect commonalities in items appearing in similar contexts and identify their function

- more input means both of the processes mentioned above can operate together to build up knowledge of both tokens (individual items) and types (items with a common function) which collectively build up a mass of linguistic knowledge

The overall quantity and frequency of the input is of particular importance when one considers the case of bilingual language acquisition. The relative input received in each of a bilingual child's two languages is of vital importance in terms of how each of the languages will develop in relation to one another, be it in terms of the speed of acquisition, or the pattern(s) and trajectory of acquisition.

Various researchers have shown that bilinguals show different acquisition rates when compared to monolingual norms (Thomas & Gathercole, 2007; Nicoladis, Palmer & Matentette, 2007; Paradis, Nicoladis, Crago & Genesee, 2010, Blom, 2010), and it has been hypothesised that these differences in rate of acquisition could be a direct by-product of bilingualism, in that bilinguals receive less input in each of their languages than age-matched monolinguals (Gathercole, 2007; Austin, 2009).

Oller and Eilers (2002) have referred to this latter phenomenon as the "distributed characteristic" of bilingualism, whereby a child's knowledge of language is initially split or distributed across their two languages. The distribution of input across the languages will not necessarily be equal in each of a bilingual's two languages, however. This can sometimes result in a bilingual having a dominant language, thanks to receiving more input in that language. Evidence of bilinguals performing better in one language when compared to their other language has been well-documented across a variety of bilingual language pairings (for examples see Paradis, Nicoladis & Crago, 2007; Paradis, Nicoladis, Crago & Genesee, 2010.

In addition, bilinguals who share the same language pairing, but vary in their levels of exposure to each of their languages show differences in performance (Paradis, 2010; Sorace & Serratrice, 2009). Furthermore, there is also evidence showing that language development of bilingual children in relation to monolingual children is often at an equivalent level in their dominant language, but there is evidence of a comparable delay in their other language (Blom, 2010; Paradis, Nicoladis, Crago & Genesee, 2010).

Other research has shown that the relative status of each of a bilingual's two languages in the general community can also have an impact on the acquisition process, with delays being observed in the minority language, but not in the majority language (Gathercole, 2007). Differences have even been observed across different minority languages in the same community context based on the varying levels of prestige these minority languages possess in society (Scheele, Leseman & Mayo (2010). Both of these factors are related to input directly, in that a language with high prestige, or a majority language, (in fact, these are often one and the same), is generally more present in the community, and as such a bilingual child is likely to be exposed to as much, if not more of the majority/high prestige language than the minority/low prestige language (Scheele at al., 2010).

Paradis et al.'s (2010) study also showed the importance of taking all input sources into account when assessing a bilingual's relative dominance. They discovered an effect of reduced input for irregular English past tense forms in English-dominant bilinguals in relation to English monolinguals, but French-dominant bilinguals' performance for past tense irregular forms in French was not significantly different from their French monolingual peers. The authors argue that these differences manifested due to the fact that past tense irregulars in French have higher type frequencies than past tense irregulars in English due to "families" of French irregulars that share syntactic and phonological overlap. English irregulars show a comparable lack of such families.

However, it is important to note that all of the children in the study attended French-medium schools, and as such one could argue that the French-dominant bilinguals' levels of exposure to French was more equivalent to monolingual French speakers than the English-dominant bilinguals level of exposure was to English monolinguals (see also Hoff (2006) for a review of multiple factors than have been shown to play a role in the amount and kind of input children are exposed to, and are worth taking into account when assessing a bilingual's language dominance).

Blom (2010) explored the role of the relative input of each of a bilingual's two languages in a population of Turkish-Dutch bilingual children. The bilingual children studied varied in their relative exposure to Dutch and Turkish respectively. Dutch-dominant children had significantly higher mean length of utterance scores (MLUs), and were much more developed in their acquisition of finiteness in Dutch than Turkish-dominant children. They concluded that the level of input received in Dutch determined the speed with which Dutch was acquired.

However, differences across children were only evident between children with very pronounced differences in their input levels for Dutch. They surmised, "…only clearly reduced input will result in a protracted development" (pg.439). Again, it is important to assess language dominance in terms of the relative amount of exposure to each language both within and across bilingual children. DeHouwer (1995) has even suggested that being bilingual does not necessarily mean that a bilingual child will receive less exposure to each language when compared to a monolingual speaker exposed to one language. Rather, given the right circumstances, a bilingual child can be exposed to as much (if not more) input, and more varied communicative experiences in both their languages than monolingual children who are exposed to just one language.

The quantity and quality of language exposure received by a bilingual or monolingual child will of course rely on various factors. Hoff (2006) reviewed findings of the role of differing social contexts and the potential way(s) in which they could influence language development based on the impact they had on language exposure. They highlight the importance of the availability of communicative interaction and language models, based on evidence of incomplete acquisition of language in hearing children of deaf parents (Goldin-Meadow, 2003) and based on the landmark studies of socially isolated children who did not acquire language, such as Genie (Curtiss, 1977) and Aveyron (Lane, 1976). In these cases, communicative and/or language models were not available.

Research evidence from numerous sources investigating monolingual language development (Hoff-Ginsberg, 1991, 1998; Hoff 2003b; Hoff & Naigles, 2002; Hart & Risley, 1995; Rowe, 2008) all point to the conclusion that socio-economic status (SES) has an impact on language development due to the effect it has on the two key variables mentioned above. This is because the above investigations have shown how parents' approaches to communicating with their children seem to differ across SES groups. Hoff (2006) found the following:

consistent evidence, across cultures, [suggests] that higher SES mothers talk more to their children than do lower SES mothers, that the speech of higher SES mothers more frequently is uttered for the purpose of eliciting conversation than the speech of lower SES mothers, and that the speech of lower SES mothers more frequently is uttered for the purpose of directing their children's behaviour than the speech of higher SES mothers (p.6).

Similarly, Rowe (2008) showed in her study of parental styles in child-directed speech, that parents of a higher SES were generally more knowledgeable about child language development, (as assessed by a battery called KIDI – Knowledge of Infant Development Index), and as a consequence of this, the speech high SES parents directed at their children was found to be more frequent, and more varied than parents of lower SES. This resulted in more advanced language development in children from high SES families than age-matched children from lower SES families.

Collectively, what previous research tells us is that considering as many of the input sources available to the children as possible can provide important information regarding the collective input that a given child receives. In a bilingual context, this is especially important for determining the level of input for each of a bilingual child's languages.

Bearing in mind all the results showing evidence of differences in the rate of bilingual language acquisition versus monolingual language acquisition, it has generally not been discovered that the performance of bilinguals in relation to their monolingual peers is qualitatively different in terms of the general patterns of development (Nicoladis, Rose & Foursha-Stevenson, 2010; Schwartz et al., 2009; Muller & Hulk, 2001; De Houwer, 1990; Paradis & Genesee, 1996; Gathercole, 2007).

Moreover, any differences observed in terms of slight delays in young bilinguals compared to monolinguals have been observed to be neutralised in slightly older bilingual children, as by that point the have attained the “critical mass” of input required to achieve equivalent proficiency levels (Gathercole, 2007; Oller & Eilers, 2002).

Collectively, the above results suggest that it is differences in the overall quantity of input at the macro level that are largely at the root of child monolingual-bilingual differences, and that these differences in the input are mediated at the micro level (i.e. at the level of individual lexical items or individual constructions) by type and token frequency effects. Moreover, these input differences, and the differences in pace of acquisition that they may cause generally do not seem to be pervasive beyond a certain point (i.e. a certain age).

In terms of specific properties of the input, although there is a large body of research evidence that points in the direction of frequency distributions in the input as a significant factors in child language acquisition, the extent to which overall input frequency and item frequencies plays a role is still a topic of much debate. There is research evidence that seems to reflect a much smaller role of frequency in monolingual acquisition; with examples of similar rates of target production in constructs with different frequencies (Westergaard & Bentzen, 2007; Anderssen & Westergaard, 2010) and different success rates for constructs with similar frequencies (Westergaard & Bentzen, 2007).

Even those who state, based on research evidence, that frequency *does* play a significant role, do not postulate that frequency is the *only* factor to be considered. Lieven (2010) for example, stresses that:

…frequency is not the only factor on which the strength of a particular representation depends, and in addition, given the highly premature nature of our understanding of language comprehension and production, we often do not know the level of analysis appropriate for a frequency-based prediction. (p.2546)

Similarly, Clahsen and Neubauer (2010) state that "…frequency effects **by themselves** [emphasis added] do not necessarily tell us much about lexical or grammatical organization…" (p.2635), nor about the language acquisition process in general. Frequency is a factor to be considered, definitely, but it's certainly not the only factor worth taking into consideration: "…frequency is clearly only part of the story…the way it interacts with other variables needs to be further explored" (Goodman et al., 2008).

In sum, researchers overall suggest that frequency should be considered as a contributing variable, interacting with various other factors. Anderssen and Westergaard stated that:

A lack of frequency does not in itself seem to be able to cause non-target-consistent production. Nevertheless…frequency has been argued to have an effect on acquisition together with other factors such as economy and complexity, in that lack of input frequency may make errors persist longer in the child grammar. (pg.2570)

The take home message is that we cannot completely disregard item frequency nor overall input frequency, particularly in CDS. It seems that frequency plays a role somehow, but not enough is yet known about how this influence is exerted in the acquisition process and to what extent. There is also the added problem of defining the level of granularity at which one searches for frequency effects (c.f. Lieven, 2010). Overall, frequency can be seen as an important mediating factor, in both monolingual and bilingual language acquisition, in that it can for example; affect the availability of linguistic cues (see Gathercole & Hoff, 2007), but it is not the only factor worth considering.

2.5 Semantics, Pragmatics and the Role of the Communicative Context

Various studies have shown evidence for frequency as a contributing variable, interacting with factors such as morphological complexity, salience, semantics and syntactic diversity (Tardif et al. 1997; Naigles & Hoff-Ginsberg, 1998; Blackwell; 2005). Goodman, Dale & Li (2008) suggest a role of "semantic concreteness" in acquisition of language, in that linguistic items that are conceptually clearer or easier to comprehend are likely to be acquired earlier, regardless of their relative frequency (pg.527)

Similarly, various findings in the monolingual literature have shown how the communicative context of an adult-child language exchange impacts on the way in which a child will perceive the input and subsequently respond to it (Matthews, Theakston, Lieven & Tomasello, 2006; O'Neill, 1996). For example, a recent study by Salomo, Graf, Lieven and Tomasello (2010) illustrated the importance of communicative context by exploring the role of perceptual availability and discourse contexts on 3- and 4-year-old children's responses to questions. The researchers manipulated multiple experimental scenarios, in which the experimenter asking the question either could or could not see the video scenario the child was asked to describe (perceptual availability vs. no perceptual availability), and whether or not the experimenter had heard previous sentences referring to the topic of discussion or not (shared vs. unshared discourse context).

Results showed that children used much more specific language, (i.e. more use of lexical nouns), in the condition in which the adult could not see the video scenario the child described, but they had heard previous reference to the scene by the other experimenter in a preceding sentence. In contrast, use of lexical nouns was much lower in scenarios in which the experimenter could see the events on-screen described by the child but had not been present when the other experimenter had just uttered a sentence describing the scene (i.e. previously unshared discourse context).

From this the researchers surmised that the perceptual availability aspect is of more importance to a young child in establishing their knowledge of what other interlocutors know about the linguistic context at hand, illustrating the importance of joint attention in children's use and understanding of language (p.11). What studies such as this one show, is that the perceived knowledge on the child part's of the adult's communicative intentions have a significant impact on the child's use of language, quite apart from influences such as item frequency.

Commented [s4]: (MORE ON THE ROLE OF SEMANTICS AND PRAGMATICS)
Valian and Casey – nature of the learning context;
Naigles and Hoff-Ginsberg – Noun semantics,
Blackwell – adjetives and semantics

2.6 Complexity, Consistency, and Reliability

Bates and MacWhinney's (1989) competition model touches upon various features of language structure that they consider play a role in language performance and acquisition. Their framework is centred on the concept of cues, in that a given form-function mapping is a cue to a given linguistic meaning or representation. They define cues based on multiple characteristics, including:

- Cue availability --> this refers to the number of times a cue is available in a given task domain
- Cue reliability --> this refers to how many times a cue's occurrence leads to the correct conclusion – i.e. how often it marks for the target concept
- Cue validity --> "Validity is defined as the product of availability times reliability" (pg. 164)
- Cue strength --> this is defined as being calculated in terms of cue validity and its relation to task frequency

Which factors contribute to determining complexity?

The above characteristics of linguistic cues, as outline by Bates and MacWhinney, collectively contribute to a definition of what constitutes language complexity. A linguistic feature that has low cue availability, low cue reliability and low cue validity will in turn be considered to be complex. Intuitively, a cue that is less available can be more complex to identify and subsequently acquire. However, on a different level, such a cue may not be so complex, i.e. it may be presented in the same context, in the same form at all times (i.e. a one-to-one form function mapping that has high cue reliability). However, the lack of exposure to this cue (i.e its low cue availability), reduces the opportunity to learn its functional significance, and undercuts the simplicity of the form-function mapping.

In a similar vein, Kusters (2008), McWhorter (2008), Miestamo (2008), and Fenk-Ozclon and Fenk (2008) discuss various features of language that contribute to determining the complexity of a given linguistic form. The definitions they employ are outlined in *Table 2.1*, below. The table outlines multiple ways in which a linguistic construction may be considered to be complex. These factors range from the level of consistency in a given system, to the number of exceptions to a given rule or set of rules, to the number of components that make up the construction.

Both Fenk-Ozclon and Fenk (2008), and Dammel and Kurscher (2008) refer to complexity in terms of the number of components of a system. Dammel and Kurschner use as an example the number of allomorphs for plural marking. A higher number of plural allomorphs would be more complex, as the language learner would need to identify the common function of a whole host of allomorphs, and this could only be achieved by observing and identifying the distribution of these allomorphs and identifying their common slot (e.g. as a suffix added to singular nouns), and in turn their common function.

They further elaborate on the fact that features of the system can in themselves vary in their complexity. For example, plural marking via suffixation is more identifiable than plural marking based on stem changes, especially if those stem changes vary depending on the singular noun. Plural suffixes would be considered to be both more available as cues, but also more consistent in terms of the variety of the forms they take.

Dammel and Kurschner (2008) refer to the concept of fusion, whereby a feature that encodes for multiple linguistic concepts. For example, a morpheme that encoded for gender, number and case, has a high level of fusion, and by definition is considered to be a more complex morpheme than a morpheme that marks for number only.

Definitions of complexity.

In a collection of papers edited by Miestamo, Sinnemaki, and Karlsson (2008) addressing linguistic complexity, various discussions regarding types and levels of complexity, and their definitions, are discussed. Kusters (2008) distinguishes between “absolute complexity” and “relative complexity”. Absolute complexity refers to the properties of the language itself, encompassing various types of structural complexities (e.g. morphosyntactic complexity). Relative complexity, by Kusters’ definition, refers to the acquisition process of the language learner in terms of what they find to be complex and more difficult to acquire.

As such, in the Competition Model framework, a cue that is less available may have high relative complexity, in that its acquisition is a complex task for the language learner, but at an absolute level, the structure of the cue and the way in which it’s expressed may not be so complex, (e.g. the cue may have a clear and consistent form-function mapping).

Miestamo (2008) uses alternative terms for the same concepts outlined by Kusters, whereby “complexity” refers to the language structure and “cost/difficulty” refers to the learner’s task of acquiring a given language feature. Dahl (2008) elaborates on Kusters’ absolute complexity definition by stating that absolute complexity is made up of two sub-types of complexity:

Table 2.1.

Definitions of factors that contribute to a calculation of relative complexity

Kusters (2008)	**McWhorter (2008)**	**Miestamo (2008)** ***Fenk-Ozclon and Fenk (2008)***
Relative Economy	**Overspecification**	**Fewer Distinctions Principle**
The number of categories expressing a given concept. Less categories = simpler	More rules and exceptions require more time to describe and subsequently learn	Fewer distinctions in terms of rules and their components is simpler
Transparency	**Structural Elaboration**	**One-Meaning One-Form Principle**
The number of deviations and exceptions from one-to-one mappings	Literally, the number of rules	For absolute complexity, a one-to-one mapping is least complex
Consistency	**Irregularity**	**Number of components**
In terms of how the system is ordered, and the consistency of its relation to other linguistic components	Referring to the number of exceptions to the rule, which deviate from the regular pattern	If the number of components is higher, the level of complexity of the linguistic construct is higher

- System complexity --> For example, the number of definite articles in a language’s determiner system and the number of distinctions they make (e.g. for number, case, gender, etc)

- Structural complexity --> A longer sentence is structurally more complex than a shorter sentence due to a more complex syntactic structure

(Adapted from Dahl, 2008)

Alternatively, one may refer to complexity in terms of the way in which it operates across the different linguistic domains (e.g. something may be simple at a phonology level, but complex at the syntax level, or vice versa). Or, there may be aspects of the same linguistic domain that are more or less complex. Kusters (2008) uses as an example a phonological distinction which may be functionally clear to the language learner, but may be highly complex at an articulatory level. For example, one of the phonemes that features in the distinction may be beyond the current articulatory ability of the child (i.e. the language learner), but they are still able to identify the distinction in adult speech. This would be an example of a feature that has low absolute complexity, but high relative complexity.

Riddle (2008) postulates that complexity can be defined in terms of processing complexity. That is, a feature with high memory demands, which would relate to performance difficulty, could for example apply to having to acquire a given feature that is expressed by numerous exceptions. Such a feature requires more processing and memory resources due to having to learn various individual exceptions to the rule. They also refer to perceptual complexity, in that a feature can be marked in a way that is difficult to describe, and in turn is difficult to perceive.

Riddle (2008) uses as a point of reference, the article system in English, and its acquisition in terms of when the presence or absence of an article is required. This system involves a complex set of exceptions, and the ways in which articles are pronounced vary under different conditions. In both cases, a description of the exception and patterns to these rules is quite long, and means that their representations are complex.

Miestamo (2008) discusses how absolute complexity (i.e. complexity related to language structure) and relative complexity (i.e. complexity for the language learner) operate in relation to one another, and stated that:

…structures that are easy and efficient (in terms of their structure) tend to be preferred in performance and they also find their way more often to grammatical convention…perhaps (absolute) simplicity does not always mean ease of processing, but surely (absolute) complexity does in many cases add to processing difficulty." (p. 37-38)

Moreover, Miestamo addresses the option of judging the complexity of a language as a whole (global complexity) versus the option of judging the complexity of a specific aspect of a given language (local complexity). They argue that assessing local complexity allows for direct comparison of the same structures in different languages, leading to more objective study of which language is the most complex, at least in terms of the linguistic aspect under scrutiny.

Complexity in acquisition.

Research evidence assessing complexity has tended to focus on local complexity of specific language structures. The results of these studies generally seem to indicate that linguistic features with high absolute complexity tend to be acquired later than features with lower levels of complexity, according to the definitions of complexity outlined above. Moreover, a host of studies on bilingual acquisition allow direct comparisons of structure acquisition in both a bilingual's languages.

Matthews et al.'s (2007) study of word order acquisition in French showed how word order is acquired later in French-speaking children, than in English-speaking children. Matthews et al. (2007) argued that this can be attributed to the inconsistency of objects in French, due to the fact that object clitics and object pronouns do not overlap in terms of their position in relation to verbs, leading to variation in the way in which objects are marked, and the position of those object markers.

Slobin (1973) discusses studies by Mikes (1967) and Mikes and Vlahovic, (1966) that observed the acquisition of locative case marking in bilingual Serbo-Croatian/Hungarian bilingual children. These two studies found that at the early age of 2, bilingual children were able to use locative inflections productively in Hungarian, but were only just beginning to acquire locative expressions in their other language, Serbo-Croatian. Slobin postulated that these research findings could be interpreted based on the formal linguistic complexity of locative expression in each of the two languages.

A description of the way in which locatives are expressed in the two languages demonstrates how the system of locative expression for Serbo-Croation is more complex at the formal grammar level than Hungarian. Hungarian marks for locative case via noun inflections only. Serbo-Croation however, marks via prepositions. It has noun inflections to encode direction and position, and "…every prepositions governs a noun inflection…furthermore, the particular phonological realization of a given inflection is determined by the gender and by the final sound of each particular noun" (Slobin, 1973, p. 188).

Essentially, locative expression in Hungarian is marked via one method (inflection), in one place (placed at the end of nouns) and consistently expresses the same concepts - i.e. it is functionally consistent. For Serbo-Croatian, locative expression is marked via various forms, which do not always express the same thing (e.g. some inflections express a distinction between position and direction and others don't). These observations led Slobin to propose that word final inflections in Hungarian are acquired early due to their consistency, which in turn reduces the complexity.

Language complexity may also be reflected in those forms that adult L2 speakers struggle to acquire. Davydova (2011) discussed the complexity of the present perfect in English, and the difficulty with which L2 English speakers of various language backgrounds acquired this grammatical feature of English. L1 speakers of Russian, German, and Hindi, (all of whom were mid-stage L2 learners of English), showed similar patterns of use of the English present perfect, and were equivalent in terms of their frequency of use. Davydova argued that this common acquisition pattern in a heterogeneous set of L2ers derived from the complexity of the present perfect in English.

She defined its complexity in terms of it being a compound expression as opposed to being expressed by a single lexical item in the vein of Croft (1990); and outlined the semantic complexity of the present perfect, in that it can serve four different semantic functions that vary in their temporal relations – (e.g. "He has broken his arm." vs. "I have lived in Hamburg since 2001" (Davydova, 2011, pg.1-2)).

Due to this complexity, its acquisition is late, and its pattern of acquisition seems to be shaped by its complexity.

Gathercole (2007) in her study of Spanish-English bilinguals in Miami and Welsh-English bilinguals in North Wales, also observed effects of structure complexity on acquisition. For Welsh, children's production of various forms and the acquisition patterns of those forms reflected the relative opacity of forms (by this Gathercole refers to the relative opacity of each form-function mapping). Essentially, those items with the most opaque form-function mappings were acquired latest. Moreover, in the Spanish-English bilinguals, *that*-trace acquisition was earlier for Spanish than for English in all bilingual groups (regardless of the relative amount of exposure to Spanish and English). Gathercole suggests that this may be "…due to the opacity of the obligatory versus optional use of complementizer *that* in English, in contrast to the transparent use of *que* in Spanish." (p. 233). That's is, the form-function mapping for "that" in English is far more opaque than that of *que* in Spanish.

2.7 Processing Constraints

A high level of complexity can also have an impact at the processing level. Anderssen and Westergaard (2010), in their study of Norwegian monolingual child language acquisition, argued for the influence of a factor they refer to as "the principle of economy" (pg.2586). By this they referred to children's tendency to select the less complex linguistic string, seemingly regardless of the individual input frequency of each of the options available. In this particular case, complexity refers to the level of adaptation and information integration required to achieve target language production.

This economy principle was illustrated in Norwegian-speaking children's use of Word Order (WO), in contexts where WO is variable – namely, subject placement and possessive and noun placement. Anderssen and Westergaard explored whether the most frequent WO used by Norwegian-speaking adults in child-directed speech was the most productive in these contexts. Results revealed a preference for the WO that was least frequent in the adult input. As such, the production patterns of the children did not seem to reflect the production patterns of the adults.

The researchers argued that this was "…due to a simple principle of economy in the acquisition process, preventing or delaying syntactic movement in early child language." (pg.2575). The syntactic movement they refer to is the movement of subjects from what they refer to as "low" position to "high" position. High position is considered to be the position that is filled by subjects that are "informationally and prosodically light" (pg. 2573); that is, when the information about the subject is given. When the information is not given subjects take the "low" position, as such stress is put on the subject to facilitate its identification (pg. 2578).

Children preferred to avoid syntactic movement; even when information about subjects was given. The authors argued that children avoided movement seemingly due to the complexity of this process. This complexity may have demanded a high level of processing resources, which the children at this age were yet to acquire.

Beyer and Hudson-Kam (2009) explored the acquisition of –*s* as a third person present tense marker in 6-7-year-old monolingual English speaking children. They addressed the relative strength and validity of linguistic forms as grammatical cues, and the factors that determine these properties. In English, in the particular context explored by Beyer and Hudson-Kam, *–s* marks subject, number, tense, and aspect, and as such is a “loading-bearing morpheme” (p.209) that codes for a large amount of grammatical information. As such, the task of the child - to first comprehend the functional significance of this morpheme, and then produce this morpheme in the appropriate linguistic context - is more complex at a processing level, and in turn, is a more difficult goal to achieve.

A global comprehension task and an online eye-tracking task were used to tap into children’s comprehension of *–s* as a tense marker versus their comprehension of *–ed* as a past tense marker. In the global comprehension task 7-year-olds did not show significant differences in their comprehension of the two grammatical morphemes in test conditions. The 6-year-olds, however, struggled with correctly interpreting the *–s* marker and selecting the appropriate corresponding image. The authors suggested that the 6-year-olds’ lack of comprehension of *–s* was due to the weakness of *–s* as a cue, allowed by its multiple form-function mappings. They further postulated that due to its complexity as a cue, *-s* requires more cognitive resources, (e.g. on-line processing skills), to decode its functional significance, and that at age 6, children lack the cognitive maturity needed to successfully decipher its various form-function mappings (pg. 214).

Results from the online eye-tracking task, however, indicated that the 6-year-olds did seem to be interpreting the verb + *-s* information in the same way as the 7-year-olds. After the point of disambiguation (POD), when the *–s* morpheme occurred, looks to the target increased significantly, along with the action competitor (AC) (the image where the action matched, but the tense did not), and after some time, looks to the target lasted significantly longer than gazes to the AC. This pattern applied to both 6- and 7-year-olds in trials where the target image was selected.

In trials where the non-target response was made, 6-year-olds exhibited a looking pattern in which their attention was held by the AC from the outset, and remained their main focus of attention throughout these trials. The researchers suggested "…the disambiguating *-s* information that becomes available after the POD is not strong enough a cue to drive looks away from the AC and towards the target" (p.211).

In sum, a combination of the relative complexity and opacity of *–s* as a tense marker, as well as processing limitations on the part of the 6-year-olds, which impeded their ability to switch their attention from one image (the AC) to another image (the target) when disambiguating information is provided, collectively seemed to contribute to later acquisition (see Goodman et al., 2008 for similar evidence of processing constraints).

Jacubowicz (2011) explored the acquisition of wh-questions in typically developing French speaking children and French-speaking children with SLI. They observed children's preference for producing short-distance alternatives when other long-distance wh-questions were the target forms. Jacubowicz suggests that this strategy may have been due to working memory constraints that make long-distance wh-questions difficult to achieve for young children. Another of her observations, whereby children employed a strategy dubbed "wh-copying", further supports this idea.

This strategy involved children stating the wh-form several times during the course of the full question, when only one instance of the wh-form was required for the sentence to be grammatical. This seemed to be an adaptive strategy whereby children "copied" the wh-form in order to keep its representation active in working memory.

Slobin (1973) proposed that children avoid linguistic cues that are distributed, namely: "Avoid interruption or rearrangement of linguistic units." (pg. 199). Essentially, splitting features that mark for the same linguistic concept is counter-productive at a processing level, as one is required to maintain the representation marked by the first cue during a period when other intervening material that does not mark for the same feature is being processed. Moreover, when the co-occurrence of these features occurs in such a way that other material appears between them, it is more difficult to identify the fact that these seemingly disparate features are in fact marking for the same linguistic feature. Essentially, if a feature is distributed, it is less salient and its function will be identified at a later point.

Support comes from Lieven and Tomasello (2008), who also argued that distributed constructions are more complex due to their (physically) disparate occurrence, which makes them perceptually less available, i.e. less salient. As a point of departure they compare how Turkish marks for agent and patient with dedicated morphemes on the relevant nouns, while English marks for agent-patient relations via word order. For the latter language, the cues are physically disparate, and the agent and patient are not marked by a consistent form, but rather by a consistent distribution of lexical items. For Turkish, the agent is marked by a dedicated morpheme, and it is marked locally on the agent noun.

Likewise, the patient is expressed by another dedicated morpheme that appears on the patient noun. As such, Turkish agent-patient marking is more salient due to its consistency, and its locality to nouns. Its salience also makes it easily generalisable, and this is supported by the fact that all patient nouns take the same patient morpheme, and all agent nouns take the same agent morpheme.

Hsieh, Leonard and Swanson (1999) observed how the English plural -s and the third person singular verb –s are acquired at different point in time, with the plural –s being acquired first. Based on data from various spoken English corpora, the researchers noted that plural nouns appeared in sentence-final position approximately 50% of the time (out of all occurrence of plural nouns) whereas third person verb forms appeared in word-final position in only 11% of cases (out of all occurrence of this verb type). This information is relevant to the concept of salience when considering that there is evidence to suggest that fricatives, (such as /z/), are lengthened when in word-final position (see Klatt, 1976).

Hsieh et al.'s own investigations of corpora data also revealed that the final /z/ of both plurals and third person singular verbs were longer when in sentence final position, and further that the /z/ duration was longer on average for plural forms than for verb forms in word final position, and in other positions. When sounds are lengthened, they become more identifiable, and in turn, become more salient. The researchers thus argued that plural –s is acquired earlier than third person singular verb –s due to its higher perceptual salience. Similarly, Tomasello (2006) stated how grammatical morphemes may lack salience at a phonological level when they are "…phonologically reduced, unstressed or monosyllabic" (Tomasello, 2006, p. 64). In such conditions, morphemes may get ignored or overlooked in the noise; or morphemes can be overlooked when they lack importance at a semantic level, in that the morpheme "…carries very little semantic weight." (Tomasello, 2006, p. 64).

Goodman and colleagues (2008) suggested that factors such as salience and processing load, etc may mediate and/or interact with the role of frequency (pg. 516). They suggested this based on the general observation that open class words (e.g. nouns) have lower individual frequencies than function words, and yet nouns tend to be acquired earliest by children. They argue for a role of "semantic concreteness", in that nouns are less abstract than closed class words, and as such may be easier to process and identify at the comprehension level. Nouns are also less variable in terms of the syntactic contexts in which they occur, which may add to the salience of these nouns, as their presentation is more consistent and reliable than that of closed class words, leading to a lower level of processing demands.

Salomo et al. (2010) suggested that their finding that previous discourse context did not seem to influence children's use of specific language (lexical nouns) vs. non-specific (pronoun, etc) language was due to the timing of that previous discourse context. They argued that because the context was established in a previous, separate sentence, and not as part of the question asked directly to the children, that the children could not compute the previous information and keep it in memory long enough for it to be informative in their decision making (p.12). That is, processing constraints may have stopped them from being able to use this previous discourse context to guide their language selection.

Paradis (2010) observed differences in bilingual performance across productive tasks and grammaticality judgement tasks, and suggested that this variation was a consequence of relative processing constraints of each of the task modalities. Based on Bialystok's (2001, 2007) findings that bilinguals exhibit superior executive functioning ability, particularly in their ability to focus on target information and successfully inhibit or ignore irrelevant information, (a skill that bilinguals must acquire in order to successfully manage and co-ordinate their two languages); Paradis (2010) suggested that a high level of executive functioning skill would explain why the bilinguals performed better on grammaticality judgement tasks as opposed to productive tasks. Grammaticality judgement tasks require children to use the exact skill that Bialystok argues that bilinguals have as a product of their bilingualism; as such, high levels of performance on such tasks are unsurprising as the processing demands required are likely to be well within the processing capability of the average bilingual.

The overall complexity of a given language feature can be the function of various factors. Sometimes the combined complexity of a construct due to processing constraints, salience or other such factors will be enough to undermine its high frequency, as was the case in Anderssen and Westergaard's (2010) study (see also Fotiadou & Tsimpli, 2010). Processing limitations may come into play at any level of language. On the most basic level, if a child is presented with more information that they can process, they will become selective regarding what they choose to pay attention to. Those linguistic items that are the most salient, consistent, frequent and most importantly, communicatively beneficial to the child will have precedence over other items that are less salient or less consistent. In other cases, frequencies can contribute to the relative of complexity of one feature compared to another.

In the case of bilingual acquisition, differences in age of acquisition in relation to monolingual peers may derive from differences in the level of complexity of the feature to be acquired in each language. Paradis, Nicoladis, Crago and Genesee, 2011 have shown that bilinguals show differences when compared to monolinguals for some structures, but not for others, and argue that the differences lie in the relative complexity and consistency of the structures to be acquired in each language.

This conclusion derived from the fact that bilingual-monolingual differences in their study were most pronounced for irregular past tense forms (as opposed to regular past tense forms). They suggested that, as the irregular past tense has numerous ways in which it can be marked, identifying the common function of irregular past tense forms is a complex process that demands more processing capacity and may require higher levels of exposure to the relevant language (see also Paradis, Nicoladis & Crago, 2007 and Nicoladis, Palmer & Marentette, 2007).

An important factor in the acquisition of a grammatical morpheme is its form-function mapping – a direct one-to-one mapping is high in clarity, consistency and reliability; and low in complexity; as such, the link between the form and function is more identifiable and acquired earlier, and with more ease (c.f. Tomasello, 2003). Van Heugten and Johnson (2010) noted earlier discriminative response patterns to the *–je* suffix as a diminutive marker in grammatical versus ungrammatical sentences in Dutch compared to the *–en* suffix as a plural marker, for which no discriminative behaviour was observed across grammatical and ungrammatical sentences. They suggest that this may be because *–en* is functionally more diverse, as it is not only a marker for plural but also functions in a different way elsewhere (p.3).

That is, *-en* is a more complex marker, and in turn less reliable as a marker for plurality than *-je* is as a marker for diminutivity. Often it is the case that complexity and reliability correlate negatively, i.e. the more complex a structure is, often the less reliable it is, and vice versa. In relation to this Gathercole and Hoff (2007) suggested that, "…linguistically complex structures are, in part, those for which it is difficult to discern consistent [i.e. reliable] patterns in the input" (p.120).

Schwartz et al. (2009) similarly have observed delay in the acquisition of irregular plural forms in Hebrew for both monolingual Hebrew-speaking children and bilingual Russian-Hebrew speakers. They argue that these delays are due to the overall morphosyntactic complexity of irregular plural forms in Hebrew, which are irregular in terms of the kind of suffixes they take and involve unique full stem changes (from singular to plural), which they argue are "completely lexicalised", making them highly specific and idiosyncratic in nature (pg.506). As such, a high level of input is required for all of these forms to be acquired.

Paradis (2010) assessed verb morphology acquisition in French-English bilinguals and also observed effects of structure complexity. Paradis observed equivalent performance by bilinguals and monolinguals for less complex verb morphemes. However, for more complex morphemes, in this case morphemes that marked for tense (as opposed to morphemes that did not), monolinguals showed a clear advantage over bilinguals. The author attributed this to the differing levels of morphosyntactic complexity of the different morpheme sets. As such, bilinguals needed to be exposed to a larger "critical mass" of exposure before acquisition of more complex morphemes was possible.

In support, Gathercole's (2007) paper on bilingual acquisition in Spanish-English and Welsh-English bilinguals of varied language dominance, observed earlier neutralisation of differences between monolingual and bilingual groups for those structures that were less opaque than for structures that were more opaque. Again, these results seem to reflect that more complex structures require a higher "critical mass" for generalisation patterns to be achieved. This critical mass is dependent upon relative amount of exposure to the necessary input. The child requires more exposure to obtain the data needed to decipher complex structures, and this requires a longer period of exposure to a given language/set of languages.

The developmental trajectory of the bilingual children in these studies was not qualitatively different from the development of their monolingual peers in each of the languages. The order of acquisition of forms, and the processes that bilingual and monolingual children exhibited in each of the languages were similar in both groups. This suggests that bilingual and monolingual children share common language processes that are dictated by features of the language(s) at hand.

2.8 Chapter Summary

The above evidence collectively suggests the following with regards to monolingual and bilingual language acquisition:

- Input is important – a wide body of research has shown effects of input and language exposure on language development
- Children pay attention to distributional regularities in language

- Language features that have clearer and consistent distributional patterns seem to be acquired earlier
- Language features that are more salient (perceptually, semantically, etc) are acquired earlier
- Language features that are more frequent are acquired earlier

Chapter 3

The Acquisition of Gender

3.1 Chapter Overview

In the previous chapter, various features of language and the roles that they seem to play in the acquisition process were discussed in relation to both bilinguals and monolinguals. The current study focuses on the acquisition of one particular aspect of the Welsh language – grammatical gender. This chapter explores the literature to date on monolingual and bilingual acquisition of grammatical gender cross-linguistically, within the context of the linguistic themes and theoretical topics discussed in **Chapter 2.**

3.2 Grammatical Gender Cross-linguistically

Many languages of the world possess grammatical gender. Grammatical gender involves classifying the nouns of a language into distinct categories. Members of the same category share certain properties (e.g. morphological features). The ways in which gender categories are defined, and the properties of nouns which partly determine their categorisation, vary across languages. Due to this variation, cross-linguistic investigation of the acquisition of grammatical gender has provided mixed results, both in terms of the pace and manner of acquisition of grammatical gender. For some languages, grammatical gender seems to be acquired in a rapid, and structured fashion, (e.g. Spanish - Hernandez Pina, 1984; Martinez & Shatz, 1996 and French – Karmiloff-Smith, 1979); while other languages show markedly later mastery of GG (e.g. Welsh - Thomas & Gathercole, 2007 and Russian - Smoczynska, 1986), or seem to reflect more piecemeal acquisition patterns (e.g. Russian – Seva, Kempe, Brooks, Mironova, Pershukova, & Fedorova, 2007; Kempe, Brooks, Mironova & Fedorova, 2003). These differences reflect effects of the structure of the gender systems of those languages, which affect how and when the gender systems are acquired. The following sections outline investigations of grammatical gender acquisition in a number of languages, describing specific properties of the gender systems of those languages, and illustrating how those properties shape the acquisition process.

3.3 Cues to Gender

Cues to gender manifest in many different forms across languages. Languages such as Spanish, French, and Italian have masculine and feminine articles that distinguish between masculine and feminine nouns; other languages lack gendered articles, but have noun endings that mark for gender. The type of markers that are central to a language's gender system are not important per se; rather it is the properties of these markers that are most important. Spanish, for example, possesses a highly transparent grammatical gender system. This transparency largely stems from two phonologically distinct gendered articles (*la* and *el*), combined with highly consistent noun endings, namely –*o* for masculine nouns, and –*a* for feminine nouns. Though there are some exceptions, nouns ending in –*o* are masculine 99.9% of the time, while nouns in ending in –*a* are feminine 96.3% of the time (Teschner & Russell, 1984). Young children acquiring Spanish as their first language have at their disposal clear and consistent phonological cues that allow them to detect commonalities across nouns. This allows them to successfully identify nouns that share morpho-phonological properties as members of the same category. Gathercole and Hasson (1995) observed that the regularity of these cues in the language is so pervasive that adult native speakers of Spanish rely on such cues more than semantic information (i.e. when words refer to human referents with biological gender), suggesting that they "…treat nouns as simply following some convention, whether that convention classifies the word as masculine or feminine" (p. 53) (see Karmiloff-Smith (1979) for similar findings for French).

Seigneuric, Zagar, Meunier and Spinelli (2007) showed similar effects of word endings on gender categorisation, in that sensitivity to gendered word endings affected children's categorization of novel French words. These effects were found for highly predictive French word endings such as *-ette* (96% of nouns with the ending *-ette* are feminine), and *-ain* (99% of nouns ending in *-ain* are masculine). Essentially, "…phonological cues constitute powerful biases that affect categorization" (Seigneuric et al. 2007, p. 241). Further, it was shown that children were better able to assign gender grammatically (via article production) than semantically (via selection of male or female characters). The authors suggest that this occurred because the children were exposed to many exemplars of nouns with particular word endings paired with the masculine or feminine article, but far fewer words they were exposed to contained semantic gender information. Statistical learning mechanisms allow children to establish links between gender-marked noun forms and corresponding gendered articles.

However, Hohlfeld (2006) found evidence of a lack of a facilitative effect of phonological regularities in word endings in adults' online gender processing of German. Importantly, phonological cues must be pervasive, consistent and salient in order to instil these "powerful biases". When cues are less consistent, either due to a large number of exceptions, or due to a lack of availability of these cues (e.g. in a case where only a limited number of nouns may take gendered endings), this makes the task of identifying nouns as being members of the same "type" more difficult. If a certain level of regularity is not present, then facilitative effects may not emerge. This may have been the case in Hohlfeld's study.

Muller (2000) observed the acquisition of gender in French and German, in a population of bilingual French-German speaking children. Muller observed the later mastery of gendered articles in German than in French in these children, and postulated that this was due to the nature of the determiner system in German. In French, determiners mark for gender unambiguously (*un* and *le* for masculine nouns, *une* and *la* for feminine nouns). However, in German, determiner forms aren't so clear-cut. The article *die* marks feminine singular nouns; however, it also marks for feminine plural nouns and all masculine and neuter plural nouns too. *Die* is therefore multifunctional and consequently is not so easily identified as a marker for feminine nouns in the singular.

Muller also observed how her participants acquired the neuter gender in German relatively late. She postulated that this was due to the fact that masculine and neuter markers share features and that "…the masculine and neuter paradigms are not sufficiently distinct…" (p. 390). This led to errors of masculine forms being used when neuter forms were appropriate. Errors in this direction seemingly occurred because masculine nouns are more frequent, and consequently are more pervasive across the German language as a whole.

Wegener (2000) elaborated on the complexity of German determiners in relation to gender, "…for the 16 possible functions of the definite article, only 6 forms are available, which are all multifunctional: *der, die, das, dem, des, den*: only *das* represents a clear indicator for gender" (p. 514). The more functions a cue fulfils, the more difficult it is to tease apart each of those functions, and hence the later one will acquire the knowledge necessary for complete acquisition.

When some regularity is present however, aspects of complex gender features can be acquired successfully. Though overall Muller (2000) observed later mastery of gendered articles in German than French in her population of 2L1 French-German bilinguals; in cases where clear patterns were present in the co-occurrence of certain word-endings with certain articles, children were able to produce article-noun combinations in both languages at a similarly early age, with equal levels of success. And indeed, overall, more errors in children's article use were found for nouns that did not have predictive (or even partially predictive) endings than those nouns that did have these endings.

A beneficial effect of diminutive forms has been observed in Lithuanian (Savickiene, Kempe & Brooks, 2009), Russian (Kempe & Brooks, 2001; Seva et al. 2007; Kempe et al. 2003), and Serbian (Seva, Kempe, Brooks, Mironova, Pershukova & Fedorova, 2007). These languages all share one particular feature – diminutive forms are more homogeneously marked than simplex forms. In all cases, more accurate gender marking was observed for diminutive noun forms than simplex forms. Kempe et al. (2003) argued that "…diminutives facilitate learning by aiding the learner in recognizing morphological gender cues…" (p. 480). Moreover, Savickiene et al. (2009) postulated that diminutives in Lithuanian "…demonstrate the principle that a salient and homogeneous cluster of words that function like a low-level schema can facilitate morphology acquisition in the entire system" (p.482).

This facilitative effect of diminutives was observed for Serbian, which possesses a far less productive diminutive system than Russian (see Seva et al. 2007). Despite this difference between Russian and Serbian, the positive effect of diminutives observed in both languages was of a similar degree in each case. This suggests that even low-level regularities, provided that there is a certain degree of morphological homogeneity, are sufficient for children to be able to detect distributional patterns and extract key information.

Seva et al. (2007) also suggested that diminutives are so effective because they have increased salience:

…adding a diminutive morpheme to a noun inserts a phonologically invariant segment…it is possible that this 'island of invariance' may serve to mark and highlight the upcoming inflectional changes, thereby drawing the learner's attention to morpho-phonological information such as the association between noun ending and gender or case… (p. 125-126).

Savickiene et al. (2003) do, however, point out that diminutives possess added salience due to "additional semantic and pragmatic features like endearment, attachment and sympathy…" (p. 478), and this must be factored into one's assessment of the relative salience of diminutives.

Support for the idea that even low-level regularities have a notable facilitative effect comes from Szagun, Stumper, Sondag and Franik (2007), who observed German children's acquisition of gender (as judged by their production of articles in naturalistic data) and noted that children's responses seemed to follow probabilistic patterns. Children picked up on pseudo-regularities in the adult input, and used these to assist them in their own gender classifications. Even when rules were only of a probabilistic nature, children were still able to extract the quasi-regular distributional patterns and create low-level schemas from which they could achieve accurate gender assignment with some productivity, and with more success than for those nouns that lacked any kind of form-based regularity.

Smoczyńska (1985) observed differences in age of acquisition of GG in Russian versus Polish. Though these languages' gender systems share many common properties, Smoczyńska (1985) noted that they do differ in a few key aspects:

Two apparently minor factors appear to cause a considerable delay in Russian acquisition. First, the fact that the Russian unstressed *-o* is pronounced as *a*; and second, the existence of diminutive masculine forms which end in *-a* and are declined like feminine forms… (p. 645).

The Russian system is more inconsistent in terms of the morphological features of nouns and their relation to masculine vs. feminine gender, resulting in opacity of the mapping between form (in this case, the phonological form *–a*) and function (marking for feminine or masculine gender). The Polish gender system lacks this extra opacity, and Polish children are therefore better able to extract commonalities across exemplars and establish links between different forms.

What these acquisition data tell us is that the phonological forms of gender cues are important, and seem to play an integral role in building gender representations. Results from adult processing of gender also support this idea.

Bordag and Pechmann (2007) investigated whether gender congruency effects could be observed in Czech-speaking adults for two types of declined ordinal forms. A gender congruency effect refers to when reaction times to target items are faster when the preceding stimulus item is of the same gender class as the target (c.f. Schriefers, 1993). The experimenters explored whether gender congruency effects would be observed for both soft declined forms, (which are not phonologically distinct based on gender), and hard declined forms, (which take phonologically distinct forms depending on the gender of the noun). A gender congruency effect was found only for the hard declined ordinal forms. The authors argued that the different inflections of the hard declined ordinals were at the root of the gender congruency effect, and that it is "…the phonological forms, not the abstract gender features, which compete for selection" (p. 78).

Similarly, Schiller and Caramazza (2002), observed gender congruency effects of stimulus nouns on target nouns in adult gender processing in German for singular nouns, but not for plural nouns . Singular nouns in German take distinct determiner forms based on gender, while all plurals take the same determiner form, *die.* Even though stimulus plural nouns sometimes differed in gender in relation to target plural nouns, the fact that they shared the determiner feature seemed to mediate any potential gender congruency effects based on the conflicting genders of the paired nouns. These findings also suggested that the conflict arises at the phonological level.

Holmes and Segui (2005) also observed facilitatory effects of gendered word endings in French L1 adults in a gender assignment paradigm. Participants assigned gender to nouns with gendered endings faster, and with more accuracy, further suggesting that adults observe and relate the occurrence of gendered word endings across nouns and eventually identify these nouns as members of the same "category" (i.e. the same gender class). Further, the authors observed faster reaction times for consonant initial nouns (which are paired with distinct determiner forms depending on the gender) than for vowel initial consonants (all of which are preceded by the same determiner form (e.g. *l'ami* 'the friend (m.)' vs. *l'amie* 'the friend (f.)'). This is because for the consonant initial nouns, the gender distinction made on determiners that co-occur with these nouns allowed them to access gender information more quickly in the task paradigm (see also Taft & Meunier, 1999). In support, Roulet-Amiot and Jakubowicz's (2006) study of French DP production in young children showed that L1 French-speaking children exhibited early mastery of target gendered article production. Gendered articles are the most reliable gender cues in French, as:

- They are pervasive and frequent in the language - they co-occur with the vast proportion of French nouns (not including vowel-initial nouns)
- They always appear in the same position (i.e. before the noun), and as such have high distributional regularity
- There are clear and distinct phonological forms for masculine and feminine – and so there are salient cues for masculine and feminine gender respectively

Gendered articles in French mark the first productive gender distinction in French-speaking children, as evidenced by their early discriminatory production of such forms (see also Mariscal, 2008, for evidence of early production of gendered articles in Spanish).

From the above findings, it seems that formal cues to gender, and the phonological forms that they take, shape the acquisition process. Such findings led Gollan and Frost (2001) to suggest that: “The most reliable cue to gender in each language (e.g. the gender-marked article in French) adopts a central role in representing grammatical gender” (p. 629). They refer to this as the “reliable cue hypothesis” (p. 629), which further stipulates that when the most reliable cue is not available, this will impede gender processing.

They tested this hypothesis by comparing adults’ performance on a gender decision task in Hebrew. Hebrew possesses a quasi-regular gender-marking system on nouns. Masculine nouns are unmarked, and feminine nouns generally take one of three inflections, but there are many irregular feminine nouns that lack inflections and resemble bare masculine forms. For plural nouns, there are both masculine and feminine inflections, but in some cases masculine nouns take “feminine” inflections, or vice versa.

In their first experiment, the researchers included singular noun stimuli that included regular masculine nouns, regular feminine nouns, and irregular feminine nouns - it was not possible to have irregular masculine nouns, as they are extremely rare in Hebrew (Gollan & Frost, 2001, p. 632). An effect of regularity was found, in that irregular feminine nouns were often incorrectly identified as masculine nouns due to their resemblance to masculine nouns, and due to a lack of feminine inflections.

In a second experiment, only irregular feminine and regular masculine nouns were included (i.e. all bare nouns without gendered inflections). An effect of regularity was still present, but error rates for feminine nouns here were lower. The authors suggest that the absence of the influence of the feminine word endings (present in regular feminine nouns) resulted in participants taking a more lexically-based approach as opposed to an analysis based on noun form regularities. Essentially, where there is material in the language that can allow rapid processing decisions to be made via a consistent pattern, this will occur; but when a consistent rule is not available, or cannot be easily implemented, lexical analysis seems to occur.

3.4 The Role of Semantics

Formal gender cues can be related to other sources of information. Importantly, as well as formal gender distinctions, languages also possess semantic gender information (i.e. some nouns refer to entities that have biological sex). It is often the case that for such nouns, semantic and formal gender classifications overlap (e.g. *la mujer* 'the (f). woman' in Spanish). For nouns such as these, both formal and semantic information may be accessed, and when in accord, this combined information can facilitate children's identification of a noun as a member of one gender category or another.

For French, both Desrochers and Brabant (1995) and Seugneuric et al. (2007) observed facilitatory effects of semantic/natural gender in gender assignment tasks involving novel words. Similarly, for both French and Italian, Vigliocco and Franck (1999) observed more adult speaker errors in their constrained sentence completion tasks when noun referents lacked additional natural gender information. Further, in two additional experiments of theirs, effects of natural gender were still present when all noun referents were matched for animacy, (i.e. all noun referents were animate), but not for semantic gender (some had semantic gender information, others did not), suggesting that it was not animacy per se that resulted in varied error rates across nouns, but rather the specific semantic gender information that some of the animate nouns possessed.

Muller (2000) observed that the earliest discriminatory use of gendered articles in her German-speaking child participants were made at a semantic level, in that they first began to use articles in a discriminative way when noun referents possessed additional semantic gender information. It seems that children distinguish semantic concepts such as male versus female, and animate versus inanimate early on, and can use this semantic knowledge to “break into” the formal gender system initially. This reflects an influence of semantics on formal gender classification.

However, there is also evidence to suggest the opposite trend - that of an influence of formal cues on semantic classification. Seugneuric et al. (2007) observed an effect of gendered word endings (i.e. formal cues) even on semantic categorization. When asked to select either a male or female picture to correspond with a novel word, adults’ decisions were clearly influenced by the presence or absence of gendered word endings on nouns.

Gathercole and Hasson (1995) observed adult Spanish speakers’ article choices in relation to noun forms for human referents. For some noun forms, the same form is used irrespective of the natural gender of the referent (e.g. *el piloto* “the (m.) pilot”, *la persona* “the (f.) person”, *el modelo* “the (m.) model”, *la victima* “the (f.) victim”). Other nouns have masculine and feminine equivalent forms (e.g. *el jefe* “the (m.) boss” vs. *la jefa* “the (f.) boss”). These researchers observed which forms of nouns (and their articles) adult native speakers of Spanish produced when referring to feminine referents (participants were required to complete a sentence that contained a female or common noun that functioned as the subject of the sentence). Nouns were controlled for noun form. The researchers observed that speakers were often resistant to changing forms such *el piloto* “the (m.) pilot” to *la pilota* “the (f.) pilot”, or even *la piloto* “the (f.) pilot*”.*

This led the authors to suggest that the representational strength of noun form regularities in Spanish resists changes in noun form and changes in corresponding articles: “The force of grammatical gender pulls the speaker away from considering gender marking as directly related in any way to the real-world status of referents. This force is one that favours conventionality, in that the gender shape of a noun is inherent to the noun, not the referent of that noun” (p.65). Essentially, when morpho-phonological forms are pervasive and regular, as they are for Spanish nouns, semantic information plays a minor role.

The research evidence suggests that both semantic and phonological information play key roles in the acquisition and processing of gender, and that gender systems can largely be mapped on the basic of semantic and phonological regularities. Corbett (1991) holds that semantics in particular forms the core of any gender system, as evidenced by the fact that many languages have gender systems that are defined only at the semantic level, while those languages that do have formal gender systems also contain semantic gender information that often correlates with phonological or syntactic gender distinctions. .

Mirkovic, MacDonald and Seidenberg (2005) discussed how their computational modelling techniques revealed positive effects of semantic information when their models attempted to abstract out the Serbian gender system from the input received. They used a recurrent network model in which five "subjects" learnt the Serbian gender system. Subjects were exposed to sub-sets of Serbian nouns – these sub-sets either specified gender or didn't specify gender, but offered other information (e.g. semantic information – in one condition semantic information was limited, in another it was not). Less training was needed when semantic information was readily available.

In addition, when they used models to test the subjects in terms of generalisation, the subjects were able to decipher and produce accurate phonological forms of "untrained", (i.e. unencountered), items even with a limited noun set to work with. These results suggested that if phonological forms can be produced accurately based on gender and animacy information it seems likely that the gender of a word may be determined based on its phonology. The authors mused, "…is gender simply a convenient term for a network of probabilistic constraints involving other information, principally semantics and phonology?" (p. 165). From the evidence so far, the answer may well be yes.

3.5 The Role of Input

Royle and Valois' (2010) study explored the acquisition of gendered adjective forms in young French-speaking children. They focussed in particular on "variable" French adjectives. These are adjectives that "…have word-final consonants that appear on feminine forms only…these consonants are somewhat arbitrary and cannot generally be adduced based on the masculine forms…" (p. 316).

They assessed children's use and acquisition of these forms by creating comprehension and elicitation tasks that included size and colour adjectives. Some were non-variable; others were variable. They consistently found, both in comprehension and production, that children made more errors for feminine variable adjective forms. The authors suggested that this might have been because masculine and feminine forms were lexically acquired, and as such had separate representations. The concept of gender agreement was present in these children, as evidenced by few errors made in their determiner production in their DPs. The children were also able to produce masculine adjective forms with masculine nouns appropriately, reflecting knowledge of adjectives. The authors interpreted the results as showing that masculine and feminine forms of adjectives were acquired separately, and that these forms may in fact compete at a lexical level.

The masculine adjective form is often the default in French. For example, when referring to two green objects, one of which is masculine and one of which is feminine, the masculine adjective form *vert* "green (m.)', (as opposed to the feminine form verte "green (f.)' would be used to refer to both. As a result, the masculine forms are acquired first. The feminine forms will have to compete with the existing masculine forms, making them more difficult to acquire. Further, Royle and Valois suggested that at age 3-5, children are yet to establish "…a rule linking feminine and masculine adjective forms in their lexicon" (p.331).

What the results did seem to show was that children were not acquiring adjective forms on a rule-based basis, as shown by their variable use and comprehension of different variable feminine adjective forms, and also their variability in usage and comprehension of variable masculine vs. variable feminine adjectives. These interpretations are in line with a constructivist account of language acquisition, whereby children will acquire concepts incrementally based on input.

This hypothesis is further supported by the fact that children showed more accurate and stable production of variable size adjectives when compared to variable colour adjectives. The authors suggested that this was due to the higher frequencies of size adjectives in child speech and in child-directed speech. That is, the higher level of exposure to and experience with these forms resulted in their earlier acquisition.

In relation to this, Mariscal (2008), in her investigation of Spanish children's acquisition of Spanish NPs, observed the early development of gender agreement. She stated that children "start small" (p. 143), by first omitting determiners, then producing "proto-determiners" before moving on to producing target article forms, in conjunction with certain nouns. This developmental pattern shows how "…the acquisition of NP and gender agreement is a complex process which advances as the children gradually integrate different sources of evidence: phonological, distributional and functional" (p. 143). The primary sources of information at the disposal of children are lexical and distributional. Children must pay attention to the lexical or sub-lexical forms that mark gender and track the distribution of these forms in order to relate them to one another and acquire gender categories.

Patterns of development also showed signs of piecemeal learning in that target article forms developed initially only for specific nouns. Variability was observed both within and across all individual children, suggesting that the unique input that each child is exposed to shapes their developmental trajectory, depending on the specific nouns and the specific phrases and sentences each child is exposed to, and the frequency of that exposure. These studies both support a constructivist approach to language acquisition, and suggest that the input a child is exposed to is crucial in the acquisition process.

Seigneuric et al. (2007) noted a steady increase in sensitivity to noun endings with age in a group of children between 3 and 9 years of age. They suggested that the older children's increased exposure to the language was at the core of these differences. Essentially, the older children had been exposed to more language, and specifically more exemplars, so they had more opportunity to consolidate information in the input. "The relevance of noun endings would increase as a child's vocabulary expands, resulting in more opportunities to note regularities across words…" (Seigneuric et al., 2007 p. 242).

Szagun et al. (2007) observed lexically-specific variation in children's gender assignment, with higher target rates for those lexical items that were most frequent in the adult input, while Muller's (2000) data on a group of children's bilingual first language acquisition of German and French reflected "…word-specific gender paradigms…" (p. 388), suggesting that the gender system emerges gradually, on a step-by-step basis, based on the input. Effects of noun familiarity were also observed in Savickiene et al.'s (2009) study of gender marking in Lithuanian and Russian. Less errors were attested for familiar nouns than for novel nouns, suggesting that acquisition can occur on a lexical basis.

Gathercole (2002) compared monolingual Spanish, 2L1 Spanish-English bilinguals and L1 Spanish and L2 English bilingual children's acquisition of irregular noun forms in Spanish (e.g. *la mano* – a feminine noun with a typically "masculine" ending –o) via a grammaticality judgment task. Monolinguals outperformed bilinguals in their ability to identify ungrammatical items. This effect held even when comparing bilinguals of high SES with monolinguals of high SES. Moreover, when the accuracy of the corrections made in the task were examined, it also became clear that the monolingual children were more accurate in their corrections.

Within the bilingual group, those bilinguals with the highest level of exposure to Spanish (i.e. two-way schooling and only Spanish at home) made the most accurate corrections, while the bilinguals in English immersion schools and from bilingual English-Spanish homes performed worst. Overall, monolinguals outperformed bilinguals at the earliest ages and bilinguals with more exposure to Spanish outperformed bilinguals with less exposure to Spanish. By age 10, bilinguals seem to “catch up” with their monolingual peers, unless they received less input in Spanish, in which case, they still seemed to lag behind somewhat (Gathercole, 2002, p. 216).

All of the above results show that input and relative exposure to language affects subsequent language acquisition directly. Children must be exposed to a “critical mass” (see Gathercole, 2002; Oller & Eilers, 2002) of input, before they are able to abstract out enough information to acquire fully productive knowledge of gender. The critical mass needed will depend entirely on the nature of the material they have to work with, and on their own language experience. Languages in which gender is presented transparently via homogeneous and consistently distributed cues are acquired earlier, “…children take advantage of the systematicity that is manifested in the morphological patternings, and acquire gender rather early in those languages where the distributional facts are accessible.” (Levy, 1987, p. 81).

3.6 Chapter Summary

The above findings suggest that for those languages in which gender information is rather less accessible – either due to irregularity of cues, scarcity of cues, or complex relations between cues – gender is acquired comparatively later, and in a rather different manner. The language of the current study – Welsh – falls into the latter category of languages with opaque and quasi-regular gender systems. The next chapter outlines the structure of the Welsh gender system and presents findings to date on the acquisition of GG in Welsh, taking into consideration the themes discussed above.

Chapter 4

Consonant Mutation and the Welsh Gender System

"Consonant mutation…is arguably the most notorious feature of Welsh: it has prompted scholars to theorize and moved learners of the language – as they vainly scan dictionaries for seemingly non-existent words – to despair."

Peter Wynn Thomas

4.1 Chapter Overview

This chapter outlines in detail the mutation system of Welsh, with examples illustrating each kind of mutation, as well as providing a brief overview of previous research on the use of mutation in spoken Welsh. Special attention is given to the most pervasive type of mutation in the Welsh language – Soft Mutation (SM). This focus stems from the fact that grammatical gender in Welsh is primarily marked through the use of SM. The current study investigates:

- Local gender marking of nouns via SM
- Local gender marking of nouns via gendered numeral forms
- Distant gender marking of nouns via gendered prepositional forms and pronouns

Each of these elements of the gender system is outlined in turn, with examples used to illustrate each method of gender marking.

4.2 Mutation

There are three types of initial consonant mutation that occur in Welsh (c.f. Ball & Muller, 1992). They are Nasal Mutation (NM), Aspirate Mutation (AM), and Soft Mutation (SM). Each mutation type results in different changes, and each type of mutation is applicable to different sub-groups of consonants. These modifications manifest both in the phonology and the orthography of Welsh. All involve the same basic principle: "…the syntactic environment (SE) of a mutation is characterized as consisting of a trigger and a target. The trigger is whatever the feature which, synchronically at least, can be thought of as 'causing' the mutation. The target is the word 'receiving' (i.e. undergoing) the mutation…" (Ball & Muller, 1992, p. 6).

Ball and Muller elaborate on that fact that there are two main types of mutation triggers: syntactic (whereby the syntactic frame itself is the trigger), or lexical (where a specific lexical item causes the mutation to occur). The vast majority of mutation triggers are lexical (c.f. Tallerman 1990; Borsley, 1999), and, crucially, mutation in Welsh is always triggered by an adjacent item (see Tallerman, 1990 for details). The consonants of Welsh are outlined in ***Table 4.1***, below. However, only certain consonants are subject to mutation. The consonants involved in each type of mutation are as follows.

Aspirate Mutation (AM).

Of the three mutation types, AM affects the smallest number of consonants, changing the voiceless stops /p/, /t/, and k/ to the fricatives /f,/ /θ/, and /x/ respectively. Orthographically, /p, t, k/ correspond to p, t, c and /f, θ, x/ correspond to ff/ph, th and ch. AM occurs after a number of lexical triggers, including the negative pre-verbal particle *ni,* the numeral *chwe* ‘six’, and the conjunction *na* ‘than’ (see examples (1) to (6) below).

Table 4.1

The consonants of Welsh, arranged by place and manner of articulation (adapted from Jones, 1984)

	Place of articulation									
Manner of articulation	Bilabial	Labio-dental	Dental	Alveolar	Lateral	Palato-alveolar	Palatal	Velar	Uvular	Glottal
Plosive	p b			t d			k g			
Affricate						ʧ ʤ				
Fricative		f v	θ ð	s (z)	ɬ	ʃ			x	h
Liquid				r r^{ɦ}	l					
Nasal	m m^{ɦ}			n n^{ɦ}				ŋ ŋ^{ɦ}		
Glide	w						j			

(1)

pen --> ei phen

/pen/ --> /ɛi fen/

(2)

tŷ --> ei thŷ

/tɨ:/ --> /ɛi θɨ:/

(3)

cath -->	ei chath
/kaθ/ -->	/ɛi xaθ/

(4)

ni	*chafodd*	*Delyth*	*afal*	(cafodd)
/ni/	/xavɔð/	/delɨθ/	/aval/	(kavɔð)
PART.NEG	have.2sg.PAST	Delyth	Apple	

‘Delyth didn’t get the apple.’

(5)

chwe	*phunt*	(punt)
/xwe/	/fɨnt/	(pɨnt)
six	pound(s)	

(6)

Mae	*o’n*	*well*	*na*	*thorri*	*dy*	*goes*
/maɨ/	/ɔ:n/	/weɬ/	/na/	/θɔri/	/də/	/goɨs/
Be.3SG.PRES	PRO.3SGM.PRT	better	than	break.NONFIN	your	Leg

‘It is better than breaking your leg.’

(torri) /tθɔri/

Nasal Mutation (NM).

NM affects all stops: /p, t, k, b, d, g/. When nasally mutated, these change to the nasal sounds /mʰ, nʰ, ŋʰ, m, n, ŋ/. Orthographically these are represented as mh, nh, ngh, m, n, ng, (see examples (7) to (12) below). Lexical triggers for nasal mutation include the possessive first person possessive form *fy* ‘my’, and the preposition yn ‘in’,(see examples (13) and (14) below).

(7) /p/ --> /mʰ/

pen	fy mhen
/pen/	/və mʰen/

(8) /t/ --> /nʰ/

ty	fy nhy
/tɨ/	/və nʰɨ/

(9) /k/ --> /ŋʰ/

cap	fy nghap
/kap/	/və ŋʰap/

(10) /b/ --> /m/

bara	fy mara
/bara/	/və mara/

(11) /d/ --> /n/

drws	fy nrws
/drws/	/və nrws/

(12) /g/ --> /ŋ/

golau	fy ngolau
/gɔlaɨ/	/və ŋɔlaɨ/

(13)

fy	nghath	(cath)
/və/	/ŋʰaθ/	(kaθ)
my	cat	

(14)

dwi'n	*byw*	*ym*[1]	*Mhorthmadog*	(Porthmadog)
/dwin/	/bɨw/	/əm/	/mʰɔrθmadɔg/	
Be-PRES.PRO1SG-PART	live.NONFIN	in	Porthmadog	(pɔrθmadɔg)

'I live in Porthmadog.'

[1] Note that the preposition *yn* also changes to accommodate the nasal mutation, thus *yn* is represented as *ym*

Soft Mutation (SM).

The third mutation type - Soft Mutation (SM) - is a process of lenition. Voiceless liquids and stops become voiced; /m/ and the voiced stops /b/ and /d/ become fricatives, and the voiced stop /g/ is omitted. All of the consonants that are involved in SM, and their resulting mutated forms are illustrated in ***Table 4.2***, below.

Soft Mutation/Lenition:

Voiceless stops and liquids --> voiced stops/liquids; voiced stops --> fricatives[2]

	Voicing	LABIAL	AVEOLAR	VELAR	GLOTTAL
Stops	Voiceless	p	t	k	
	Voiced	b	d	g	
Fricatives	Voiceless	f	θ	x	h
	Voiced	v	ð		
Nasals	Voiceless	m^h	n^h	$ŋ^h$	
	Voiced	m	n	ŋ	
Laterals	Voiceless		ɬ		
	Voiced		l		
Trills	Voiceless		r^h		
	Voiced		r		

e.g. after the preposition i 'to':

/baŋgor/ 'Bangor' --> /i vaŋgor/ 'to Bangor'

/ɬangoɨd/ 'Llangoed' --> /i langoɨd/ 'to Llangoed'

Figure 4.1. Matrix of all Soft Mutations organised by sound class.

(Taken from Gathercole, Thomas & Laporte, 2001).

SM and grammatical gender.

SM is extremely pervasive in the Welsh language. The linguistic environments that trigger SM are numerous, and will be discussed below. Importantly, SM functions at the core of the Welsh gender system, as it is the only way of marking the

[2] N.B. For the voiced stop /g/, lenition results in omission of the sound; no substitution occurs

distinction between masculine and feminine nouns via the forms of the nouns themselves. After the definite article *y* ('the') SM is triggered to mark feminine gender for nouns beginning with all sounds susceptible to mutation except /r^h/ and /ɬ/. It is a "local" marker in that the marker occurs on the noun itself or "its immediate modifiers" (Gathercole, Thomas & Laporte, 2001). Only feminine singular nouns with initial stops or /m/ are subject to SM after *y*, as shown in example (15); masculine nouns in the same context do not mutate, as shown in example (16).

(15)

cath	--> *y gath*
/kaθ/	--> /ə gaθ/
'cat (f.)'	'the (f.) cat'

(16)

ci	--> *y ci*
/ki/	--> /ə ki/
'dog (m.)'	'the dog (m.)'

In addition, SM of adjectives is triggered when they modify feminine nouns, as shown in (17). If an adjective follows a masculine noun it does not mutate, as shown in (18). There are, however, exceptions. Adjectives occurring with singular feminine nouns mutate, but those appearing with plural feminine nouns do not, (see (19)).

(17)

y	*gath*	*fawr*	(mawr)
/ə/	/gaθ/	/vaʊr/	
the	*cat*	big	/maʊr/

'The big cat (f.)'

(18)

y	*ci*	*mawr*
/ə/	/ki/	/maʊr/
the	*dog*	big

'The big dog (m.)'

(19)

y	*cathod*	*mawr*
/ə/	/ə kaθod/	/maʊr/
The	cats (f.)	big

'the big cats (f.)'

SM is further limited as a marker of feminine gender as it only applies to the sub-set of consonant phones outlined above. Feminine nouns that are vowel-initial or begin with any of the remaining consonants that appear word-initially in Welsh (see ***Table 4.1*,** above) cannot undergo SM after the definite article. This means that feminine nouns are often indistinguishable from masculine nouns, as shown in examples (20) and (21).

(20) /f/-initial feminine noun = no mutation

y ffwrn (b.)

/ə fʊrn/

'the oven (f.)'

(21) /f/-initial masculine noun = no mutation

y ffrwyth (g.)

/ə frʊɨθ/

'the fruit (m.)'

An extra complication of the system is that, in addition to functioning as a local marker for feminine gender, SM also functions as a distant marker for masculine gender in some cases of long-distance agreement of possessive forms with antecedents. Specifically, after the possessive adjective *ei* (3rd person singular possessive), SM marks agreement with a masculine antecedent, as shown in (22), whereas AM is used when the antecedent is feminine, as in (23). Thus, SM indicates feminine gender in one syntactic environment and masculine gender in another.

(22)

Mae'r	*bachgen*	*wedi*	*colli*	*ei*	*gi*	(ci)
/maɨr/	/baxgen/	/wedi/	/koɬi/	/ei/	/gi/	/ki/

'The boy has lost his dog.'

(23)

Mae'r	*ferch*	*wedi*	*colli*	*ei*	*chi*	(ci)
/maɨr/	/verx/	/wedi/	/koɬi/	/ei/	/xi/	/ki/

'The girl has lost her dog.'

Quite apart from SM occurring as a gender marker, there are numerous other environments that trigger SM. These include both lexical and syntactic triggers. There are a limited number of syntactic environments that trigger mutation, but they occur frequently in the language. Borsley (1999) (among others) has proposed that: "mutation is in fact triggered by any immediately preceding phrase" (pp.267), for examples of different phrasal triggers, see ***Table 4.3***, below).

Lexical triggers of SM are more numerous. Many of these lexical triggers are high frequency items, including numerous prepositions, as well as some adverbs and possessives. In these instances SM does not function as a gender marker. Examples of some of the most common lexical triggers for SM are illustrated in ***Table 4.3***, below.

The examples of the various contexts in which SM occurs, as outlined below, indicate the following:

- SM is limited in scope – it is applicable only to a sub-set of consonants, and so it is not a global gender marker
- SM has many surface phonological manifestations, depending on the lexical item mutated. This contrasts with a language such as Spanish where gender can be expressed via a consistent phonological form (e.g. the feminine –*a* ending).

Table 4.3. Soft Mutation triggers (adapted from Borsley, 1999)

Trigger type	Trigger	Affects	Example
		Soft Mutation triggers – organised by type	
Lexical triggers that mark for grammatical gender	**Definite article *y***	**Singular feminine nouns**	*y gath* 'the cat' cath > gath /k/ > /g/
	Singular feminine nouns	**Succeeding adjectives**	*cath las* 'blue cat' glas > las /g/ > Omitted
	Possessive adjective *ei*	**Possessed item of masculine antecedent**	*ei dŷ* 'his house' tŷ > dŷ /t/ > /d/
Syntactic Triggers (Phrasal Constructions)	**The subject of a Noun Phrase**	**The lexical item immediately following the subject**	*Collodd Mair ddwy bunt.* 'Mair lost two pounds' *dwy > ddwy* = /d/ > /ð/
	Certain prepositional phrases	**The lexical item immediately following the PP**	*Mae Emrys wedi rhoi i Megan ddarlun*[3] 'Emrys has given Megan a picture.' *darlun > ddarlun* = /d/ --> /ð/
	The complementizer phrase	**The lexical item immediately following the CP**	*Gwnaeth gweithio'n galed bres i'r bobl.* 'Working hard made money for the people.' *pres > bres* = /p/ > /b/
	The adverbial phrase	**The lexical item immediately following the AP**	*Gwelais i yn sydyn blismyn yn y stryd.* 'I suddenly saw policemen in the street.' *plismyn > blismyn* = /p/ > /b/
Pure lexical triggers (Do not mark a grammatical feature)	**Some prepositions (*ar, heb, dros*, etc)**	**The following noun**	*Ar dân* 'on fire' *tân > dân* =/t/ > /d/
	Some conjunctions (*pan, neu*,, etc)	**The following lexical item**	*Pan gerddais i* 'When I ran' *cerddais > gerddais = /k/> /g/*
	Adverbs	**The following adjective**	*rhy fach* 'too small' *bach > fach* = /b/ > /v/
	***yn* (predicative particle)**	**The following lexical item**	*Mae Dafydd yn gas heddiw* 'Dafydd is mean today' cas > gas = /k/ > /g/
	Some numerals	**The following lexical item**	*Dau gi* 'Two dog(s)' ci > gi = /k/ > /g/
	Some ordinals	**The following lexical item**	*Ail law* 'second hand' llaw > law = /ɬ/ > /l/

[3] This example, and the two examples below it are taken directly from Borsley (1999)

- SM is multifunctional – it does not only mark for feminine after *y*, but also marks for masculine after *ei* and occurs in a wide variety of other contexts either due to lexical or syntactic mutation triggers that are unrelated to gender

Together, these points illustrate the opacity and distributional complexity of SM. This arguably makes the task of acquiring soft mutation extremely difficult. And, as Thomas and Gathercole (2007) stated, this adds extra difficulty to the task of acquiring gender in Welsh, as one cannot master the gender system of Welsh without mastering mutation.

4.3 The Role and Use of Mutation in the Welsh Language

The above section outlined the mechanics of mutation, the different types of mutation, and the contexts in which mutation occurs. In use, all three mutation types have been shown to be quite variable.

Mutation in production: Aspirate and nasal mutation.

AM seems to be used in a variable fashion by adult native speakers (Thomas & Gathercole, 2007; Evans, 1974; Jones, 1977). AM is more productive after some triggers than others (Ball, 1988; Thomas, 1984), and has been observed as being used variably within the same triggering context (Roberts, 1988).

The evidence showing favouring of the use of AM in a few limited contexts includes more consistent use in set phrases (Roberts, 1988; Ball, 1988), and higher incidence after the third person possessive *ei* (Thomas & Gathercole, 2007; Thomas, 1984; Ball, 1988). Ball has suggested that the comparably higher level of AM after *ei* ('his/her/its') may be due to this context being highlighted more in an educational setting, as observed by some of the participants in his study, who recalled that the *ei* + AM context has been particularly stressed in their schooling (Ball, 1988, pg. 78). In addition, one can argue that AM after *ei* has higher cue validity, as *ei* + AM involves a difference in meaning (when compared to *ei* + SM). Further, AM has relatively few triggering contexts, making AM particularly salient in the few contexts where it is triggered.

Thomas and Gathercole (2007) observed very low rates of AM after conjunctions in a sample of Welsh-speaking children, with basic forms of nouns - widely known as "radicals" (c.f. Ball & Muller, 1992; Tallerman, 1999) - being favoured over aspirately mutated forms, suggesting that radical forms of nouns are frequently produced as the default in these contexts.

Use of Nasal Mutation (NM) has been observed to be similarly variable. Thomas (1984) observed, based on his samples of Welsh speakers, that "…apart from the contexts possessive pronouns [*ei* for AM and *fy* for NM] + nouns, the spirant [aspirate] and nasal mutations were, for our sample, declining…" (p.232). NM after *fy* (first person possessive 'my') has been found to be most productive (Thomas, 1984; Hatton 1988; Roberts, 1988). In addition, the recognition of the use of NM after *fy* 'my' in comprehension tasks has been shown to be more successful than in comparable productive tasks (Ball, 1988). There is also evidence to suggest that the use of NM forms in written Welsh is more consistent than in spoken Welsh (Hatton, 1988). The above findings suggest variable rules apply in terms of adults' use of mutation in Welsh, akin to variation in the way in which native English speakers express the third person possessive form in written English (i.e. Gus' boat versus Gus's boat).

Mutation in production: Soft mutation.

In contrast to the other mutation types, use of SM in spoken Welsh has been found to be much more frequent, though this is partly due to the fact that it is generally more pervasive in the language as a whole. Evidence of the frequent use of SM has been observed in various contexts including after prepositions (Thomas & Gathercole, 2007), after the third person possessive *ei* (Thomas, 1984) and after the possessive pronoun *dy* (Roberts, 1988). The strong presence of SM in the Welsh language is clear. Numerous participants in Roberts' (1988) sample even stated that spoken Welsh without any instances of SM would sound "alien" (p.56).

Bellin (1984) observed that SM is highly established in one particular context, namely when a subject NP triggers soft mutation of the following lexical item, usually the direct object (e.g. *Gwelodd Catrin fuwch* 'Catrin saw (a) cow (f.)'). In this kind of context, Bellin observed highly consistent use of the appropriate soft mutated forms in adults, stating that: "…failure to follow the rule offends the "clust" (ear)". There are contexts and rules where speakers may differ, but never about direct object mutation" (p.169). Bellin compared adult use of SM in this context with young children's production patterns in the same context. By age five, these children already seemed to have "…a strong linguistic intuition about the rule" (p. 174). They corrected sentences that lacked the direct object mutation feature by reproducing them with the correct mutation feature added. The consistent use of SM in contexts such as this one may make the SM feature more reliable (c.f. Bates & MacWhinney, 1989), and therefore more likely to be easily identified by learners.

The invasion of soft mutation.

There is some evidence of generalization of SM. Evidence of use of SM when basic forms should be produced (Thomas, 1984) and many cases of SM being used where AM or NM should be used have been documented (Thomas, 1984; Ball & Fife, 2002; Ball & Muller, 1992; Roberts, 1998; Ball 1988). Intuitively, one would expect that this is due to the higher prevalence of SM in the language as a whole, and its occurrence in a higher number of contexts. SM is most frequent in the input; as such, it is recognised and generalised to contexts in which it should not normally occur.

Both in Thomas and Gathercole's (2007) study and a study conducted by Ball (1988) the use of SM as a substitute for AM was observed. Ball suggests that this may be due to the fact that SM is triggered in similar contexts to AM (i.e. after some prepositions and conjunctions), and therefore is applied to these similar contexts. In light of the fact that SM is more prevalent in the Welsh language as a whole, this extension of SM to contexts that should trigger AM is unsurprising.

Nevertheless, though SM is being used more consistently than the other mutation types, the accuracy of its use is still questionable. Extension of SM to contexts in which it should not occur, and lack of use of SM in contexts in which it should occur have both been observed in native Welsh speakers (Roberts, 1988; Thomas, 1984; Thomas & Gathercole, 2007; Hatton, 1988). It has been suggested that the latter - mutation loss - is a more significant factor in inaccurate use of mutation than mutation replacement (Ball, 1988).

4.4 The Role of Context and Input

Observations of higher use of mutation in the written medium versus the spoken medium (Hatton, 1988), and of higher levels of mutation in Welsh spoken in more formal settings (Ball, Griffiths & Jones, 1988; Thomas, 1984) suggest that mutation is more established in contexts that require a certain level of formality. Essentially, it seems that "informal" or colloquial Welsh is partly reflected by a reduced rate of use of mutation, (i.e. more liberal use (or non-use) of correct grammatical forms).

Furthermore, it has been observed in various cases that the level of input received in Welsh seemingly determines the frequency of use and/or point of acquisition of mutation. Bellin (1988) compared Welsh speakers who had attended Welsh medium schools and were raised either in Welsh-speaking homes, homes in which both English and Welsh were spoken or English-speaking homes. Comparison of the groups revealed a correlation between the frequency of use of mutation and the level of input in Welsh, with those speakers who received the most Welsh input showing the most productive and accurate use of mutation (for support see Thomas, 1984).

Input seems to also play a role with regard to age of acquisition. Various researchers have postulated that a child must reach a "critical mass" of input before they are able to process lexical items and determine their function (c.f. Gathercole, 2002; Oller & Eilers, 2002) in that frequency of occurrence of forms plays a crucial role in subsequent acquisition of those forms (see Ellis, 2002 for a review of this topic).

With regard to Welsh, the role of input in acquisition has been explored in a group of studies by Gathercole and colleagues (Gathercole, Thomas & Laporte, 2001; Thomas & Gathercole, 2005; Gathercole & Thomas, 2005) and by Sharp (2008). All of these studies found a correlation between performance and level of input in Welsh.

4.5 Mutation and Gender

In sum, the literature to date seems to show that all mutation types are used in a variable manner, and to a level of accuracy that is far below the target level, (as dictated by the grammar). There is evidence of a shift in mutation use that favours the more common mutation type (SM) over the other (less common) mutation types (AM and NM). Appropriate use of mutation is more established in some contexts than others, which suggests that there are factors in terms of the structure of the language that may determine more or less accurate use. In addition, the role of input as a factor in the acquisition of the mutation system has been observed.

How does this impact upon the use of mutation as a marker for gender? As Thomas and Gathercole (2007) point out, the acquisition of gender in Welsh is complicated by the fact that one must acquire mutation in order to be able to acquire the central feature of the gender system. This is due to the integral role that SM (and to a lesser degree, AM) plays as a marker for gender in certain contexts, "…children need to be able to distinguish between mutated and non-mutated forms of nouns in order to infer a noun's gender, and need productive command of mutation in order to mark gender categories in their speech" (Thomas & Gathercole, 2007, p.254).

Local gender marking and SM.

In relation to the acquisition of gender in Welsh, these studies (Gathercole, Thomas & Laporte, 2001; Thomas, 2001; Gathercole & Thomas, 2005; Thomas & Gathercole, 2005, Thomas & Gathercole, 2007), have shown that:

(a) In contexts that require production of basic forms of nouns (i.e. where a mutation is not needed to provide a gender distinction) Welsh-speaking children generally seemed to adhere to this requirement and produce basic forms of nouns

(b) Comparably, in those instances where soft mutation of feminine forms was required (i.e. after the definite article, *y*) mutation rates were quite low. This reflected a general tendency for children to produce more basic forms of nouns overall, even in contexts in which SM was necessary, i.e. they exhibited under-extension of the SM rule (see also Sharp, 2008).

The tendency to produce basic forms has been further illustrated in children's production of nonsense words. Gathercole et al. (2001) discovered that performance on feminine nouns was significantly reduced for feminine nonsense nouns (12%) versus real feminine nouns (28%), but no difference were found between the performance rates for real masculine nouns (96%) vs. masculine nonsense nouns (93%). This reflected a default generalisation strategy of producing basic forms of novel nouns when they were encountered, and of producing basic forms of real nouns significantly more often than mutated forms overall.

However, in various studies, overgeneralization of SM to adjective forms, regardless of the gender of the referent, has been observed (Gathercole et al. 2001; Thomas, 2001; Sharp, 2008). As a consequence, feminine nouns were generally produced in their correct (mutated) forms less frequently than corresponding adjectives, and masculine nouns were produced in their correct (non-mutated) forms more often than corresponding adjectives.

This evidence suggests that children are aware that SM of adjectives occurs after nouns, but they are yet to decipher that this applies only after feminine nouns

(Gathercole, Thomas & Laporte, 2001; Sharp, 2008). Welsh children seemingly do not employ rule-based learning approaches, and approach learning of the gender system in a more “piecemeal” fashion (p. 13, Gathercole et al. (2001)). In some cases it is evident that children are applying SM to nouns on an item-by-item basis (Sharp, 2008).

This approach may be prompted by the “complexity” (Lieven & Tomasello, 2008) of SM as a cue, due to the many contexts that SM is triggered by, and the varied reasons behind them. This complexity may discount rule-based learning as an efficient method of acquisition of this gender construct due to a combination of the exceptions to the “SM of feminine nouns after *y*” rule, and the multiple other rules that trigger the occurrence of SM elsewhere, making the identification of SM as a gender marker especially difficult.

Though young children’s understanding of local gender marking seems to be somewhat limited based on Gathercole et al.’s (2001) results, these same results also suggest evidence of the beginnings of understanding the system. Basic forms of masculine nouns were produced more often than basic forms of feminine nouns, and mutated forms of adjectives with feminine referents were more common than mutated forms of adjectives with masculine referents. This pattern became more defined with age (for support see Sharp, 2008).

Distant gender marking and SM.

In another branch of their (2001) study, Gathercole et al. assessed 101 children aged five, seven and nine in a gender comprehension task. This task involved distant marking for gender with one of two constructs. Depending on the trial, the task required children to select either the correct noun form (soft mutated or aspirate mutated) after *ei* (third person possessive), or the correct pronoun form, according to the grammatical gender of the referent in question. Referents were humans, animals or inanimate objects.

Performance was better for masculine items than for feminine items overall, and echoed productive performance of Welsh children in local gender constructs. It was observed that rates of correct responses for pronouns were higher than for post-*ei* noun forms overall (p.20). This may again reflect the complexity of SM as a gender cue, due to its occurrence in so many other contexts. However, SM after *ei* was still at a fairly high rate, (65% on average), and this probably reflects the high prevalence of SM in the Welsh language. This presumably bolsters its "availability" (c.f. Bates & MacWhinney, 1989) as a cue, and in turn promotes its usage. In this same *ei* context, AM functions as a cue to feminine gender after *ei*. Rates of AM after *ei* were significantly lower than that of SM. The results then seem to reflect the higher prevalence of SM in the Welsh language compared to AM, which presumably bolsters its level of target use in this context.

4.6 Natural Gender and Grammatical Gender

Some nouns also have natural gender. Nouns denoting humans for example, carry with them information regarding the biological sex of the referent (e.g. dynes 'woman' is biologically female). In such cases, GG and NG often overlap. Therefore, two forms of gender information are present. In such cases, it is reasonable to expect that comprehension and production of gendered forms of such nouns (or gendered forms syntactically related to those nouns) would be achieved more easily.

Gathercole et al. (2001) discovered an animacy hierarchy in children's comprehension of pronoun forms. Performance showed the following pattern humans > animals > inanimates, indicating that for those items that had clear natural gender cues available, children were able to mark for gender more successfully, as evidenced by their pronoun selection. In addition to finding this effect with pronouns, they discovered the same effect of animacy for *ei* constructions. The researchers suggested that this reflects use of natural gender to "break into" (p.23) the grammatical gender system. In essence, natural gender seems to be used as a "bridge" or "stepping stone" to grammatical gender, at least initially, whilst children are learning to navigate the more abstract grammatical gender system.

However, natural gender has been shown to be a less significant factor in local gender contexts (Sharp, 2008). The role of natural gender is unclear, but what is clear is that its influence varies according to the specific linguistic context under scrutiny. The current investigation aims to investigate this further by examining children's production of multiple types of lexical items and sub-lexical features that mark for gender in Welsh.

4.7 The Current Study

As a cue for grammatical gender, SM is highly opaque, as there is far from a one-to-one mapping between its occurrence and its function. The result is a highly complex system. Due to the complexity of SM as a cue to gender, it is of interest to observe how young Welsh children, acquiring Welsh as their first language, attend to and make use of SM within the Welsh gender system, and further, how this complexity impacts other features of the gender system.

Exploring other features of the grammatical gender system.

As discussed above, the sole form of gender marking on nouns is via soft mutation of feminine nouns under the necessary conditions. However, additional gender cues are available in the form of various syntactically related constructions. These include demonstrative adjectives/pronouns, (i.e. hwn (m.) vs. hon (f.) ‘this’ and hwnnw (m.) vs. honno (f.) ‘that’), personal pronouns (i.e. fo ‘him/it (m.)’ vs. hi ‘her/it (f.)’), prepositions (arni ‘on her/it (f.)’ vs. arno ‘on him/it (m.)’), and some numeral forms. The current study expands on previous research by exploring the latter three forms of gender marking, each of which is described in turn below.

Local marking of nouns: Numerals.

Only a small sub-set of numeral forms - namely numbers two, three and four - are marked for gender (see (24) below). These numeral forms agree with the gender of the noun they quantify, as shown in examples (25) and (26).

(24) 2 = dau (m.) vs. dwy (f.)

3 = tri (m.) vs. tair (f.)

4 = pedwar (m.) vs. pedair (f.)

(25) Feminine numeral forms

dwy ffenestr	tair cath	pedair seren
two (f.) window (f.)	three (f.) cat (f.)	four (f.) star (f.)
‘two (f.) windows (f.)’	‘three (f.) cats (f.)’	‘four (f.) stars (f.)’

(26) Masculine numeral forms

dau afal	tri bwrdd	pedwar ci
two (m.) apple (m.)	three (m.) table (m.)	four (m.) dog (m.)

‘two (m.) apples (m.)’ ‘three (m.) tables (m.)’ ‘four (m.) dogs (m.)’

Distant marking of nouns: Prepositions and pronouns.

Like the sub-set of numeral forms described above, pronouns must also agree in grammatical gender with the antecedent noun. Masculine nouns require the pronoun form fo; while feminine nouns require the pronoun form hi (see examples (27 and 28). Additionally, when pronouns occur as objects of prepositions, some prepositions, including locative prepositions such as ar ‘on’, wrth ‘next to’, and dan ‘under’, agree in form with the pronouns, as shown in examples (29) and (30).

(27) Masculine noun = masculine pronoun

Ble	mae’r	ci?	Ble	mae	o?
Where	is-the	dog?	Where	is	he (it)?

(28) Feminine noun = feminine pronoun

Ble	mae’r	gath?	Ble	mae	hi?
Where	is-the	cat?	Where	is	she (it)?

(29)

arn**o fo**	wrth**o fo**	dan**o fo**
‘on him/it’	‘next (to) him/it’	‘under him/it’

(30)

arn**i hi**	wrth**i hi**	dan**i hi**
'on her/it'	'next (to) her/it'	'under her/it'

4.8 Rationale and Hypotheses

Production of the abovementioned forms will be compared to the use of SM as a central gender marker on nouns and their corresponding adjectives, with the aim of gaining new knowledge regarding the interaction of different gender constructs within the Welsh gender system. The current study explores first how children utilise these two relatively unexplored elements of the gender system, and second whether or not the patterns of use/acquisition of these elements interact with or are related to the patterns of acquisition/use of SM as a central gender marker on nouns and adjectives. Based on previous research, the following hypotheses were made:

1) Acquisition of productive use of the soft mutation rule for nouns and adjectives will occur in a piecemeal item-based fashion in these participants, due to the opacity of the Welsh gender system
2) Given the piecemeal nature in which the central gender rule seems to be acquired, it is predicted that acquisition of the other gender features will be similarly piecemeal due to the inconsistency of gender marking on the nouns themselves
3) It is also predicted that acquisition of gendered numerals and pronouns could be more advanced than that of the soft mutation rule due to the fact that masculine and feminine gender are each marked by a single phonological form for each gender feature (therefore these markers are more salient), and

they carry more semantic content (i.e. pronouns and numerals are whole lexical items, as opposed to sub-lexical elements)

4) Pronoun use was expected to be further developed than numeral use due to the fact that gender distinctions apply only for three numerals, while gender distinctions via pronouns apply to all nouns in the Welsh language
5) Effects of age and home language are expected, which will reflect the effect of exposure in terms of additive exposure with age, and general levels of exposure according to the language(s) spoken to children at home by their parents
6) Based on previous findings, animacy effects are expected for pronoun production, but are not expected to have an impact on gender marking in local contexts

Chapter 5

Local Gender Marking: Nouns and Adjectives

5.1. Chapter Overview

This chapter presents an experimental task that elicited nouns and adjectives in structured contexts. The rationale and method of the task (and a pre-task) are presented, followed by quantitative and qualitative explorations of the results of the main task and a discussion of the results.

5.2. Task Summary and Rationale

The Noun and Adjective Elicitation Task assessed local gender marking of (feminine) nouns and the agreement marking of associated adjectives via Soft Mutation (SM). According to the grammatical gender system of Welsh, feminine nouns are marked for gender via SM when preceded by the definite article. Masculine nouns in the same context do not mutate. Adjectives show agreement with the gender of the noun they are paired with, as shown below:

masculine noun (basic form) + adjective (basic form)

feminine noun (mutated form) + adjective (mutated form)

Previous research on the production of nouns and adjectives has indicated that both children and adults are variable in their application of the SM rule, and that acquisition follows a more piecemeal route as opposed to a rule-based pattern

(Gathercole, Thomas & Laporte, 2001; Gathercole & Thomas, 2005; Thomas & Gathercole, 2005; Thomas and Gathercole, 2007). In addition, previous work suggests that due to the complexity of SM as a gender marker, Welsh speakers look to other sources of information to guide their selection, such as natural gender information of noun referents (c.f. Gathercole, Thomas & Laporte, 2001).

The current study aimed to replicate these findings with a new set of participants. A primary aim was to further relate gender marking in previously researched domains of Welsh gender to other forms of gender marking. These other forms of gender marking are later addressed individually (see Chapters 7 and 8) and are discussed in relation to one another in Chapter 10.

5.3 Method

The main experiment consisted of an elicitation task in which a set of nouns, plus associated adjectives, were elicited. (A preliminary task elicited nouns via picture cards, to check that children knew the nouns in question.) A description of the main task is presented first, followed by a brief methodological description of the preliminary task.

<u>SECTION A – MAIN TASK</u>

5.3.1 Design and stimuli.

5.3.1.1 Linguistic stimuli.

The task consisted of 48 trials. Each of the trials had two phases, a "prompt" phase and a "target" phase. In each trial, the prompt phase featured one prompt sentence (uttered by the experimenter) and the target phase featured a sentence to be uttered by the participant. The two sentences entailed naming an object and its colour. These sentences referred to images presented on a computer screen.

Target sentences.

Target sentences featured 48 noun-adjective pairs. The pairs included 48 nouns and six colour adjectives that were balanced for occurrence with nouns. These nouns and colour adjectives all had mutatable onsets and appeared within a context that triggered mutation of feminine nouns and associated adjectives. Nouns were varied in their animacy to assess the role of natural gender cues. Some nouns referred to humans, some to animals and some to inanimate object; these three noun types were balanced for presentation (see *Table 5.1*, below for a full list of list of elicited nouns and adjectives).

Nouns were further balanced according to their forms. A small number of Welsh nouns are marked for gender by the presence of gendered word endings. These endings include *–wr* and *–yn* for masculine nouns, and *–es* and *–en* for feminine nouns. Examples of words that possess these endings are shown below:

(31)

Marked Masculine Nouns:

canwr 'singer (m.)', *pêl-droediwr* 'footballer (m.)'

mochyn 'pig' (m.)', *blodyn* 'flower (m.)'

(32)

Marked feminine nouns:

dynes ‘woman (f.)’, *tywysoges* ‘princess (f.)’

malwen ‘snail (f.)’, *deilen* ‘leaf (f.)’

Nouns were balanced in the following ways:

1) Half of the nouns were feminine, half were masculine

2) Half of the nouns referred to inanimate objects, half to animate

3) Within the animate category, half were humans, half were animals

4) Half of all nouns had gendered endings, (e.g. *powlen* ‘bowl (f.)’, *cantores* ‘singer (f.)’, *beiciwr* ‘biker (m.)’ and *tocyn* ‘ticket (m.)’. The remaining half of the nouns did not have gendered endings (e.g. *bwrdd* ‘table (m.)’, *merch* ‘girl (f.)’).

5) Nouns with and without gendered endings were balanced for frequency of occurrence across all gender and animacy categories

Full sentences involved producing the appropriate noun and colour adjective combination in a context that triggered mutation (of feminine nouns):

(33) MASC:

Dyma’r	*ci*	*glas*
here-the	dog (m.)	blue

‘Here’s the blue dog (m.)’

Basic forms of *ci* and *glas* (no mutation)

(34) FEM:

Dyma'r	*gath*	*las*
here-the	cat (f.)	blue

'Here's the blue cat (f.)'

Mutated forms of *cath* and *glas* (soft mutation)

Prompt sentences

Target sentences were preceded by prompt sentences in each trial. The prompts featured 48 nouns different from those elicited in the target stimuli, plus adjectives. Eleven different colour adjectives appeared in prompt phases. Six of these adjectives had mutatable onsets; the remaining five did not. These prompt sentences varied in their syntactic structure. The syntactic structures controlled for gender information. Zero, one or two syntactic cues were available that indicated the 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 (see (35) and (36), below).

(35) MASC :

EXP:	*Dyma*	*lun*	*ci*	*oren*
	here (is)	picture	dog (m.)	orange

'Here's an orange dog (m.)'

Basic form of *ci* (no mutation) + unmutable adjective (vowel initial)

Table 5.1. *List of nouns and corresponding adjectives (part one)*

Noun and adjective combinations with gendered endings			
Prompt nouns and adjectives		**Elicited nouns and adjectives**	
Masculine	**Feminine**	**Masculine**	**Feminine**
garddwr oren 'orange gardener'	cantores aur 'gold singer (f.)'	peintiwr glas 'blue painter (m.)'	tywysoges las 'blue princess (f.)'
adeiladwr glas 'blue builder (m.)'	athrawes aur 'gold teacher (f.)'	pêl-droediwr glas 'blue footballer'	brenhines goch 'red queen (f.)'
beiciwr aur 'gold cyclist (m.)'	dewines goch 'red sorceress (f.)'	canwr glas 'blue singer (m.)'	dynes las 'blue woman (f.)'
morgurgyn oren ' orange ant (m.)'	*colomen sbotiog* 'spotty pigeon (f.)'	mochyn coch 'red pig (m.)	llygoden binc 'pink mouse (f.)'
aderyn arian 'silver bird (m.)'	*pioden ddu* 'black magpie (f.)'	pysgodyn coch 'red fish (m.)	malwen las 'blue snail (f.)'
morgrugyn brown 'brown ant (m.)'	*colomen sbotiog* 'spotty pigeon (f.)'	pry copyn coch 'red spider (m.)'	cwningen ddu 'black rabbit (f.)'
gwelltyn oren 'orange straw (m.)'	bricsen streipiog 'stripy brick' (f.)	*blodyn pinc* 'pink flower (m.)'	*pluen goch* ' red feather (f.)'
rhosyn aur 'golden rose (m.)'	seren arian 'silver star (f.)'	*bodyn glas* ' blue toe (m.)'	*deilen goch* 'red leaf (f.)'
tocyn aur 'golden ticket (m.)'	powlen sbotiog 'spotty bowl (f.)'	*planhigyn du* 'black plant (m.)'	*teisen binc* 'pink cake (f.)'
bathodyn arian 'silver badge (m.)'	*carreg arian* 'silver rock (f.)'	*llinyn piws* 'purple string (m.)'	*cneuen ddu* 'black nut (f.)'
bwthyn coch 'red cottage (m.)'	*taten frown* 'brown potato (f.)'	*brigyn piws* 'purple stick (m.)'	*coeden goch* 'red tree (f.)'
rhosyn glas 'blue rose (m.)'	*bricsen las* 'blue brick (f.)'	*polyn du* 'black pole (m.)'	*mellten biws* 'purple lightning (bolt) (f.)

Table 5.1. List of nouns and corresponding adjectives (part two)

Noun and adjective combinations (nouns without gendered endings)			
Prompt nouns and adjectives		**Elicited nouns and adjectives**	
Masculine	**Feminine**	**Masculine**	**Feminine**
dyn sbotiog ' spotty man (m.)'	*nain aur* 'gold grandmother (f.)'	*taid glas* 'blue grandfather (m.)'	*merch binc* 'pink girl (f.)'
dewin streipiog 'stripy wizard (m.)'	*modryb binc* 'pink aunt (f.)'	*meddyg brown* 'brown doctor (m.)'	*mam goch* 'red mother (f.)'
baban oren 'orange baby (m.)'	*nain biws* 'purple grandmother (f.)'	*brenin coch* 'red king (m.)'	gwrach binc 'pink witch (f.)'

blaidd arian 'silver wolf (m.)'	*draig arian* 'silver dragon (f.)'	*ci du* 'black dog (m.)'	*dafad biws* 'purple sheep (f.)'
cranc coch 'red crab (m.)'	*tylluan streipiog* 'stripy owl (f.)'	*broga piws* 'purple frog (m.)'	*cath ddu* 'black cat (f.)'
tarw brown 'brown bull (m.)'	*draig streipiog* 'stripy dragon (f.)'	*ceffyl du* 'black horse (m.)'	*buwch las* 'blue cow (f.)'
car streipiog 'stripy car (m.)'	*ceg arian* 'silver mouth (f.)'	*ty coch* 'red house (m.)'	*gardd las* 'blue garden (f.)'
daint sbotiog 'spotty tooth (m.)'	*cynffon sbotiog* 'spotty tail (f.)'	*popty glas* 'blue oven (m.)'	*braich goch* 'red arm (f.)'
teledu arian 'silver television (m.)'	*coedwig aur* 'gold forest (f.)'	*cwmwl du* 'black cloud (m.)'	*cloch biws* 'purple bell (f.)'
traeth oren 'orange beach (m.)'	*coes goch* 'red leg (f.)'	*bwrdd glas* 'blue table (m.)'	*troed binc* 'pink foot (f.)'
teledu brown 'brown television (m.)'	*calon goch* 'red heart (f.)'	*cylch piws* 'purple circle (m.)'	*cadair las* 'blue chair (f.)'
tân coch 'red fire (m.)'	*pêl oren* 'orange ball (f.)'	*twll glas* 'blue hole (m.)'	*dinas ddu* 'black city (f.)'

(36) FEM:

EXP:	*Dyma*	*lun*	*cath*	*oren*
	here (is)	picture	cat (f.)	orange
	'Here's an orange cat (f).'			

Basic form of *cath* (no mutation) + unmutable adjective (vowel initial)

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:

(37) MASC:

EXP:	*Dyma'r*	*ci*	*oren*
	here-the	*dog (m.)*	*orange*
	'Here's the orange dog (m.)'		

Basic form of *ci* (no mutation) + unmutable adjective (vowel initial)

(38) FEM:

EXP:	*Dyma'r*	*gath*	*oren*
	here-the	cat (f.)	orange
	'Here's the orange cat (f.)'		

Mutated form of *cath* (mutation) + unmutable adjective (vowel initial)

Condition 3: 2-cues

Nouns in this condition were preceded by the definite article yr (‘r), as above, but, additionally, adjectives with mutatable onsets followed the nouns. Both are marked for gender. Masculine nouns do not mutate; nor do their corresponding adjectives, as shown in (39), while feminine nouns and their associated adjectives do mutate (see (40) below).

(39) MASC:

Dyma'r	*ci*	*glas*
here-the	dog (m.)	blue

‘Here’s the blue dog (m.)’

Basic forms of *ci* and *glas* (no mutation)

(40) FEM:

Dyma'r	*gath*	*las*
here-the	cat (f.)	blue

‘Here’s the blue cat (f.)’

Mutated forms of *cath* and *glas* (mutation)

Balancing of prompts and target sentences.

The nouns that featured in prompt sentences were always different from those that appeared in target sentences. Participants were required to produce different noun-adjective combinations from those produced by the experimenter in prompt phases. Among the analyses conducted, we observed whether the occurrence of nouns of either masculine or feminine gender in prompt sentences (along with the gender features these nouns take in certain syntactic frames) affected children's application of mutation to a different set of elicited nouns (and adjectives). The gender of the subject noun in prompt sentences matched the gender of the subject noun in target sentences in half of the trials (congruent trials), and differed in half of the trials (incongruent trials), (see *Figure 5.1* below).

The prompts were balanced in congruent and incongruent trials as follows:

- Half of the target masculine nouns appeared in congruent trials, half were in incongruent trials
- Half of the target feminine nouns were in congruent trials, half were in incongruent trials
- Half of the morphologically marked nouns (with gendered endings) were in congruent trials, half were in incongruent trials
- Half of the morphologically unmarked nouns (without gendered endings) were in congruent trials, half were in incongruent trials
- Half of the animate nouns (i.e. humans and animals) were congruent, half were incongruent
- Within the animates category, half of the human nouns appeared in congruent trials, and half in incongruent trials (the same distribution applied to animal items)
- Half of the inanimate items were in congruent trials, half were in incongruent trials

Examples of prompt and target sentence sequences are shown below:

(41) MASC:

PROMPT:	*Dyma'r*	*bwthyn*	*coch*
(EXP)	here-the	cottage (m.)	red

'Here's the red cottage (m.)'

TARGET:	*Dyma'r*	*ci*	*glas*
(PART.)	here-the	dog (f.)	blue

'Here's the blue dog (m.)'

(42) FEM:

PROMPT:	*Dyma'r*	*ddraig*	*streipiog*
(EXP)	here-the	dragon (f.)	stripey

'Here's the stripey dragon (f.)'

TARGET:	*Dyma'r*	*gath*	*las*
(PART.)	here-the	cat (f.)	blue

'Here's the blue cat (f.)'

5.3.1.2 Non-linguistic stimuli.

Images.

Ninety-six images were created. Forty-eight prompt images matched the prompt sentences of the experimenter; the remaining 48 images elicited sentences from the participant. Images were presented in colour for the purpose of eliciting colour adjectives along with nouns (see *Figure 5.1*. below for examples of congruent and incongruent trial examples).

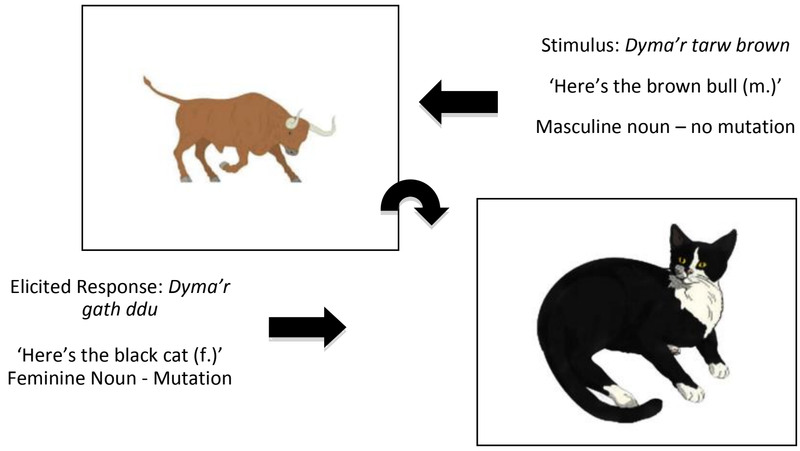
5.3.2 Participants.

Participants (N = 165) were divided into five age groups, and were further divided across three language categories, according to the language(s) spoken to them at home by their parents: Only Welsh at Home, (OWH) Welsh and English at Home (WEH), and Only English at Home (OEH). Participants were assigned to one of these three language groups based on information provided by participants (or their parents). Information was acquired via a detailed background questionnaire (see Appendix 1, after consent was acquired (see Appendix 2 for consent form). Four age groups of children (4, 5, 7, and 9 years of age) were tested. For all except the youngest group (4-year-olds), children from all language backgrounds were included. For the 4-year-olds, only children whose parents spoke only Welsh to them at home were included in the study, as pilot testing of 4-year-olds whose parents spoke only English or both Welsh and English to the child at home, revealed that children from these language groups were unable to perform this task.

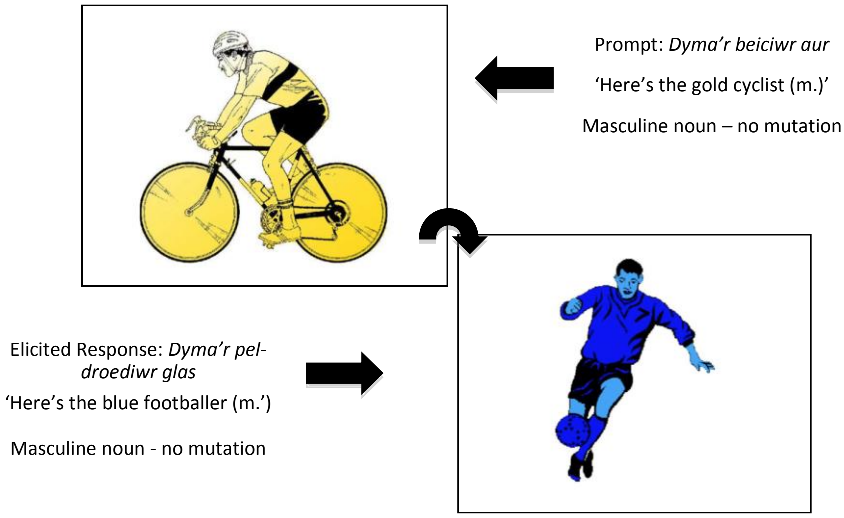
However, during testing it soon became evident that many of the 4-year-old children from the OWH group also struggled to spontaneously produce many of the target nouns. Consequently, their data were not analysed due to a high volume of no responses. These children did produce analysable data in other experimental tasks, however, and those data are discussed in later chapters. One group of Only Welsh at Home adults, (adults who had been raised in homes where both parents spoke Welsh to them from birth onwards), was recruited to act as a gauge of the maximum target acquisition level for the children. This resulted in 11 sub-groups of participants, as shown in *Table 5.2*, above. Both the child and adult participants also

Figure 5.1. Examples of trials [congruent and incongruent]

CONGRUENT:



INCONGRUENT:



took part in three other experimental tasks to be outlined in later chapters.[4] All of these tasks assessed participants' productive use Welsh gender features, with each task focussing on a different aspect of the system.

Table 5.2

Classification of participants by age and language group

Age Groups		Language Groups		
Age Range	Mean Age	Only Welsh at Home	Welsh and English at Home	Only English at Home
3;6 – 4;8	4;5	N =15	N/A	N/A
4;10 – 6;0	5;6	N =15	N = 15	N = 15
6;6 – 7;8	7;4	N =15	N = 15	N = 15
8;4 – 9;6	8;10	N =15	N = 15	N = 15
18;0 – 50;0	25;5	N =15	N/A	N/A

Participants were informed that they would be playing a game in which they would see many coloured images, and that they and the experimenter would be naming the things they saw. Before commencing with the main game, participants were given six practice trials first (see Appendix 3 for full task instructions).

In each trial, the experimenter first produced the prompt sentence in response to an image, and then the participant was asked to produce a target

[4] In a small number of cases it was not possible for some participants to take part in all the tasks due to drop-outs or failure on the part of some children to understand, or participate in, one or more of the tasks. In those cases, new participants were recruited to replace the missing data.

sentence in response to a new image. Trials were completely randomised using the RAND command in Microsoft Excel ©. A total of five different randomisations of the trials were created (see Appendix 4 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 all possible combinations of mutated/unmutated noun and adjective forms, (see Appendix 5), and 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.

SECTION B – PRELIMINARY TASK

A ***Preliminary Card Task*** was run prior to the running of the ***Noun and Adjective Elicitation Task***. The pre-task elicited the 48 nouns that were to be elicited in the main task, but in a non-mutatable context. As the main task required participants to name the objects in pictures, this task assessed children's knowledge of the target nouns, and served to determine whether:

1) The participants were familiar with and able to produce the nouns

2) The images were eliciting the desired nouns from participants

3) Whether or not children produced mutated forms of nouns even without the presence of the article

5.3.1 Design and stimuli.

5.3.1.1 Linguistic Stimuli.

The same forty-eight nouns elicited in the main task were elicited here (for a full list of the nouns (see *Table 5.1,* as presented in SECTION A, above).

5.3.1.2 Non-linguistic Stimuli.

48 picture cards elicited nouns. The images on the cards were presented in black and white as only nouns were elicited in this preliminary task (see Appendix 6).

5.3.2 Participants

All participants that participated in the Noun and Adjective Elicitation Task, first participated in this task.

5.3.3 Procedure

Participants were told that they would be playing a card game. They were asked to turn over each card one at a time. Each time they turned over a card they were asked to name the image that was on the card. If they could not name the item, clues were given as to what it was. The experimenter was careful not to use any language (e.g. pronouns), which would indicate the grammatical gender of the target noun. For example, when describing a picture of a cow, the experimenter would say something like:

Mae'r peth yma yn anifail.

Mae'r anifail yma yn rhoi llefrith i ni ac yn gwneud sŵn MW!

Beth wyt ti'n meddwl ydi enw'r anifail yma?

"This thing is an animal.

"This animal gives us milk, and makes a MOO sound."

"What do you think the name of this animal is?"

The task continued in this manner until all of the cards had been revealed. The experimenter noted any non-responses or any unexpected responses on a marking sheet whilst the child performed the task. Immediately following the card task, participants were told that they would be playing another game on the computer (i.e. the Noun and Adjective Elicitation Task) where they would see the images they had seen on the cards again in a different context.

A marking sheet was used that largely functioned as a checklist, but was also used to make note of any nouns that participants could not spontaneously produce. It was also noted when a participant produced a noun in its mutated form.

5.4 Results

5.4.1. Overview.

Multiple analyses were performed on both the noun and adjective data. The results of each dataset are presented separately. First, a set of quantitative analyses will report the noun data from the OWH adults and the OWH 5-, 7- and 9-year-olds. This was done so that comparisons could be made between adult and child data, in the hope of understanding the children's response patterns better in light of findings from the adult data. Due to the lack of WEH and OEH adult participants, comparisons could only be made between the OWH adults and children. Second, quantitative analyses of all of the noun data from child participants aged between 5- and 9-years-old from all language groups are reported. Additional analyses explore the extent to which experimenter prompt sentences affected participants' response patterns.

A second set of quantitative analyses report the adjective data for the same two sets of participants. A third set of qualitative analyses examine potential lexical effects in the aforementioned adult and child datasets for both nouns and adjectives.

5.4.2 Data scoring.

Data were scored for target/non-target responses in the choice of noun and adjective forms. Data were collapsed where appropriate according to the various variables manipulated in the task design.

5.4.3 Quantitative analyses.

QUANTITATIVE ANALYSES – PART ONE – NOUNS

The data of the OWH participants were analysed first for the following reasons:

- Adult data were available only for this home language group, and so analysing the OWH data allowed for comparisons to be made between the performance of children and the performance of adults
- The OWH group was the group exposed to the most Welsh. Based on this fact, the acquisition state of this group was expected to be the most advanced of the three language groups. The results of these analyses could be used to inform the results found for the remaining home language groups, by giving an idea of the level of acquisition that the other home language

groups would be aiming for, and the types of acquisition patterns that could appear in the groups

Various different statistical tests were run on the data, depending on the type and number of variables under investigation. LSD tests were used to for planned comparisons exploring differences across levels of within-subjects variables (e.g. gender of nouns, number of cues in a given trial, etc) while Tukey's HSD was used to explore differences across level of between-subjects variables (e.g. age, home language, etc). Regarding post-hoc tests, post-hoc ANOVAs were run when multiple variables required exploration after the preliminary analysis. Post-hoc T-tests were favoured when the focus was on two levels of a specific variable. This applied to all quantitative analyses reported in this chapter and in later chapters.

<u>OWH PARTICIPANTS</u>

Preliminary Analysis

A preliminary analysis of the OWH adult and child data entailed a mixed ANOVA in which Gender (Masculine vs. Feminine), Animacy (Animate vs. Inanimate), Cue Condition (Zero, One, or Two Cues) and Word Form (Gendered Ending vs. No Gendered Ending) were included as independent within-subjects variables; Age Group, (5, 7, 9, Adult) was included as the independent between-subjects variable, and accuracy of noun production was the dependent variable.

This analysis served to rule out any variables that did not appear to play a significant role. The analysis did not reveal a significant main effect of Cue Condition, $F(1, 59) = 1.866$, $p = .160$, and so data were collapsed by this variable in subsequent analyses. A significant main effect of Word Form was observed, $F(1, 59) = 4.680$, $p = .035$, reflecting the fact that performance for nouns with marked endings was significantly poorer than for nouns without gendered endings. Significant interactions of Gender x Word Form, $F(1, 59) = 15.599$ $p < .001$ and Gender x Animacy x Word Form, $F(1, 55) = 5.394$, $p = .024$ were also observed. The question of interest was whether nouns with gendered endings would help the child process the gender of the noun and thus perform better in their noun production when the noun had a gendered ending, and the main effect showed that this was not the case at all.

During testing it was observed that mutation rates for *cloch* 'bell (f.)' and *gardd* 'garden (f.)' were uncharacteristically high compared to all other nouns, (81% and 62% respectively). Both these nouns were feminine inanimate nouns, and may have been at the source of the above-mentioned effects and interactions. To test this possibility, the preliminary analysis was run again, this time where the scores for *cloch* and *gardd* were excluded from the dataset. No significant main effect of word form, $F(1, 54) = .304$, $p = .584$, or significant interactions of Gender x Word Form, $F(1, 54) = .118$, $p = .285$, or of Gender x Animacy x Word Form, $F(1, 54) = .052$, $p = .821$, were found in this second analysis.

We will discuss in qualitative analyses below, (see section **5.4.4 Qualitative Analyses**), why the mutation rates for these particular nouns were so high, and that the strong presence of the mutated forms of these nouns appear to reflect individual lexical learning. In following analyses, data were collapsed for Word Form.

Further analyses

In order to examine noun production, an ANOVA was conducted in which the primary factors of Noun Gender (Masc. vs. Fem), Animacy (Animate vs. Inanimate) and Age (5, 7, 9 and Adult) were treated as independent variables, and accuracy of noun production (based on appropriate presence/absence of mutation) was the dependent variable. Significant interactions of Gender x Animacy x Age Group , $F(7, 59) = 3.000$, $p = .038$ and of Gender x Age Group, $F(3, 59) = 23.986$, $p < .001$ were observed.

In order to explore the 3-way interaction of Gender x Animacy x Age Group, further analyses were run in which the data for the animate and inanimate categories were analysed for each gender category separately. In both cases, a mixed ANOVA, with Animacy (Masc Animate vs. Masc Inanimate in the first analysis, and Fem Animate vs. Fem Inanimate in the second analysis) and age group as independent variables, and accuracy of noun production as the dependent variable was run. A significant interaction of Animacy x Age was found for the feminine dataset, $F(1, 59) = 3.151$, $p = .032$. No significant interaction of Animacy x Age was found for the masculine dataset, $F(1, 59) = 2.067$, $p = .085$.

The data file was split by age group and paired t-tests analysed performance for feminine animate versus feminine inanimate nouns for each age group separately. Significant differences were found in the adult data for feminine items only, $t(1, 14) = 3.031$, $p = .009$. This revealed higher performance rates for feminine animate nouns when compared to feminine inanimate nouns (91% vs. 78%). Significant differences were not observed in any of the child groups, (5s – $t(1, 14) = -1.261$, $p = .228$; 7s – $t(1, 14) = .441$, $p = .665$; 9s – $t(1, 14) = -.380$, $p = .709$).

To explore the two-way interaction of Gender x Age Group the data file was split by age, and for each age group a paired t-test was run where a collapsed mean accuracy score for masculine nouns overall and a collapsed mean accuracy score for feminine nouns were compared. These t-tests confirmed significant effects of gender in all child age groups (5s – $t(1, 14) = 15.878$, $p < .001$; 7s – $t(1, 14) = 11.918$, $p < .001$; 9s – $t(1, 14) = 8.372$, $p < .001$*ps* < .001) but not for the adult group, $t(1, 14) = -.404$, $p = .692$). These differences are illustrated in *Figure 5.3*, (below).

Further exploration of animacy effects.

Given the main effect of animacy observed in the adult data for feminine nouns, it was of interest to determine whether this effect derived from higher performance rates for the animate category as a whole, or whether there were further differences in performance rates across the human and animal noun categories. A post-hoc ANOVA, where the feminine animate data were reconfigured into two categories (humans and animals) did not reveal a significant main effect of animacy, $F(1, 14)$ 3.400, $p = .083$, suggesting that something other than the presence or absence of natural gender information may have been at the root of the animacy effect in the adults. Possible lexical effects are explored in **Section 5.4.4.**

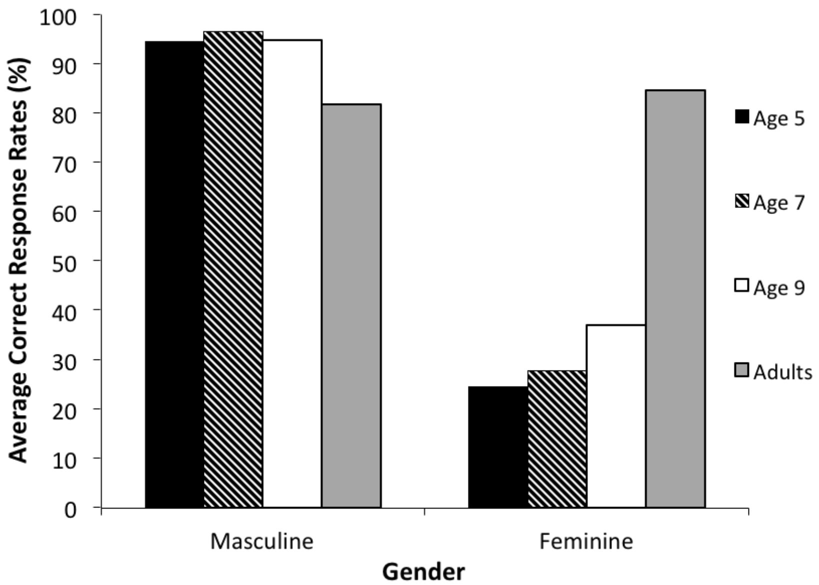


Figure 5.3. Performance rates by age group across gender categories, reflecting differences in the adults and children's response patterns.

ALL CHILD PARTICIPANTS

This set of analyses focused on the performance of three groups of children of the same age(s) who differed in their level of exposure to Welsh at home.

Preliminary Analysis

A preliminary analysis of the child data from all home language groups entailed a mixed ANOVA in which Gender (Masculine vs. Feminine), Animacy (Animate vs. Inanimate), Cue Condition (Zero, One, or Two Cues) and Word Form (Gendered Ending vs. No Gendered Ending) were included as independent within-subjects variables; Age Group, (5, 7, 9) and Home Language (OWH, WEH, OEH) were included as the independent between-subjects variables, and accuracy of noun production was the dependent variable.

This analysis served to rule out any variables that did not appear to play a significant role. As with the OWH dataset, a main effect of Word Form, $F(1, 59) = 16.869$, $p < .001$, and significant interactions of Gender x Word Form (1, 59) = 29.301, $p < .001$, and Gender x Animacy x Word Form, $F(1, 59) = 8.521$, $p = .004$. were observed. As above, scores for *cloch* 'bell (f.)' and *gardd* 'garden (f.)' were removed, and the preliminary analysis was re-run. This second analysis showed no main effect of word form, $F(1, 59) = .029$, $p = .865$, and no significant interaction of Gender x Word Form, $F(1, 59) = .189$, p = .665, or Gender x Animacy x Word Form, $F(1, 59) = .303$, $p = .583$.Data were collapsed by this variable in further analyses.

A main effect of Cue Condition, $F(2, 134) = 3.998$, $p = .007$, was also observed.

Post-hoc comparisons using the LSD test showed how performance in the 1-cue condition (M = 59.13, SD = 12.04) was significantly higher than in the 0-cues (M = 58.67, SD = 10.38) and 2-cues condition (M = 58.44, SD = 10.60), both *ps* < .05). The expectation was that if the cues to gender were assisting children, they would have done better in the 2-cue condition than in the 0- and 1-cue conditions. This effect is not consistent with that prediction. Given the anomalous score for *cloch* 'bell (f.)' (81% mutation rate on average), which happened to appear in the 1-cue condition, the analysis was run again with the data for cloch excluded. No main effect of cue condition was observed, $F(1, 134) = 2.744$, $p = .067$. Enough participants in the sample were producing a mutated form of this noun to change the result of the overall analysis. Data were collapsed by cue condition in further analyses. **Section 5.4.4** explores why high mutation rates were observed for this particular noun.

Further analyses

A second set of analyses was run on the child data with the variables of Word Form and Cue Condition now excluded from the analysis. A mixed ANOVA was conducted in which Noun Gender, (Masculine vs. Feminine) Animacy (Animate vs. Inanimate), Age Group (5, 7, 9) and Home Language (OWH, WEH, OEH) were treated as independent variables and accuracy of noun production was the dependent variable. There were significant main effects of noun gender, $F(1, 134) = 1730.285$, $p < .001$, and home language, $F(2, 134) = 13.798$, $p < .001$. The main effect of gender reflected significantly higher performances rates for masculine nouns than for feminine nouns (96% vs. 20%), as found in the OWH data. An interaction of Gender x Home Language, $F(3, 134) = 8.128$, $p = .005$, was also observed, $F(2, 128) = 10.195$, $p < .001$.

Post-hoc comparisons using the Tukey HSD test indicated that the mean score for the OEH group (M = 54.93, SD = 10.83), was significantly different (p <. 001) from that of the OWH group, (M = 61.86, SD = 8.34) and the WEH group (M = 58.75, SD = 6.12, p = .004). This effect suggests a role of language exposure, as the group with the least exposure to Welsh performed at the lowest level overall. Two post-hoc between-subjects ANOVAs (one for the feminine noun dataset and one for the masculine noun dataset) revealed a main effect of home language for feminine items, $F(2, 134) = 13.623$, $p < .001$, but not for masculine items, $F(2, 134) = .827$, $p = .439$. This reflected extremely low mutation rates across the board in the OEH group, as shown by their high scores for masculine nouns, and their very low scores for feminine nouns, (see *Figure 5.4*, below), suggesting again that lower levels of language exposure result in less frequent occurrence of mutation.

A 3-way interaction effect of Gender x Animacy x Age Group also emerged, $F(2, 134) = 5.876$, $p = .004$. Given the high accuracy rates for masculine nouns, a paired-samples t-test was run on the data for each age group on the collapsed scores for feminine animate and feminine inanimate nouns. These analyses revealed an effect of animacy for feminine nouns in the 5-year-old group, $t(46) = -3.743$, $p = .001$), but not in the 7- and 9-year-old groups, $t(44) = -.497$, $p = .622$; $t(46)$ -.555, $p = .582$). The response rates of the 5-year-olds were actually better for inanimates than for animates, contrary to expectations. Potential lexical effects are explored in **Section 5.4.4.**

The role of the prompt.

<u>OWH PARTICIPANTS</u>

In addition to the linguistic variables manipulated, the experimental design also manipulated trial congruency (i.e. whether or not the gender of the noun in the prompt sentence of a trial matched the gender of the noun that featured in the elicited sentence). Given the clear differences observed across gender categories a mixed ANOVA with congruency, gender and age group as independent variables and accuracy of noun production as the dependent variable was run. The analysis revealed a main effect of congruency $F(1, 58) = 6.332$, $p = .015$, and a significant interaction of gender by congruency, $F(1, 58) = 16.211$, $p = <001$. The scores for *cloch* ‘bell (f.)’ and *gardd* ‘garden (f.)’ were excluded from the analysis given the misleading effects they had caused above. When the analysis was re-run without these data, no significant main effects or interactions were observed, (Congruency - $F(1, 58) = .197$, $p = .659$, Gender x Congruency – $F(1, 58) = 3.114$, $p = .083$.

ALL CHILD PARTICIPANTS

For the child participant dataset, a mixed ANOVA with gender, congruency, age group and language group as variables revealed a main effect of congruency, $F(1, 136) = .21.529$, $p < .001$, and a significant interaction of Congruency x Gender, $F(1, 136) = 36.510$, $p < .001$. As with the OWH data, the scores for *cloch* ‘bell (f.)’ and *gardd* ‘garden (f.)’ were excluded from the analysis given the misleading effects they had caused above. When the analysis was re-run, these effects were no longer significant, (Congruency - $F(1, 130) = .194$, $p = .660$, Gender x Congruency – $F(1, 58) = 2.219$, $p = .139$. Overall, the gender of the nouns in prompt phases, and the forms they took, did not seem to influence participants’ response patterns.

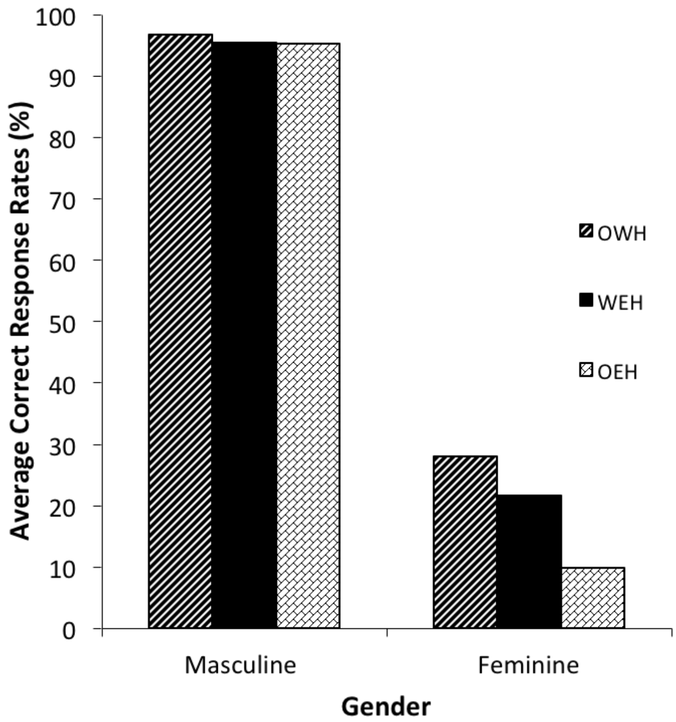


Figure 5.4. A significant interaction of Gender x Home Language reflected differences across home language groups for feminine but not masculine nouns.

QUANTITATIVE ANALYSES – PART TWO – ADJECTIVES

The adjective data were analysed separately from the noun data. As with the noun data, the OWH data (both children and adults) were analysed and compared first of all, followed by analyses of the child data from all three home language groups.

OWH PARTICIPANTS

Preliminary Analysis

A preliminary analysis of the OWH adult and child data entailed a mixed ANOVA in which Gender (Masculine vs. Feminine), Animacy (Animate vs. Inanimate), Cue Condition (Zero, One, or Two Cues) and Word Form (Gendered Ending vs. No Gendered Ending) were included as independent within-subjects variables; Age Group, (5, 7, 9, Adult) was included as the independent between-subjects variable, and accuracy of adjective production was the dependent variable.

A main effect of gender $F(1, 59) = 31.003$, $p < .001$ revealed significantly higher target response rates in masculine noun trials when compared to feminine noun trials (81.8% vs. 55.4%). Significant interactions involving gender were observed, including a significant interaction of Gender x Cue Condition $F(5, 59) = 5.045$, $p = .008$ and Gender x Word Form, $F(3, 59) = 21.440$, $p < .001$. Given these effects, further analyses explored variables other than gender for the masculine and feminine datasets separately. A main effect of age group $F(3, 59) = 14.340$, $p < .001$ was also found. Post hoc comparisons for age group using Tukey's HSD test revealed that the mean score for the adults (M = 87.22 SD = 11.75) differed significantly from the mean scores of the 5-year-olds (M = 60.66, SD = 12.02, $p < .001$), 7-year-olds, (M

= 61.18, SD = 12.04, $p < .001$) and the 9-year-olds (M = 68.23, SD = 15.44, $p = .001$). as shown in *Figure 5.5*.

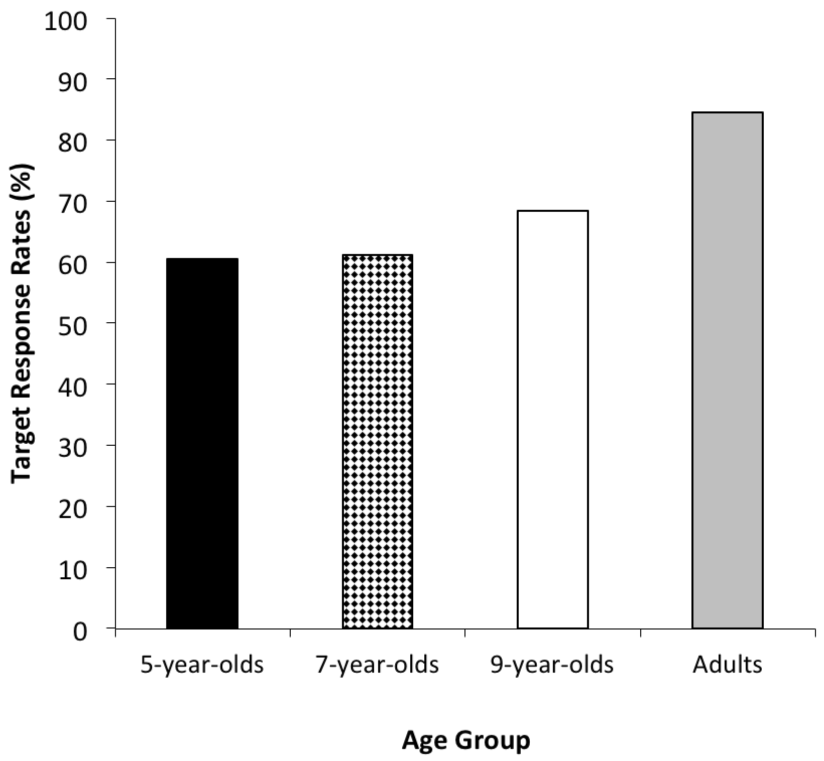


Figure 5.5. A main effect of age reflecting significantly higher target response rates in the adult group when compared to all child age groups.

Further Analyses

Given the significant interactions involving gender observed in the initial ANOVA, other factors were explored in two separate datasets – one dataset with responses in masculine noun trials, and one dataset with responses for feminine noun trials. For each dataset, the factors of Word Form (presence vs. absence of gendered word ending), Cue Condition (number of syntactic cues in prompt sentences) and Animacy (Animate versus Inanimate) were explored. Analyses reported below are presented with the gender categories separated, with data from the masculine category and then the feminine category presented in turn. In addition, a final set of analyses explored the extent to which experimenter prompt sentences affected participants' adjective production.

MASCULINE DATASET

In order to examine adjective production following masculine nouns, an ANOVA was conducted in which Word Form (marked vs. unmarked) Cue Condition (zero, one or two syntactic cues) Animacy (Animate vs. Inanimate), and Age Group were included as the independent variables and accuracy of adjective production was the dependent variable.

Two significant main effects/interactions were observed. A main effect of Word Form, $F(1, 59) = 8.402$, $p = .005$ showed how performance rates were better for adjectives paired with unmarked masculine nouns. A significant interaction of Cue Condition x Word Form was also observed, $F(2, 110) = 3.172$, $p =.046$. Two post-hoc ANOVAs examined performance by cue condition for the marked masculine noun trials and the unmarked masculine noun trials separately. A main effect of cue condition was observed for unmarked nouns, $F(2, 114) = 4.991$, $p = .008$, but not for marked nouns, $F(2, 114) = 2.977$, $p = .055$..,Post hoc comparisons for cue condition using the LSD test revealed that the mean score for the 0-cue condition, (M = 87.43, SD = 21.81), was significantly better ($p = .008$) than the 2-cue condition (M = 79.64, SD = 23.84), for unmarked nouns. Both of the above findings moved contrary to expectations – given that the presence of word endings and the presence of more syntactic cues were expected to improve, not impede, performance. In analyses below both these effects are addressed, and these analyses show that both effects observed were related to the specific adjectives elicited across cue conditions.

FEMININE DATASET

In order to examine adjective production following feminine nouns, an ANOVA was conducted in which Word Form (marked vs. unmarked) Cue Condition (zero, one or two syntactic cues) Animacy (Animate vs. Inanimate), and Age Group were included as the independent variables and accuracy of adjective production was the dependent variable.

A main effect of cue condition was observed, $F(2, 59) = 3.917$, $p = .032$. Planned post-hoc comparisons using the LSD test revealed significantly better (p = .047) performance in the 2-cue condition (M = 60.81, SD = 33.41) when compared to the 0-cue condition (M = 53.60, SD = 34.68). This effect was the reverse of that observed in the masculine adjective data.

Three significant interactions of Animacy x Age $F(5, 59) = 3.140$, $p = .032$, Word Form x Age $F(5, 59) = 3.442$, $p = .023$, and Animacy x Word Form, $F(3, 59) = 8.497$ were also observed.

The ANOVA was re-run, this time with the data file split by age group. A main effect of animacy was found for the 9-year-olds, $F(1, 14) = 4.813$, $p = .044$, but not the 5-year-olds, $F(1, 14) = .591$, $p = .457$, the 7-year-olds, $F(1, 14) = .937$, $p = .349$, nor the adults, $F(1, 14) = 3.738$, $p = .074$. The effect for the 9-year-olds reflected higher rates of correct adjective production for trials with inanimate as opposed to animate nouns.

An effect of Word Form was found for the 7-year-olds, $F(1, 44) = 16.205$, $p = .001$, and for the 9-year-olds, $F(1, 44) = 9.354$, $p = .008$, but not the 5-year-olds, $F(1, 14) = 1.650$, $p = .223$, nor the adults, $F(1, 14) = .453$, $p = .512$. Correct response rates in the 7- and 9-year-old groups were significantly higher for adjectives appearing with unmarked nouns.

Upon closer inspection of the data, it seemed that the effects observed in both the masculine and feminine datasets may have derived from an artefact of the experimental design. Although nouns were carefully balanced in terms of word form, animacy, gender and the cue condition they appeared in, the coloured adjectives paired with nouns were not correctly balanced according to these factors.[5]

Analyses by Adjective Type

MASCULINE DATASET

The data were re-calculated, whereby the data were collapsed by adjective type. A mixed ANOVA was conducted where Adjective Type (*coch* 'red', *glas* 'blue', *du* 'black', *piws* 'purple'), and Age Group (5, 7, 9, Adult) were included as factors. The analysis revealed a significant main effect of adjective type, $F(3, 59) = 9.883$, $p < .001$.

Post-hoc comparisons with the LSD test revealed that correct response rates for c*och* 'red' (M = 72.19 SD = 33.35) and *piws* 'purple' (M = 77.21, SD = 31.57) were

[5] This error in the experimental design was not identified until almost all of the data had been collected, and therefore could not be rectified for the current investigation. It therefore had to be considered as a relevant factor for subsequent analysis of the data.

significantly lower (p = .002, p = .028) than for *glas* ‘ blue’ (M = 87.45, SD = 22.21) and signifcantly lower (p = .001, p = .017) than for *du* ‘ black' (M = 88.28, SD = 19.54,). These results reflected the fact that mutation rates for *glas* ‘blue’ and du ‘black’ were lowest (resulting in higher scores for masculine trials) and mutation rates for *coch* ‘red’ and *piws* ‘purple’ were highest (resulting in lower scores for masculine trials).

The distribution of the adjectives matched the effects of Cue condition and Word Form observed in the adjective data for the masculine dataset. *Coch* ‘red’, which was mutated frequently, appeared with marked masculine nouns more frequently, while *glas* ‘blue’ which was mutated least of all the adjective types, appeared more often with unmarked masculine nouns. Likewise, *glas* ‘blue’ appeared in 0-cue trials more than in 2-cue trials, while the reverse was true of the occurrence of *coch* ‘red.’ This led to higher rates of target (unmutated) adjective forms in the 0-cue trials and for trials with unmarked masculine nouns due to the discrepancy in mutation rates for *coch* ‘red’ versus *glas* ‘blue.’

FEMININE DATASET

The data were re-calculated, whereby the data were collapsed by adjective type. A mixed ANOVA was conducted where Adjective Type (*coch* ‘red’, *glas* ‘blue’, *du* ‘black’, *piws* ‘purple’), and Age Group (5, 7, 9, Adult) were included as factors. The analysis revealed a significant main effect of Adjective Type, $F(3, 59) = 11.109$, $p < .001$.Planned post hoc comparisons using the LSD test revealed significant differences in mutation rates for *glas* ‘blue’ (M = 41.64, SD = 37.87) and all other adjective types (*Coch* 'red' – M = 66.13, SD = 34.12, p < .001; *Piws* 'purple' – M = 59.11, SD = 38.48, p = .003; *Du* 'black' – M = 56.12, SD = 34.47, p = .002).

The apparent effect of word form observed in the 7- and 9-year olds (see above) also appeared to be related to the varied mutation rates observed across adjective types. *Coch* ' red' which was mutated most extensively, (and at rates far beyond those for *glas* 'blue'), appeared with many more marked feminine nouns than unmarked feminine nouns. Conversely, *glas* 'blue' appeared with more unmarked feminine nouns than marked feminine nouns. Likewise, the effect of animacy found in the 9-year-old group appeared to be due to especially high rates of mutation of *coch* 'red' when co-occurring with a small sub-set of inanimate feminine nouns, namely *pluen* 'feather (69%), *deilen* 'leaf (f.)' (75%), and *coeden* 'tree (f.)' (56%).

ALL CHILD PARTICIPANTS

Preliminary Analysis

A preliminary analysis of the child data from all home language groups entailed a mixed ANOVA in which Gender (Masculine vs. Feminine), Animacy (Animate vs. Inanimate), Cue Condition (Zero, One, or Two Cues) and Word Form (Gendered Ending vs. No Gendered Ending) were included as independent within-subjects variables; Age Group, (5, 7, 9) and Home Language (OWH, WEH, OEH) were included as the independent between-subjects variables, and accuracy of noun production was the dependent variable.

A main effect of gender, $F(1, 134) = 143.482$, $p < .001$ and significant interactions of Gender x Home Language, $F(4, 134) = 10.225$, $p < .001$, Gender x Cue

Condition, $F(5, 134) = 8.388$, $p < .001$, Gender x Word Form, $F(3, 134) = 39.992$, $p < .001$ and Gender x Animacy x Cue Condition, $F(7, 59) = 7.349$, $p = .001$, were observed. The main effect of gender indicated higher target response rates for adjectives paired with masculine nouns than for those paired with feminine nouns ($M = 84.27$, $SD = 18.83$ vs. $M = 28.79$, $SD = 28.31$). Given these effects, the dataset was split in two – one new dataset data for masculine noun trials only and a second dataset with data for feminine noun trials only.

MASCULINE DATASET

In order to examine adjective production following masculine nouns, an ANOVA was conducted in which Word Form (marked vs. unmarked) Cue Condition (zero, one or two syntactic cues) Animacy (Animate vs. Inanimate), Age Group (5, 7, 9) and Home Language (OWH, WEH, OEH), were included as the independent variables and accuracy of adjective production was the dependent variable.

No main effect of Home Language was observed overall, $F(2, 134) = 2.955$, $p = .056$, but in terms of general patterns of responding, target response rates were highest in the OEH group, ($M = 90.98$, $SD = 12.11$), lowest in the WEH group ($M = 78.87$, $SD = 21.09$, $p < .001$) and middling in the OWH group ($M = 83.44$, $SD = 16.43$, $p < .001$).

Significant interactions of Animacy x Cue Condition x Age $F(7, 59) = 2.482$, $p = .045$, and Animacy x Word Form x Age, $F(6, 134) = 3.690$, $p = .028$, were observed.

A follow-up analysis entailed examining the performance across Animacy and Cue conditions in the first instance, and by Animacy and Word Form conditions in the second instance, for each age group separately. This was done with a split file method, with the output for the repeated measures ANOVA presented for each age group separately.

An interaction of Animacy x Cue Condition was found in the 5-year-old data, $F(5, 44) = 4.377$, $p = .017$, but not in the 7-year-old data, $F(5, 44) = 1.130$, $p = .386$, nor the 9-year-old data, $F(5, 45) = .498$, $p = .610$. The interaction in the 5-year-old data appeared to stem from the fact that in the 0-cue condition, performance for animates was best, but in the 1-cue and 2-cue conditions, performance for inanimates was better.

A significant main effect of Animacy x Word Form was observed for the 9-year-olds, F(1, 39) = 4.225, p = .047, but not for the 5-year-olds, F(1, 27) = 2.122, p = .157, nor the 7-year-olds, F(1, 37) = .008, p = .927. A post-hoc t-test revealed significant differences in target response rates for masculine inanimate marked nouns (M = 80.89, SD = 22.27) vs. masculine inanimate unmarked (M = 90.00, SD = 17.29) nouns, $t(2, 46) = -3.316$, $p = .002$ in the 9-year-old group.

The possibility that these effects were related to lexical effects of the adjectives elicited in different conditions is explored in a section below (see *Analyses by Adjective Type*, below).

FEMININE DATASET

In order to examine adjective production following feminine nouns, an ANOVA was conducted in which Word Form (marked vs. unmarked) Cue Condition (zero, one or two syntactic cues) Animacy (Animate vs. Inanimate), Age Group (5, 7, 9) and Home Language (OWH, WEH, OEH), were included as the independent variables and accuracy of adjective production was the dependent variable.

A significant main effect of Home Language was observed overall, F(2, 134) = 19.488, p < .001. Planned comparisons using Tukey's HSD revealed that the OEH group (M = 10.49, SD = 16.88) performed significantly worse (*p* = .006) than the WEH group (M = 29.30, SD = 26.36) and significantly worse (*p* < .001) than the OWH group (M = 47.47, SD = 27.75). This resulted in the opposite pattern of performance across language groups observed in the masculine noun dataset, and explains the interaction of Gender x Home Language observed in the preliminary analysis. For both the feminine and masculine datasets, these pattern of responding across groups reflected lower mutation rates in the OEH group, (see *Figure 5.6* below). S

Significant interactions of Animacy x Cue Condition, *F*(5, 134) = 4.509, *p* = .012, Animacy x Word Form, *F*(3, 134) = 14.688, *p* < .001, and Animacy x Word Form x Age, *F*(6, 134) = 3.705, p =.007 were also observed. Post hoc t-tests compared performance for animate vs. inanimate nouns across the three levels of cue condition. These tests revealed that performance in the 0-cue condition appeared to be markedly better for inanimates than for animates, *t*(1, 137) = -2.837, *p* = .005, while for the 2-cue condition, performance for animates was better than for inanimates, *t*(1, 137) = 2.937, *p* = .009.. It is explored below whether lexical effects may have been at the root of this finding (see section *Analyses by Adjective Type*, FEMININE DATASET, below).

Performance by Animacy and by Word Form were explored by re-running the analysis and splitting the file by age group, to determine the source of the Animacy x Word Form x Age interaction. An interaction of Animacy x Word Form was found both in the 5-year-old group, *F*(3, 44) = 6.492, *p* = .014, and the 9-year-old group *F*(3, 44) = 9.173, *p* = .004, but not in the 7-year-old group, *F*(3, 44) = .056, *p* = .814. Post hoc t-tests revealed that for both the 5-year-old and 9-year-old data, performance for trials with inanimate nouns with gendered endings was significantly better than for inanimate nouns without gendered endings (5s – $t(1, 47) = 2.040$, p =. .047; 9s – $t(1, 44) = 3.477$, $p = .001$). It is explored below whether lexical effects may have been at the root of this finding (see section *Analyses by Adjective Type*, FEMININE DATASET, below).

Analyses by Adjective Type

MASCULINE DATASET

The data were re-calculated, whereby the data were collapsed by Adjective Type. A mixed ANOVA was conducted where Adjective Type (*coch* 'red', *glas* 'blue', *du* 'black', *piws* 'purple'), Age Group (5, 7, 9) and Home Language were included as factors. The analysis revealed a significant main effect of adjective type, $F(3, 134) = 18.056$, $p < .001$, and a significant interaction of Adjective Type X Home Language $F(3, 134) = 3.462$, $p = .002$. A post hoc multivariate ANOVA was run, in which home language effects were assessed for each adjective type score. A main effect of Home Language was observed for *coch* 'red' $F(2, 139) = 5.656$, $p = .004$, and *piws* 'purple' $F(2, 139) = 10.152$, $p < .001$, but not for *glas* 'blue' $F(2, 139) = 3.044$, $p = .057$, nor for *du* 'black', $F(2, 139) = .952$, $p = .389$.

Post hoc comparisons using Tukey's HSD test revealed significant differences across home language groups for *coch* ' red' and for *piws* 'purple.' For *coch*, the OEH group (M = 85.97, SD = 29.14) performed significantly better ($p = .011$) than the WEH group (M = 65.14, SD = 37.39) and significantly better ($p = .013$) than the OWH group (M = 65.65, SD = 36.18). For *piws*, the OEH group (M = 96.35, SD = 16.30) performed significantly better (p = .035) than the WEH group (M = 82.79, SD = 24.36) and significantly better (p = < .001) than the OWH group (M = 72.10, SD = 34.83).

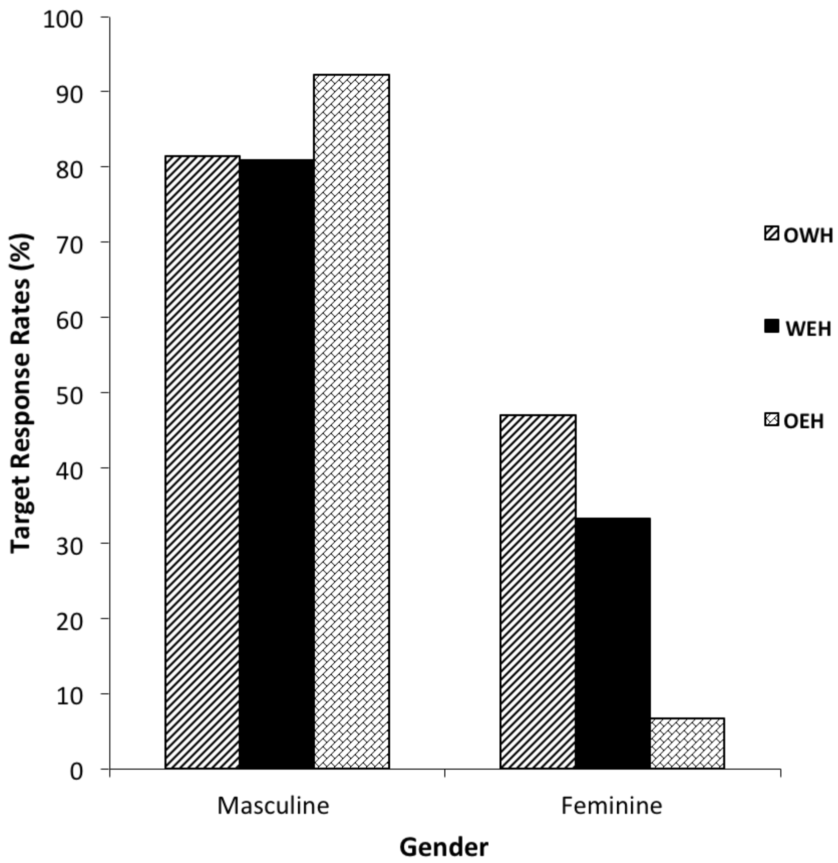


Figure 5.6. Opposite patterns of responding across gender categories, indicating reduced levels of mutation in the OEH group in each case.

The differences observed between trials with masculine marked animate nouns as opposed to trials with masculine unmarked animate nouns (see above) appeared to be related to the target adjectives that co-occurred with these nouns. *Coch* ‘red’, which was mutated frequently, appeared with more marked animate masculine nouns than unmarked animate masculine nouns. Thus, the apparent interaction of Animacy x Word Form appeared to be a lexical effect deriving from an uneven distribution of the adjective types across these variables.

Likewise, the interaction of Animacy x Cue Condition observed in the 5-year-olds appeared to be due to a combination of the fact that more animate nouns were elicited with *glas* ‘blue’ in the 0-cue condition, and that *coch* ‘red’ appeared with more animate nouns in the 1- and 2-cues conditions. Given that *glas* ‘blue’ was mutated least frequently, and *coch* ‘red’ was mutated most frequently; combined, these discrepancies in the distribution of these adjectives appear to be at the root of the Animacy x Cue Condition interaction.

Section 5.4.4 qualitatively explores potential lexical effects further by exploring frequency count data to determine whether differences in the frequency of occurrence of mutated vs. basic forms of these adjectives in natural speech may be related to the differences observed across adjective types in the experimental data.

<u>FEMININE DATASET</u>

A mixed ANOVA was conducted where Adjective Type (*coch* ‘red’, *glas* ‘blue’, *du* ‘black’, *piws* ‘purple’), Age (5, 7, 9), and Home Language (OWH, WEH, OEH) were included as factors. The analysis revealed a significant main effect of adjective type, $F(3, 134) = 16.956$, $p < .001$.

Post hoc comparisons using the LSD test revealed that response rates for *coch* ‘red’ (M = 37.87, SD = 36.62) were significantly higher than for *glas* (M = 16.60, SD = 27.72, $p < .001$), *du* ‘black (M = 28.84, SD = 33.44, $p = .004$) and *piws* ‘purple’ (M = 28.54, SD = 37.76, $p < .001$. And performance rates for *glas* ‘blue’ were significantly lower than for piws ‘purple’ (M = , SD, p = < .001) and du ‘black’ (M = 28.54, SD = 37.76, $p < .001$). These patterns of responding are consistent with those found in the masculine dataset, whereby mutation rates for *glas* ‘blue’ were lowest and mutation rates for *coch* ‘red’ were highest.

Interaction effects observed above showed how performance for feminine inanimates was better than for feminine animates in the 0-cue condtion. This seemed to be because *coch* ‘red ‘ appeared with inanimates nouns but did not appear with animate nouns in this condition, while glas ‘blue’ appeared with more animate nouns than inanimate nouns in the 0-cue condition. Given that *coch* ‘red’ resulted in significantly higher mutation rates, with *glas* ‘blue.’ These discrepancies in adjective distribution appear to explain both interactions.

Section 5.4.4 qualitatively explores potential lexical effects further by exploring frequency count data to see whether differences in the frequency of occurrence of mutated vs. basic forms of these adjectives may be related to the differences observed across adjective types in the experimental data.

The role of the prompt.

As with the noun data, a final set of analyses explored any potential effects of trial congruency on patterns of responding. For the OWH data, a mixed ANOVA with gender, congruency and age group as variables revealed no main effect of congruency, $F(1, 57) = 3.905$, $p = .057$, but a significant interaction of Gender x Congruency was observed, $F(1, 57) = 4.281$, $p = .043$.

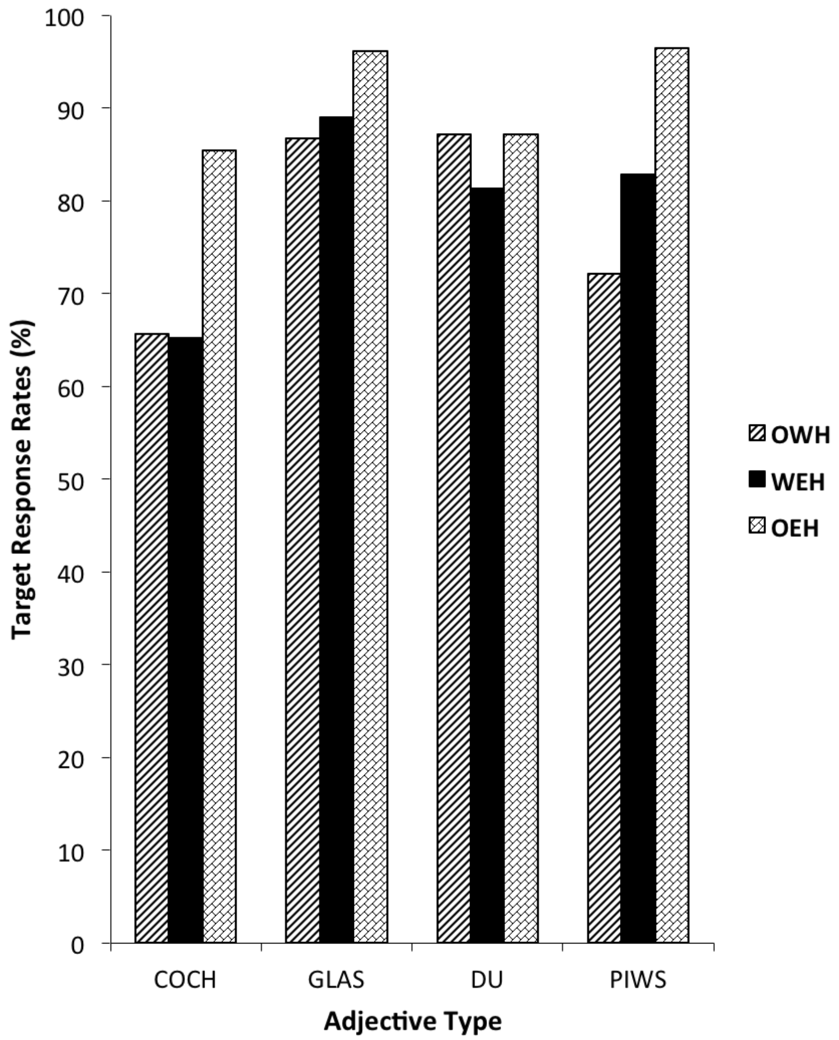


Figure 5.7. A significant interaction of Adjective Type by Home Language reflected differences across home language groups for specific adjective types.

Two post hoc repeated measures ANOVAs explored whether congruency had an effect on feminine noun trials and masculine noun trials separately. No main effect of congruency was observed for the masculine adjective dataset, $F(1, 57) = .001$, $p = .977$, but a main effect of congruency was observed for the feminine adjective dataset, $F(1, 57) = 8.152$, $p = .006$. This main effect showed how performance in congruent trials (M = 53.89, SD = 30.46) was significantly lower than performance in incongruent trials (M = 59.29, SD = 31.81).

For the child data, a second ANOVA was run with Gender, Congruency, Age Group and Home Language as variables. No significant effect of congruency was observed, $F(1, 131) = 2.793$, $p = .060$, but a significant interaction of Gender x Congruency, $F(1, 131) = 26.618$, $p < .001$, was attested.

Two post hoc repeated measures ANOVAs explored whether congruency had an effect on feminine noun trials and masculine noun trials separately. No main effect of congruency was observed for the masculine adjective dataset, $F(1, 131) = 1.506$, $p = .222$, but a main effect of congruency was observed for the feminine adjective dataset, $F(1, 131) = 28.045$, $p < .001$. As with the OWH group, this main effect showed how performance in congruent trials (M = 25.60, SD = 27.70) was significantly lower than performance in incongruent trials (M = 31.93, SD = 30.67).

The effect of congruency observed moved in the same direction in both the OWH dataset and the cross-home language dataset. In both cases, performance for adjectives appearing with feminine nouns in incongruent trials was higher than for adjectives appearing with feminine nouns in congruent trials. This effect also appeared to be related to the adjective types elicited.

As outlined above, mutation rates across adjective types varied. *Coch* ‘ red’ was mutated 66.13% of the time in feminine trials by the OWH participants, and 37.87% of the time by the child participants from all home language groups. This adjective had the highest mutation rates of all of the adjective types. Glas ‘blue’ has the lowest mutation rates overall (41.64% in the OWH dataset, and 37.87% in the cross-home language dataset). In feminine nouns trials, coch appeared in incongruent feminine trials five times, but appeared in congruent feminine trials only twice. *Glas* ‘blue’ appeared in incongruent feminine trials once, but appeared in congruent feminine trials four times. Combined, the imbalance in the occurrence of *coch* ‘red’ and *glas* ‘blue’ across congruency conditions, with the adjective with the lowest mutation rates appearing in more *congruent* trials, and the adjective with the highest mutation rates appearing in more *incongruent* trials had skewed the data, resulting in higher scores overall for the incongruent condition.

5.4.4 Qualitative Analyses.

5.4.4.1 Nouns: Lexical effects.

Various effects of animacy, cue condition, and word form were observed in the adult and child data for feminine nouns. However, in some cases the effects observed moved contrary to expectations (e.g. in the child dataset performance for words without gendered endings was higher than for nouns with gendered endings). In order to better understand the effects observed, response rates for individual feminine nouns were qualitatively analysed and compared, to determine whether specific lexical items may have been at the root of some, or all, of these effects.

Adult Data: Feminine nouns.

An effect of animacy in the feminine noun dataset seemed to indicate an advantage for animate nouns. *Table 5.3* ranks feminine nouns by level of target mutation rates. Performance rates for animate nouns were consistently higher; the lowest score was for *tywysoges 'princess'*. *Table 5.3* also shows the experimental data in relation to data from the *Cronfa Electroneg Gymraeg* (CEG) 'Welsh Electronic Corpus' (Ellis, O'Dochartaigh, Hicks, Morgan & Laporte, 2001) – a one million token corpus of written Welsh words.

Consultation with the CEG revealed that *tywysoge*s was one of the least frequent feminine animate nouns. Further, the majority of nouns were found in mutated form more frequently than in the basic form, but *tywysoges* was only found in the basic form (see *Table 5.3.).* Consultation with three spoken Welsh corpora – the *Siarad* Corpus[6] and the *Caffael yr Iaith Gymraeg* (CIG1 and CIG2) corpora[7]

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[6] The Siarad Corpus is an open access corpus and can be accessed via the following link: http://www.siarad.org.uk/siarad.php. The project was funded by the AHRC and was conducted by

Table 5.3

Experimental Data (adult data only) and Corpus Data regarding soft mutation of nouns (experimental data are ranked by % correct, and divided by animacy)

EXPERIMENTAL DATA		**CEG CORPUS DATA**	
Noun	**% Correct**	**Mutated tokens**	**Non-mutated tokens**
buwch 'cow (f.)'	100	46 (77%)	14 (23%)
Llygoden 'mouse'	100	4 (14%)	25 (86%)
dynes 'woman (f.)'	94	22 (69%)	10 (31%)
merch 'girl (f.)'	94	213 (56%)	167 (44%)
cwningen 'rabbit (f.)'	94	12 (37%)	21 (63%)
mam 'mother (f.)'	94	168 (27%)	466 (73%)
cath 'cat (f.)'	94	41 (73%)	15 (27%)
malwen 'snail (f.)'	89	1 (50%)	1 (50%)
gwrach 'witch (f.)'	89	9 (69%)	4 (31%)
dafad 'sheep (f.)'	83	11 (44%)	14 (56%)
brenhines 'queen (f.)'	83	35 (42%)	48 (58%)
tywysoges ' princess (f.)'	72	0 (0%)	15 (100%)
dinas 'city (f.)'	94	147 (67%)	46 (33%)
coeden 'tree (f.)'	94	79 (71%)	32 (29%)
cloch 'bell (f.)'	89	125 (89%)	16 (11%)
cadair 'chair (f.)'	89	102 (72%)	40 (28%)
braich 'arm (f.)'	83	52 (72%)	20 (28%)
teisen 'cake (f.)'	83	8 (67%)	4 (33%)
gardd 'garden (f.)'	78	65 (81%)	15 (19%)
pluen 'feather (f.)'	67	14 (93%)	1 (7%)
mellten 'lightning bolt (f.)'	67	2 (33%)	4 (67%)
cneuen 'nut (f.)'	56	6 (75%)	2 (25%)
troed 'foot (f.)'	56	67 (78%)	19 (22%)
deilen 'leaf (f.)'	56	8 (53%)	7 (47%)

(Morris Jones, 2004) revealed no tokens for *tywysoges* (see *Table 5.4.* below), further suggesting its status as a low frequency noun. The overall low frequency of

Margaret Deuchar and colleagues. For more details regarding the corpus see Deuchar, Davies, Herring, Parafita Couto, and Carter (in press).

[7] The CIG corpus is an open access corpus of mother-child dyads, collected by Robert Morris Jones and colleagues, and can be accessed via http://talkbank.org/

tywysoges, and especially the low frequency of mutated forms, seems to be at the root of the lower mutation rates.

In the experimental data, scores for inanimate feminine nouns ranged from 94% to 56% (see *Table 5.3* for details). CEG frequency counts, based on written corpora, for mutated versus basic forms of nouns with the lowest mutation rates (in

Table 5.4

Experimental data (adult data only) and corpora data from Siarad, CIG1 and CIG2 for selected singular feminine nouns

Experimental Data (%)		**Siarad Corpus (tokens)**		**CIG1 Corpus (tokens)**		**CIG2 corpus (tokens)**	
Noun	**% Correct**	**Mut.**	**Not Mut.**	**Mut.**	**Not Mut.**	**Mut.**	**Not Mut.**
tywysoges 'princess (f.)'	72	N/A	N/A	N/A	N/A	N/A	N/A
buwch 'cow (f.)'	100	6	9	53	160	43	198
merch 'girl (f.)'	94	25	19	23	25	11	21
cath 'cat (f.)'	94	14	11	31	85	23	49
pluen 'feather (f.)'	67	N/A	N/A	2	5	N/A	N/A
mellten 'lightning bolt (f.)'	67	N/A	N/A	N/A	N/A	N/A	N/A
troed 'foot (f.)'	56	4	7	21	36	16	34
deilen 'leaf (f.)'	56	N/A	N/A	N/A	N/A	N/A	N/A
cneuen 'nut (f.)'	56	N/A	N/A	N/A	N/A	N/A	N/A
coeden 'tree (f.)'	94	7	14	47	26	54	33

the experimental data) were scrutinised. It appeared that mutated forms were more common for most of these (*see Table 5.3*).

However, frequency counts extracted from the three spoken corpora showed that the number of tokens for the basic forms (i.e. not mutated) of these nouns were more frequent than tokens for mutated forms (see *Table 5.4*.). These data suggest that patterns of occurrence of mutated versus radical forms of feminine nouns in spoken Welsh may diverge from patterns in written Welsh, and that the spoken corpora data may be more representative of the adult participants' use of mutation.

It is possible that mutation rates were low for some of the inanimate nouns because many of these singular feminine nouns derive from collective noun forms, (see Roberts & Gathercole, 2009; in press), whereby the basic forms of nouns refer to a collection, and singular forms derive from the collection noun forms. This contrasts with plural nouns that derive from singular forms. For example, *sêr* 'stars (f.)' refers to stars as a collective, and *seren* 'star (f.)' derives from *sêr* 'stars (f.)'. In contrast *cathod* 'cats (f.)' derives from the singular form *cath* 'cat (f.)'. *Cnau* 'nuts (f.)', *plu* 'feathers (f.)', *mellt* 'lightning (f.)' and *dail* 'leaves (f.)' are all collective nouns.

Frequency counts from the CEG show that *cneuen* 'nut (f.)', *pluen* 'feather (f.)', *mellten* 'lightning bolt (f.)', *deilen* 'leaf (f.)' are less frequent than their collective forms. Collective forms of these nouns (when these nouns occur) are also more frequent than singular forms in the spoken corpora (see *Table 5.5).* The higher frequency of plural forms will affect the base token frequencies of singular forms. In turn, collective forms will be more salient, resulting in lower rates of mutation of the singular forms (as the collective forms don't carry the mutation feature).

Similarly, when comparing the frequency counts for *cneuen* ‘nut (f.)’ and *coeden* ‘tree (f.)’ – two nouns with the same initial consonant which both derive from collective noun forms (cnau ‘nuts (f.)’ and coed ‘trees (f.)’), and which have the same feminine word ending, *–en* – *coeden* ‘tree (f.)’ is more frequent than *cneuen* ‘nut (f.)’ in all corpora (see *Tables 5.3 and 5.4*). If these corpora can be taken as being approximately representative of Welsh usage, *coeden* ‘tree (f.)’ is more frequent in the input than *cneuen* ‘nut (f.)’, and in turn, the frequency of *coeden* ‘tree (f.)’ in post article position would be higher than *cneuen* ‘nut (f.)’ in post-article position. The corpora data also reveal higher token frequencies for *goeden* (mutated form) than for *coeden* (basic form), see *Tables 5.3. and 5.4.* In all cases, frequency effects seem parallel to the differences in mutation use observed in the adult data.

Table 5.5

Frequency counts for collective versus singular forms of selected nouns in the Welsh corpora

Singular Nouns	**CEG**	**Siarad**	**CIG1**	**CIG2**
pluen ‘feather (f.)’	15	0	7	0
mellten ‘lightning bolt (f.)’	10	0	0	0
deilen ‘leaf (f.)’	15	0	0	0
cneuen ‘nut (f.)’	9	0	0	0
Plural Nouns				
plu ‘feathers (f.)’	41	0	1	0
mellt ‘lighting (f.)’	25	0	0	0
dail ‘leaves (f.)’	0	0	17	7
cnau ‘nuts (f.)’	25	1	22	2

Child data (all language groups): Feminine Nouns.

Effects of word form: All children.

Performance rates for unmarked (without gendered endings) feminine nouns in the experimental task appeared to be significantly better than for marked (with gendered endings) feminine nouns. However, differences across lexical items within the unmarked feminine noun category were evident. While mutation rates were generally low in this category, (ranging from 2 to 31%), two nouns had comparatively higher mutation rates than other feminine nouns, namely *cloch ‘bell (f.)’* (56%) and *gardd* ‘garden (f.)’ (47%).

Frequency counts from all four Welsh corpora show higher frequencies for *gloch* than *cloch* (see *Table 5.6*). Telling time in Welsh involves the phrase *o’r gloch* “o’clock”. In all of the spoken corpora, the wide majority of the tokens of *gloch* appear in the set phrase *o’r gloch*. This seems to be the source of the high frequency of *gloch* as opposed to *cloch*.

Table 5.6.

Frequency counts for mutated versus radical forms of cloch and gardd in all Welsh corpora

Noun	**CEG**		**Siarad**		**CIG1**		**CIG2**	
cloch	*cloch*	*gloch*	*cloch*	*gloch*	*cloch*	*gloch*	*cloch*	*gloch*
‘bell’	16	125	3	101	6	15	7	128
gardd	*gardd*	*ardd*	*gardd*	*ardd*	*gardd*	*ardd*	*gardd*	*ardd*
‘garden’	15	65	1	48	17	83	15	51

In all four corpora, *ardd* has a higher number of tokens than *gardd* (see *Table 5.6*). Many tokens in the spoken corpora occurred in the phrase *yn <u>yr</u> ardd* 'in the garden.' These frequency count data suggest that *gardd* 'garden (f.)' appears in mutated form (*ardd*) far more often that in its basic form, and that it appears most frequently after the definite article. This may explain why these children produce *gardd* 'garden (f.)' in its mutated form after the definite article at rates far higher than for other feminine nouns.

Effects of animacy: 5-year-olds.

It appeared that mutation rates for inanimate feminine nouns in the 5-year-old group were higher than for animate feminine nouns (21% vs. 14% on average). The apparent advantage for inanimate nouns derived from especially high mutation rates for *gardd* 'garden (f.)' and *cloch* 'bell (f.)' (56% and 47%, respectively). When the data for these two nouns are removed, average mutation rates for inanimate nouns fall to 13%, resembling the mutation rates for the animate nouns (14%).

Effects of cue condition: All children.

A final effect of cue condition in the child dataset seemed to indicate an advantage for nouns in the 1-cue condition versus the 0-cue condition (24% 1-cue versus 18%). However, very high mutation rates for *cloch* 'bell (f.)' (56% on average) raised the average mutation rate in the 1-cue category. When the data for this noun are taken out, rates of mutation for the 1-cue condition drop to 19% (versus 18% for nouns in the 0-cue condition).

Summary of lexical effects for nouns.

Collectively, based on frequency count data of mutated and radical forms of nouns in both written and spoken Welsh corpora, the apparent effects of animacy, word form, and cue condition found in the experimental data seemed to derive from lexical effects, due to especially high mutation rates for a small number of specific feminine nouns. These lexical effects appeared parallel to differences in the frequencies of nouns in the input (as judged by the corpora), and to differences in the frequency of occurrence of mutated versus basic forms of feminine nouns in the input.

5.4.4.2 Adjectives: Lexical Effects.

Effects deriving from adjective distribution.

Effects of word form and cue condition seemed apparent for adjective production in both the masculine and feminine noun trials. The main effect of adjective type attested in the OWH children's data revealed that mutation rates for *coch* 'red' were very high, while mutation rates for *glas* 'blue' were very low. The effects of word form and cue condition occurred due to an uneven distribution of adjective types across levels of the manipulated variables. This section explores whether corpora data also reveal differing rates of mutated forms across these adjective types.

Frequency count data.

To better understand the differing patterns of mutation for *coch* 'red' and *glas* 'blue' observed in the experimental data, frequency count data for these adjectives (in both mutated and basic forms) were obtained from the three spoken Welsh corpora mentioned above.

Table 5.7 shows the proportion of times in which *coch* 'red' and *glas* 'blue' appear in mutated versus basic forms in post-nominal position. Based on these data, the mutated forms *goch* and *las* appear to occur post-nominally more frequently than the non-mutated forms do. It should be noted, however, that the experimental data clearly showed higher occurrence of mutation for *coch* 'red' than for *glas* 'blue'. It may be that the /k/ > /g/ mutation is more productive, due to the high frequency of /k/-initial words in the Welsh language. (*Y Geiriadur Mawr* 'The Big Dictionary' has twice as many pages with /k/-initial words as it has for /g/-initial words, (see *Table 5.8*).

Table 5.7

Proportions of occurrence of mutated versus radical forms of adjectives in post-nominal position

	Siarad		**CIG 1**		**CIG 2**	
coch	*coch*	*goch*	*coch*	*goch*	*coch*	*goch*
'red'	41.9%	43.5%	36.6%	55.9%	14.7%	57.1%
glas	*glas*	*las*	*glas*	*las*	*glas*	*las*
'blue'	27.6%	12.5%	29.1%	54.2%	25.9%	63.6%

Summary of lexical effects for adjectives.

The frequency count data for *coch* 'red' and *glas* 'blue' seemed to show similar patterns of distribution in a group of spoken corpora of Welsh.

However, Welsh in general shows an exceptionally high frequency of /k/-initial words, so the k > g mutation may be particularly salient. This may help explain why children exhibited higher mutation rates for *coch* 'red' than for other colour adjectives that were not /k/-initial.

Table 5.8

The number of pages in Y Geiriadur Mawr dedicated to words beginning with each of the consonants that are subject to soft mutation, ranked from high to low

Orthographic Symbol	**Phoneme**	**Number of pages**
c	/k/	88
g	/g/	48
d	/d/	47
b	/b/	28
t	/t/	25
p	/p/	23
ll	/ɬ/	18
rh	/rʰ/	10

5.5 Results Summary

5.5.1 Results Summary: Nouns.

The quantitative results for the noun data showed firstly that response patterns in the child and adult participants differed significantly. Adults mutated feminine nouns by and large and generally did not mutate masculine nouns, showing a productive command of the soft mutation feature in relation to grammatical gender. Their mutation patterns did not seem to be influenced by noun animacy, word form, or by the experimenter's prompt sentences.

Child participants overall exhibited low rates of mutation, resulting in high performance rates for masculine nouns that did not require mutation and low performance rates for feminine nouns that did require mutation. Further, within the child participant pool differences were observed across language groups. Performance rates in the OEH group were on average significantly lower than in the WEH and OWH groups. This is taken to reflect their reduced exposure to Welsh at home and the lack of exposure to Welsh in their earliest years. These differences across home language groups were evident only for feminine nouns (i.e. for those nouns that required mutation).

Effects emerged in quantitative analyses that seemed to indicate that children were influenced by noun animacy and by word form. However, qualitative analysis of the mutation rates for individual nouns revealed that mutation rates were variable both within and across levels of these variables. These data suggest that children acquire the mutation feature on an item-by-item basis, based on frequency of exposure to individual nouns (both in mutated and basic forms). Frequency count data of written and spoken Welsh seem to confirm this notion, with the mutation patterns found in the experimental data matching well with the frequency count data.

5.5.2 Results Summary: Adjectives.

Patterns of mutation for adjectives echoed those observed for nouns. Adults showed productive command of the mutation feature, largely applying mutation to adjectives paired with feminine nouns and producing adjectives paired with masculine nouns in their basic forms at close to ceiling levels. Children again showed much lower mutation rates overall, resulting in high performances rates for adjectives paired with masculine nouns and low performance rates for adjectives paired with feminine nouns.

Again, home language effects were evident here. Mutation rates were especially low in the OEH group. This meant that the OEH group had significantly higher performance rates for adjectives paired with masculine nouns, and significantly lower performance rates for adjectives paired with feminine nouns. These low mutation rates are again taken to be deriving from reduced exposure to Welsh.

As with the nouns, various effects emerged in quantitative analyses that seemed to indicate that children were influenced by noun animacy and word form. However, upon closer scrutiny of mutation production by adjective form it soon became evident that patterns of mutation varied according to the particular adjective required. These differences across adjectives are taken to reflect differences in the frequency of words that share the initial consonants of these adjectives, which impacts upon the salience of the mutation processes they undertake.

5.6 Discussion

When combined, the noun and adjective data suggest that children acquire the soft mutation feature in a piecemeal item-by-item fashion. Lexical effects were present for both nouns and adjectives, and mutation rates were low even in 9-year-old children. However, mutation of feminine nouns was far more frequent than mutation of masculine nouns, suggesting that these children are progressing in their acquisition of the gender feature.

Even at age nine children were still performing at below 50% in their mutation of feminine nouns. This may derive from the opacity of the gender feature, in terms of its limited applicability (not all sounds are subject to soft mutation), the multifunctionality of SM itself, and the numerous exceptions to the rule. Collectively, these descriptions of the system suggest that children require a high level of exposure to Welsh over a long period of time in order to amass enough knowledge of the system.

Adult speakers of Welsh showed a high level of productivity and seemed to be able to clearly distinguish masculine and feminine nouns (and corresponding adjectives) at close to ceiling levels. This suggests that the adult Welsh that the children are exposed to may largely include correct forms of nouns and adjectives that will provide children with the data they need to fully master the system. However, it must be noted that the mutation patterns of these adults in an experimental setting may not reflect their usage of the system in informal speech, and even in an experimental setting, variation in adults' application of the mutation rule was still evident.

Chapter 6

Consonants and mutation

6.1 Chapter Overview

This chapter presents a screening procedure that assessed the phonemic repertoires of the 5-year-old participants. First, the rationale and a methodological description of the task are presented, followed by qualitative explorations of the results and a discussion of these results. Then, the results of this task are discussed in relation to the participants' responses in the ***Noun and Adjective Elicitation Task.***

6.2 Task Summary and Rationale

This ***Verbal Repetition Task*** assessed children's verbal production of thirteen Welsh consonant phones in a simple naming context. These thirteen consonants participate in or are products of Soft Mutation (SM) in Welsh (see the description of the SM system, as outlined in ***Chapter 4***). This task functioned as a measure of children's basic ability to articulate these phones in word-initial position, with a view to linking their articulatory ability with their production of target nouns and adjectives in the ***Noun and Adjective Elicitation Task***.

This screening procedure served to establish whether or not a general lack of one or more mutated noun/adjective forms in the responses of the 5-year-old participants in the ***Noun and Adjective Elicitation Task*** was due to lack of acquisition of those consonant phonemes that occur word-initially. Children were required to name novel characters by repeating their “names” after the experimenter. Naming occurred across two game formats – a board game and a card game.

6.3 Method

The experiment presented consonant phones in word-initial position across a set of 108 novel nouns. Novel nouns were carefully formed so that they were phonotactically legal and followed the general phonological patterns of Welsh (see Awbery, 1984). Nouns matched 108 novel picture characters. Characters were presented in the context of two games, a board game and a card game. These games involved eliciting the names of characters from participants, by asking them to repeat the names of characters after the experimenter said them.

6.3.1 Design and Stimuli.

6.3.1.1 Linguistic Stimuli.

Target novel nouns.

One-hundred-and-eight invented nouns were developed, which featured the thirteen consonantal phones of the Welsh language that participate in the SM process. Nine of the thirteen phones are subject to word-initial mutation: /p/ /t/ /k/ /b/ /d/ /g/ /m/ /ɬ/ /rʰ/. The remaining four phones, /v/ /ð/ /r/ and /l/, occur word-initially as products of the SM.

Balancing of nouns.

All target consonants appeared in word-initial position in the invented nouns. The consonants were balanced for frequency of occurrence across the set of 108 novel nouns. Each consonant appeared in four different invented nouns as an initial singleton consonant, (13 x 4 = 52). Additionally, some novel nouns were assigned initial consonant clusters made up of a *stop + nasal* or a *stop + liquid.* This resulted in 56 additional invented words with 14 different consonant clusters. *Table 6.1* (below) outlines the full list of initial consonants and consonant clusters.

Table 6.1

Full list of consonants and consonant clusters

Individual Consonants	Consonant Clusters
/p/	/pl/ /pr/
/t/	/tl/ /tr/
/p/	/kl/ /kr/ /kn/
/b/	/bl/ /br/
/d/	/dl/ /dr/
/g/	/gl/ /gr/ /gn/
/v/	N/A
/ð/	N/A
/m/	N/A
/ł/	N/A
/l/	N/A
/r^h /	N/A
/r/	N/A

Nouns were further balanced in terms of which vowel(s) appeared after initial consonants/consonant clusters. Seven different vowels appeared after the initial consonants of words. For each set of four novel nouns with the same initial consonant/consonant cluster, every noun in the set was followed by a different vowel. The seven vowels included were: /a/, /ɛ/, /i/, /ɔ/, /ɨ/, /ʊ/, and /ə/.

Items were balanced as evenly as possible in terms of the number of times each of the seven vowels appeared overall, across all 108 invented words. The number of nouns and the number of vowel types did not allow for perfect balancing (108/7 = 15.4), but the closest approximation to this was achieved.

Overall, across all 108 singleton nouns and cluster nouns, each of the seven vowels appeared word-initially in 15-16 different nouns. Three of the vowels appeared in sixteen words each; the remaining four vowels appeared in fifteen words each. All seven vowels appeared in at least one invented word involving each of the initial consonants, (whether a consonant appeared as a singleton or in a cluster) and none were used more than twice. Nouns were further balanced for number of syllables. Half of the nouns were monosyllabic and the remaining nouns were disyllabic. This balancing was applied systematically across all of the sub-sets of four nouns for each singleton consonant and consonant cluster, (for a full novel word list see Appendix 7).

6.3.1.2 Non-linguistic stimuli.

Novel characters.

Each invented noun was paired with a visual stimulus: an invented picture character. These picture characters provided referents for the nouns. Characters were developed in such a way as to make the task as fun and child-friendly as possible. Characters were colourful and varied in shape, colour and in their idiosyncratic features. Each character appeared within the context of one of the two games – 54 characters appeared in the board game, and the remaining 54 characters appeared in the posting game (see Appendix 8 for examples of characters).

Board game.

The first game was a board game in which the participant could move from one spot to the next, gradually moving to the "winner" goal at the end, which was marked with stars. For a full visual breakdown of the game see Appendix 9.

Posting game.

The second game involved two coloured boxes – one red, one blue – and a set of fifty-four cards These cards had images of novel characters on them. The background colour of each of the cards was either blue or red (see Appendix 11 for examples of the cards used).

6.3.2 Participants.

Forty-five children aged 4;11 to 5;11 participated. These children were allocated to one of three groups, based on the languages(s) their parents spoke to them at home: Only Welsh at Home (OWH), Welsh and English at Hom (WEH), and only English at Home (OEH).[8]

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8 Some of these children were the participants whose Noun and Adjective data were analysed in Chapter 5, others were recruited at a later point, and participated in this task and the Noun and Adjective Task for the purpose of comparing performance on these two tasks. Their data were not analysed in Chapter 5, as enough participants had already participated in the Noun and Adjective Elicitation Task.

6.4 Procedure

Each participant played the board game first. The games were conducted in this order because a pilot run of the games had made it clear that the posting game was the more engaging and entertaining of the two, and so “the best was saved until last.” For the board game, the experimenter explained that the child would be taking away circular counters from the board, one at a time, revealing characters underneath the counters.

The experimenter explained that they would “name” each character as they were revealed. The child was asked to repeat the “name” of each character before removing another counter to reveal the next character, (see Appendix 12 for full task instructions). The experimenter explained that the child would find funny little people underneath the circles, and that they all had special names. The experimenter would be telling the names to the child, and then the child would need to play “copycat” and repeat the name.

Before the game began participants were given the opportunity to practise repeating words verbally with real words. This provided participants with a solid idea of what the requirements of the task were. It also gave the experimenter the opportunity to observe whether a given participant was capable of repeating familiar words accurately. If this were not the case then their ability to repeat unfamiliar, invented words would be questionable.

After several practice trials the target trials began. The experimenter uttered each invented word clearly and distinctly; then, immediately afterwards the participant was asked to repeat exactly the word they had just heard. If several attempts were made to repeat the same invented word, the closest approximation to the target novel noun was accepted.

Immediately after the Board Game, the participant was presented with the Posting Game. The participant's task was to "post" each card into the box corresponding to the background colour of that card, (i.e. red background card into red box, blue background card into blue box). The experimenter again "named" each character as they appeared. Before posting each card the participant was required to repeat the name of the character on the card, (see Appendix 13 for full task instructions).

The experimenter explained to the child that they would still be repeating the words the experimenter said, as in the Board Game, but that instead of pulling things away to reveal the characters, they would be seeing the characters first and then posting them into the boxes. The experimenter explained that the child would find more funny little people on the cards, and that they all had special names too. The experimenter would be telling the names to the child when they picked a card, and then the child would need to play "copycat" and repeat the name before "posting" the card in the right box. All trials were audio recorded. The experimenter later re-listened to all recordings several times to ensure that each phone uttered in every trial was identified correctly.

6.5 Results

6.5.1 Overview.

First, the accuracy of children's production of consonants in the repetition task was analysed qualitatively. Following this, quantitative correlational analyses explored whether performance on the repetition task was related to performance on the ***Noun and Adjective Mutation Task***.

6.5.2 The repetition task.

Accuracy of consonant articulation/production.

Some of the sounds and clusters tested were common to Welsh and English, and some were unique to Welsh. Data were analysed in groups by consonant and consonant cluster type, and according to whether they were common to the two languages or unique to Welsh. In each case, ANOVAs were conducted in which the phonemes/phoneme clusters and home language, (OWH, WEH, OEH), were treated as variables.

Consonants common to Welsh and English.

The singleton consonants common to Welsh and English are /p, t, k, b, d, g, m, v, l, ð/. An ANOVA was conducted in which phoneme type and home language were treated as variables. Analyses revealed significant effects of phoneme, $F(9, 45) = 63.178$, $p < .001$, but not of home language, $F(2, 45) = 2.341$, $p = .109$. Pair-wise comparisons revealed significant differences in performance between the stops, /m/, /v/, and /l /, on the one hand, versus /ð/, on the other (all *p*s < .001). Performance was uniformly high for the former, and relatively poor for the latter. Data for the stops and /m/ are shown in *Figure 6.1*, and data for /v/, /l/, and /ð/ to the left of *Figure 6.2.*

Consonants unique to Welsh.

The singleton consonants unique to Welsh are the liquids /ɬ/, /r/, and /r^h/. Levels of target response rates for /ɬ/, /r/ and /r^h/ are shown at the right in *Figure 6.2*. An

ANOVA revealed that there was a significant difference overall in performance across these three phonemes, $F(2, 44) = 6.135$, $p = .003$, with performance rates for /r/ being significantly higher than performance rates for /rʰ/ ($p = .001$, pair-wise comparison). A significant main effect of home language was also present, $F(2, 44) = 4.860$, $p = .013$. The OEH children exhibited lower target response rates for all three consonants, and performed significantly worse than the OWH group, ($p = .001$, pair-wise comparison). No significant interaction of Phoneme Type x Home Language was found, $F(4, 44) = 1.588$, $p = .185$. The lower performance rates of the OEH group seemed to reflect their lack of experience with, and exposure to, these Welsh-specific sounds.

Clusters common to Welsh and English.

The only cluster type assessed that was common to Welsh and English was that of *Stop + /l/.* Four of the six stop + /l/ clusters included in the task were ones common to Welsh and English. A repeated measures ANOVA confirmed that there were no significant effects for these common stop + /l/ clusters, $F(3, 44) = .540$, $p = .656$, nor of home language, $F(2, 44) = .456$, $p = .631$ (see *Figure 6.3*). Levels of target response rates for all four stop + /l/ clusters common to Welsh and English were high, ranging from 76% to 80%. It may be worth noting, however, that for all such C + /l/ clusters, there was a tendency for the WEH children to outperform the other two groups.

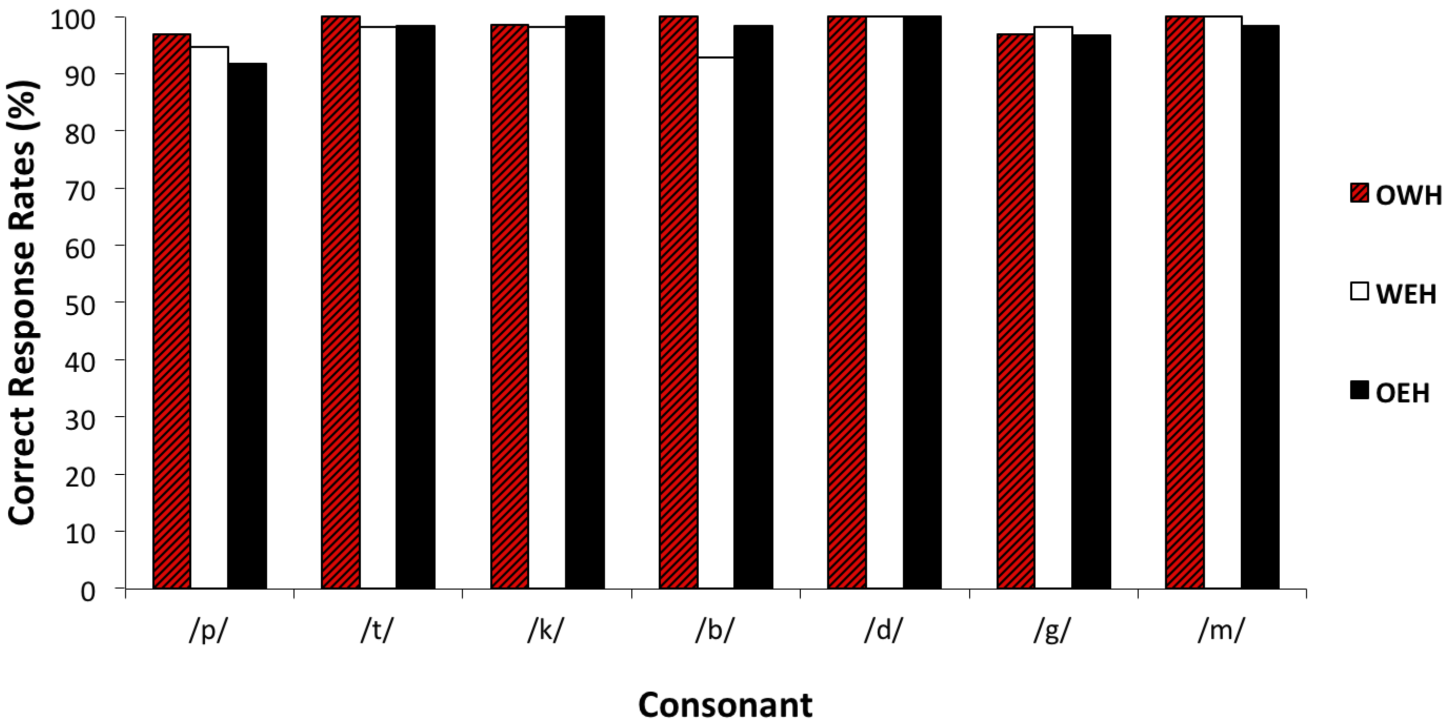


Figure 6.1. Rates of correct responses for stops and /m/.

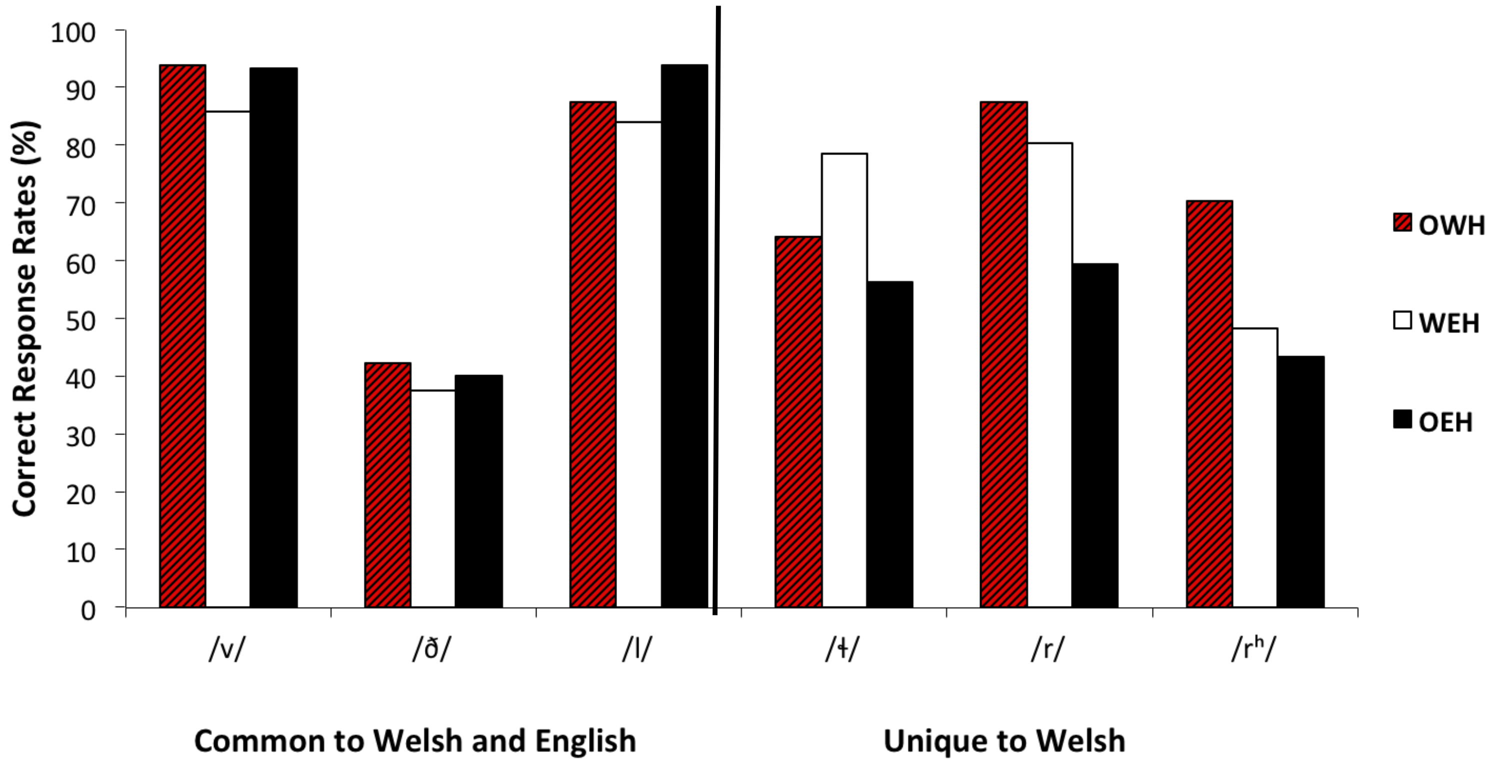


Figure 6.2. Rates of correct responses for fricatives and liquids.

Clusters unique to Welsh.

There were three main types of clusters unique to Welsh, stop + /r/, alveolar stop + /l/, and velar stop + /n/. An ANOVA in which these clusters and home languages were treated as variables revealed main effects of both phoneme type $F(9, 44) = 23.857$, $p < .001$, and of home language, $F(2, 44) = 3.382$, $p = .043$. Multiple pair-wise comparisons revealed best performance on C + /r/ and /kn/ clusters, least good performance on /dl/, and intermediate performance on /tl/ and /gn/ (all pairwise comparison *ps* < .001).

The main effect of language group observed in this analysis reflected a marginally significant difference in the performance rates of the OWH group versus the OEH group (p = .054, pair-wise comparison). No significant interaction of phoneme type and home language was observed $F(18, 44) = 1.196$, $p = .260$. These results indicated that the OEH group consistently performed below the OWH group, and that the OWH group generally performed highest, with the WEH group falling between the two groups. (Close inspection of the data suggested considerable variation in the performance of the WEH group—in some cases, they tended to perform best (/pr/, /br/), in some cases their performance was similar to that of the OWH children (/kr/, /dl/), and in some cases they fell between the OWH and OEH children or were more like the OEH children (e.g., /tl/, /kn/).

Thus, language exposure and experience seemed to play a role in the children's ability to articulate Welsh clusters accurately, in that the OWH children performed best, the OEH children performed worst, and the WEH children's performance generally fell between the two (see *Figures 6.4* and *6.5*). However, as with the stop + /r/ clusters, all groups exhibited some difficulty in articulating some of these sounds (especially /tl/, /dl/ and /gn/), suggesting that clusters of these types are generally difficult for children to produce at this age.

Summary of accuracy data.

Overall, no differences across home language groups emerged for those sounds common to both Welsh and English; thus, performance across groups was equivalent on sounds shared by the two languages. As noted, however, there seemed to be a tendency for the WEH group to show better mastery of stop + /l/ clusters, common to both languages. This group have been exposed to both languages from birth and so may have profited from more practice with these clusters in both languages.

For Welsh-specific sounds, the OEH group showed an overall disadvantage when compared to the WEH and OWH groups. This difference across groups appears to stem from the fact that while the OWH and WEH children have been exposed to Welsh from birth, the OEH group have usually not had much exposure to Welsh until at least pre-school age.

With the exception of the common stop + /l/ clusters, children from all home language groups struggled to produce clusters accurately. This was most evident for the Welsh alveolar stop + /l/ and stop + /n/ clusters. In particular, children struggled most with articulating /dl/. (The coarticulation of /d/ and /l/, both voiced and both alveolar, may be especially difficult.)

With regard to the consonants that were important for the ***Noun and Adjective Elicitation Task*** due to their involvement in soft mutation, (i.e. /p t k b d g m v d ð/), it is important to note that all of these consonants were common to Welsh and English. No differences across home language groups were observed in the repetition task for any of the above-mentioned consonants, presumably because these consonants are all common to Welsh and English. Therefore, children's ability to produce the sounds that they needed to produce in the mutation task did not differ across home language groups.[9]

THE REPETITION TASK RELATIVE TO PERFORMANCE ON THE GENDER TASK

The results of this task were then analysed in relation to the ***Noun and Adjective Elicitation Task,*** (see previous chapter), in terms of whether production of target forms of real nouns in the mutation task was related to children's accuracy for reproducing the initial consonants of novel nouns in the repetition task. Correlational analyses examined whether performance on the repetition task was related to performance on the ***Noun and Adjective Task*** or not. When correlations were found, further qualitative analyses examined how children's production of phonemes in real nouns related to their production of the same phonemes when repeating novel nouns.

6.5.3 Data Scoring.

Data were scored for correct/incorrect responses in terms of the initial consonant produced. Scores were tallied and an overall percentage score was calculated for this task. Tallies and percentage scores were also calculated for these participants' performance in the **Noun and Adjective Elicitation Task**. Correlational

[9] Detailed analyses of the error patterns of the children in the repetition task can be found in Sharp and Gathercole (submitted).

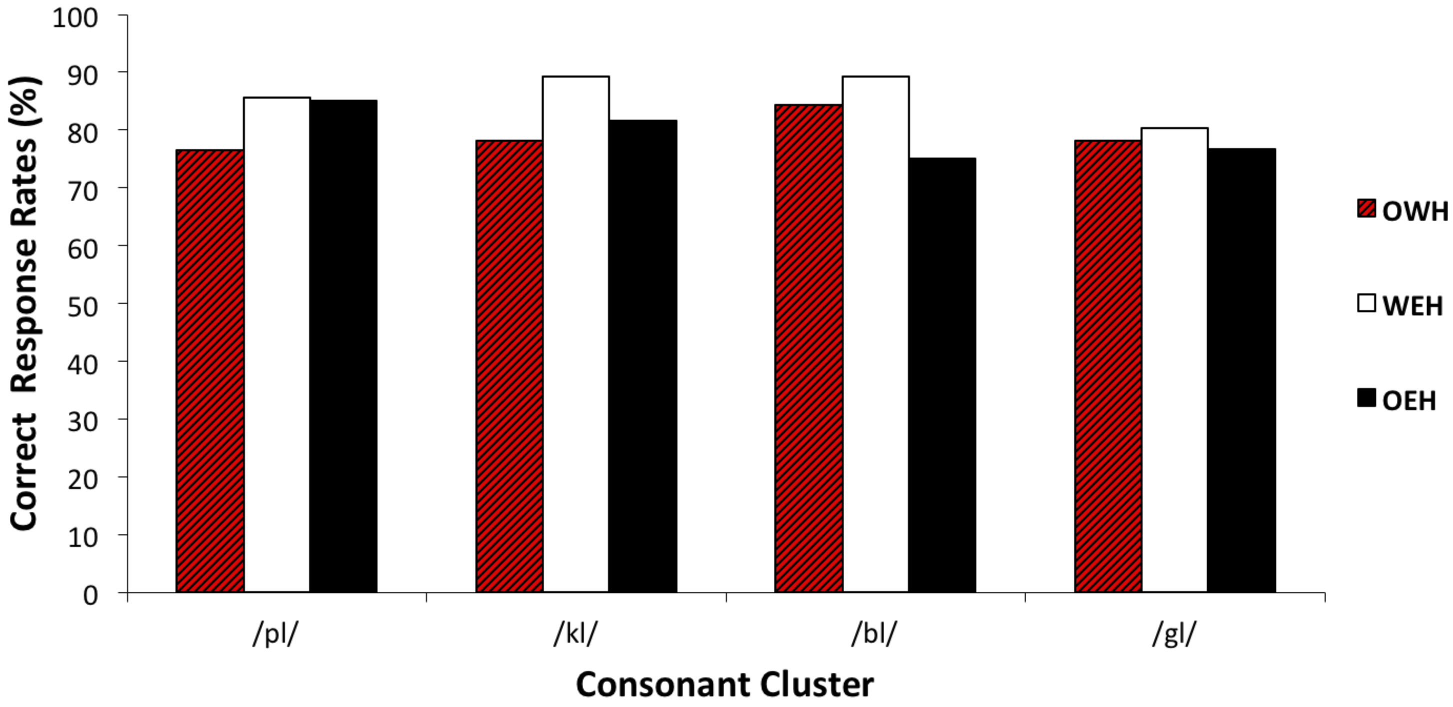


Figure 6.3. Rates of correct responses for consonant clusters common to Welsh and English.

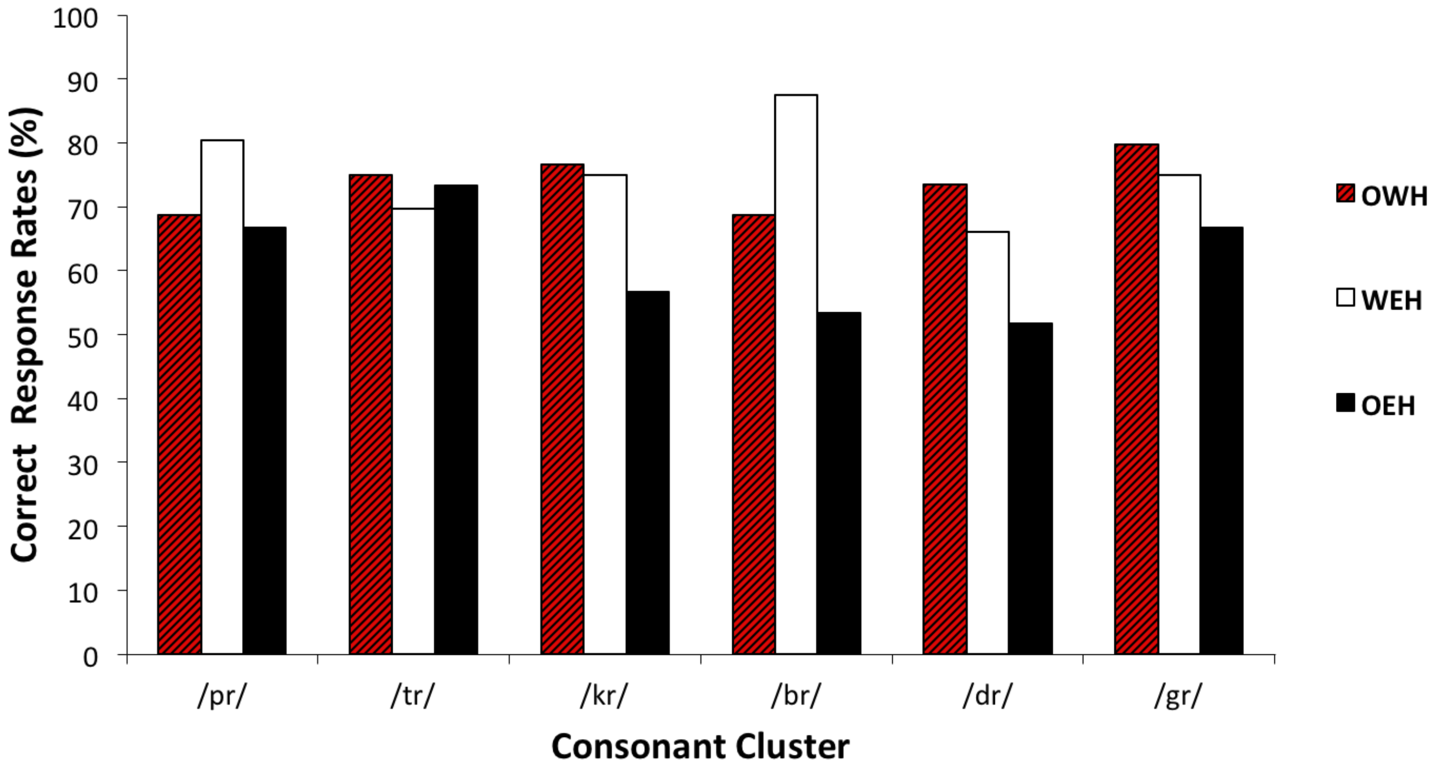


Figure 6.4. Rates of correct responses for stop + /r/ clusters.

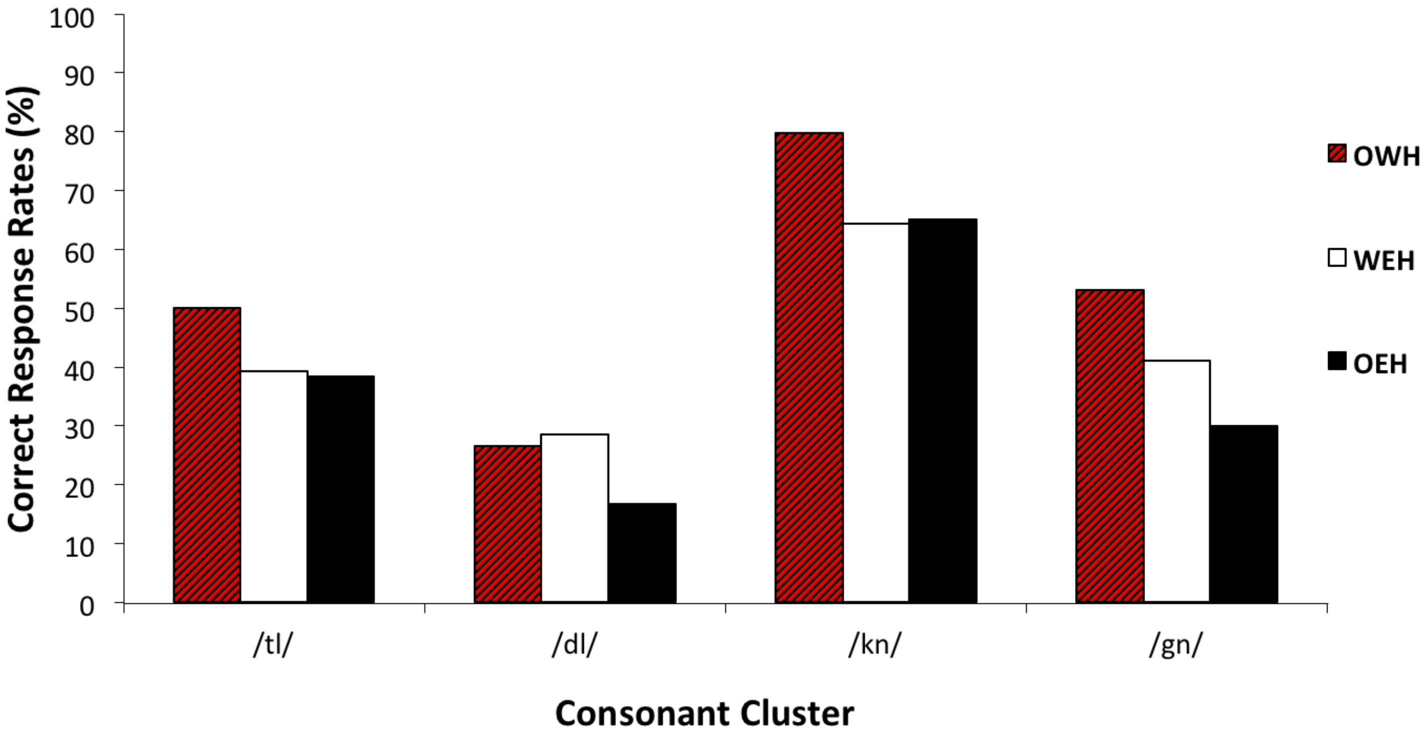


Figure 6.5. Rates of correct responses for alveolar stop + /l/ clusters, and velar stop + /n/ clusters.

analyses were conducted to determine whether performance rates on the repetition task correlated with children's performance in the ***Noun and Adjective Elicitation Task***. In addition, correlational analyses observed whether mutation rates for nouns correlated with mutation rates for adjectives.

6.5.4 Analyses: Relating consonant production to mutation.

Nouns.

The overall data of the 5-year old children for nouns and for the repetition task were subjected to a two-tailed bivariate correlational analysis. The analysis revealed a moderate positive correlation, r = .347, p = .024, suggesting that children with higher performance on one task tended to exhibit higher performance rates on the other task.

Adjectives.

The data of the 5-year old children for adjectives and for the repetition task were subjected to a two-tailed bivariate correlational analysis. The analysis revealed a very weak positive correlation, r = .105, p = .439. This result suggests that the accuracy of children's repetitions did not seem to be related to their performance for adjectives.

Given the differential effects observed in the both the noun and adjective data across gender categories, two separate correlational analyses were conducted with the repetition task data. One included the masculine noun and adjective data, and one included the feminine noun and adjective data.

Masculine Data.

The overall data of the 5-year old children for masculine nouns and for the repetition task were subjected to a two-tailed bivariate correlational analysis. The analysis revealed no correlation.

The overall data of the 4- and 5-year old children for adjectives paired with masculine nouns, and their data for the repetition task, were subjected to a two-tailed bivariate correlational analysis. The analysis revealed a negative correlation, $r = -.454$, $p < .001$. This reflected a trend in which children who performed well on the repetition task tended to perform worse for adjectives paired with masculine nouns, (i.e. they were inappropriately mutating adjectives more often).

Feminine Data.

The overall data of the 5-year old children for feminine nouns and the overall data for the repetition task were subjected to a two-tailed bivariate correlational analysis. The analysis revealed a marginally significant positive correlation, $r = .257$, $p = .054$. This showed that children who performed better on the repetition task tended to perform better on feminine nouns.

A second correlational analysis was run with the data for adjectives paired with feminine nouns and the overall data for the repetition task. A significant positive correlation was observed, $r = .418$, $p < .001$. This significant correlation reflected the fact that children who performed better on the repetition task overall were better at mutating feminine adjectives.

Exploration of articulatory constraints in relation to mutation.

The only dataset that did not show a significant/marginal correlation with the repetition task data was the masculine noun dataset, for which almost no application of mutation was observed. From the correlational effects observed above, it seemed that children's performance on the repetition task could be linked to the occurrence of mutation in the children's responses in the noun and adjective task. The question that arose from the above results was the following: why does there seem to be a correlation between accuracy of repetition and rate of mutation?

It may be possible that the link found between accuracy of repetition in this task and occurrence of mutation in the ***Noun and Adjective Elicitation Task*** was related to difficulty in articulating consonants in general. Alternatively, it may not have been related to articulation ability, but to variation in the attentional capabilities of individual children. That is, children who are better able to pay attention to phonology in general, would in theory be able to pay better attention both for articulatory repetition and for mutation.

Separating the data for the singleton consonant initial novel nouns versus the data for the cluster-initial novel nouns may help to determine which of these factors play a larger role, as consonant clusters should arguably be more difficult to articulate than singleton consonants.

The performance of the children for the repetition task was most varied for novel words with initial consonant clusters, as outlined above. To explore the possibility that rates of mutation could be linked to the articulatory skill levels of children (as judged by their ability to reproduce complex consonant clusters accurately), children's performance rates were re-calculated on the repetition task so that a score for each child was calculated for:

- Singleton consonant-initial novel noun repetition
- Consonant cluster-initial novel noun repetition

Children's repetition scores were related to children's performance on the ***Noun and Adjective Elicitation Task*** in terms of their:

- Real masculine noun production overall
- Real feminine noun production overall

Two correlational analyses were run, in which children's performance for clustered consonant repetition was analysed in relation to performance on the ***Noun and Adjective Elicitation Task*** for masculine nouns in general, and then by performance for feminine nouns in general. Neither correlation was significant.

Two more analyses were run, this time whereby children's performance for singleton consonant repetition was analysed in relation to performance for masculine nouns in general, and then by performance for feminine nouns in general. Singleton consonant repetition performance did not correlate with performance on masculine nouns, but it did correlate positively with performance for feminine nouns, $r = .304$, $p = .022$.

This suggested that children who were most accurate in their production of word-initial singleton consonants were those children who mutated feminine nouns most frequently in the ***Noun and Adjective Elicitation Task***. The data for the feminine nouns that appeared in the ***Noun and Adjective Elicitation Task*** were then split into two groups: data for feminine nouns with initial consonant clusters, and data for feminine nouns with initial singleton consonants. Scores were then recalculated.

Two final correlational analyses explored how performance for repetition of singleton versus clustered consonant novel nouns compared with children's production and mutation of singleton-initial and cluster-initial feminine nouns. The first correlational analysis revealed that singleton consonant repetition scores were significantly positively correlated with the rate at which children mutated singleton consonant-initial feminine nouns, $r = .448$, $p = .001$. The second analysis revealed that scores of clustered consonant repetition did not seem to correlate with mutation rates for cluster-initial feminine nouns, $r = .104$, $p = .446$.

What these findings suggest is that the patterns of mutation in these children may not derive entirely from articulatory difficulties on the part of participants, as the children who were able to reproduce cluster initial novel nouns well in the repetition task did not seem to show higher mutation rates of cluster-initial nouns when compared to children who appeared to struggle with reproducing cluster-initial nouns. Rather, it might be that the children who were best able to pay attention to sounds (but not necessarily best able to produce these sounds), were best able to apply mutation productively.

6.6 Discussion

Collectively, what the above results seem to suggest is that level of performance on the repetition task did seem to correlate with rates of mutation in these children. If we look back at the response patterns observed in the ***Noun and***

Adjective Elicitation Task, we will recall that mutation rates for masculine nouns were almost entirely absent in the children. However, children did show overextension of the feminine soft mutation feature to adjectives paired with masculine nouns, and also exhibited some mutation of feminine nouns, and more extensive mutation of adjectives paired with those nouns. These children appeared to perform better in the repetition task.

What this information seemed to suggest at first glance, was that children who exhibited more advanced articulatory skill in general (in terms of more accurate production of the consonants that participate in SM in the repetition task), tended to exhibit mutation more than those children who exhibited less articulatory skill. This seemed to be especially true of children's accuracy in reproducing novel nouns with an initial singleton consonant, and its relation to children's accuracy in terms of correct mutation of real feminine nouns with initial singleton consonants.

However, level of skill in reproducing cluster-initial consonants did not seem to be linked to rates of mutation of real cluster-initial consonants. This final result suggests that overall articulatory skill may not have been the driving factor. Children who were better able to produce clustered consonants were no better at mutation. Rather, variability in individual children's attentional skills may have played a more significant role in children's mastery of both consonant production and mutation. That is, their ability to notice phonology may have helped these children to learn something about how to reproduce sounds, and how to produce mutations, suggesting that acquisition of mutation isn't just reliant on articulatory skill. However, further investigation would be required to better determine how perceptual and attentional abilities affect the acquisition process, both for phonology in general, and for mutation specifically.

Chapter 7

Distant gender marking in Welsh:

Prepositions and Pronouns

7.1 Chapter Overview

This chapter presents an experimental task that elicited pronouns and gender-inflected prepositions in structured contexts. This task involved the same set of 48 target nouns as the previous task. First, the rationale and a methodological description of the task are presented. Then quantitative and qualitative explorations of the results and a discussion of the results follow.

7.2 Task Summary and Rationale

This task assessed distant gender agreement with nouns via gender-inflected prepositions and pronominal objects. According to the gender system of Welsh, some prepositions are marked for gender: when a referent is masculine, these prepositions take the ending *–o* (e.g. *arno* 'on him/it', *dano* 'under him/it', *wrtho* 'next (to) him/it'), which corresponds to the masculine pronoun *fo* 'him/it.' When a referent is feminine those same prepositions take the ending *–i* (e.g. *arni* 'on her/it', *dani* 'under her/it', *wrthi* 'next (to) her/it'), which corresponds to the feminine pronoun *hi* 'her/it.' The task assessed whether prepositions and pronominal objects were produced in keeping with the grammatical gender of the noun antecedent in each case.

Welsh preposition + pronoun structures had not been explored previously in the acquisition literature. It was of interest to determine how the acquisition of these structures compared to other previously researched aspects of the gender system (e.g. gender marking via Soft Mutation). The form function mapping of a pronoun, as a whole lexical item with only a single form for each gender, is more transparent than that of a soft mutation (SM) on a feminine noun (due to the complexity of SM as a gender cue/marker). Pronouns also carry semantic load. In light of these facts, it was expected that participants' responses would reflect earlier emergence of gender marking via pronouns as opposed to gender marking via SM.

Moreover, due to the fact that gender is marked more consistently via pronouns, and also that pronouns are a global form of gender marking (in that a pronoun may refer back to any noun referent, but SM cannot apply to all feminine nouns) it was expected that rates of correct pronoun production in reference to noun referents that possessed natural gender information (e.g. *dynes* 'woman (f.)') would be higher than for nouns that did not (e.g. *bwrdd* 'table (m.)'). Regarding prepositions, due to their association and co-occurrence with these pronouns, it was expected that the patterns of acquisition of these forms would align closely with that of the pronouns.

7.3 Method

The experiment consisted of an elicitation task in which forms were probed through a cloze task procedure involving prepositions and objects of prepositions in reference to human, animal, and inanimate antecedents.

7.3.1 Design and Stimuli.

7.3.1.1 Linguistic Stimuli.

Sentences.

The task consisted of 48 trials. Each of the 48 trials had two phases – a "prompt" phase and a "target" phase. In each trial, the prompt phase featured one prompt sentence and the target phase featured a phrase to be completed by the participant. The two sentences expressed the location of one object relative to another in a picture.

Target sentences.

Target sentences featured the same 48 nouns that were elicited in the ***Noun and Adjective Elicitation Task*** (see *Table 5.1,* above, for details). These target nouns functioned as the subjects of sentences, whilst a different set of 48 nouns were used as objects. These nouns varied in their animacy – some were animate (some humans, some animals); others were inanimate objects – and were balanced for frequency of occurrence. Full sentences expressed the location of the second object relative to the first (e.g., 'The doll has a teddy next to her'). The locations involved three target prepositions with masculine and feminine pronominal objects:

(43)

ar 'on' – *arno fo* 'on him/it'/ *arni hi* 'on her/it'

dan 'under' – *dano fo* 'under him/it'/ *dani hi* ' under her/it'

wrth 'next to'– *wrtho fo* 'next (to) him/it'/ *wrthi hi* 'next to her/it'

Participants were required to complete the experimenter's sentences by producing the appropriate preposition + pronoun structure in each case. See (44), below, for an example:

(44)

Experimenter:

Mae'r	*beiciwr*	*efo*	*mynydd*
Is-the	cyclist (m.)	with	mountain (m.)

"The cyclist (m.) has (a) mountain…"

Participant:

wrtho	*fo*
next (to) him (it)	him (it)

"…next to him (it)."

Target sentences were constructed in such a way that 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 (45) and (46) below:

(45) MASC:

EXP:	*Dyma*	*lun*	*ci*	*efo*	*pêl…*
	Here (is)	picture	dog (m.)	with	ball (f.)
	"Here's (a) picture (of a) dog (m.) with a ball (f.)…"				
PART:	*dano*	*fo*			
	under (him)	him (it)			
	"…under him."				

(46) FEM:

EXP:	*Dyma*	*lun*	*cath*	*efo*	*pêl…*
	Here (is)	picture	cat (f.)	with	ball (f.)
	"Here's (a) picture (of a) cat (f.) with a ball (f.)…"				
PART:	*dani*	*hi*			
	under (her)	her (it)			
	"…under her."				

Condition 2: 1-cue.

The definite article *y/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:

(47) MASC:

EXP:	*Mae'r*	*ci*	*efo*	*pêl*
	Is-the	dog (m.)	with	ball (f.)
	"The dog (m.) has a ball (f.)…"			
PART:	*dano*	*fo*		
	under (him)	him (it)		
	"…under him."			

(48) FEM:

EXP:	*Mae'r*	*gath*	*efo*	*pêl*
	Is-the	cat (f.)	with	ball (f.)
	"The cat (f.) has a ball (f.)…"			
PART:	*dani*	*hi*		
	under (her)	her (it)		
	"…under her."			

Condition 3: 2-cues.

Nouns in this condition were preceded by the definite article *yr* (*'r*), as above, but, additionally, adjectives with mutatable onsets followed the nouns. Both are marked for gender, as shown in (49). Masculine nouns do not mutate; nor do their corresponding adjectives, as shown in (50).

(49) MASC:

EXP:	*Mae'r*	*ci*	*glas*	*efo*	*pêl*
	Is-the	dog (m.)	blue	with	ball (f.)
	"The blue dog (m.) has a ball (f.)…"				
PART:	*arno*	*fo*			
	on (him)	him (it)			

(50) FEM:

EXP:	*Mae'r*	*gath*	*las*	*efo*	*pêl*
	Is-the	cat	blue	with	ball (f.)
	"The blue cat (f.) has a ball (f.)…"				
PART:	*arni*	*hi*			
	on (her)	her (it)			

Prompt sentences.

Prompt sentences preceded target sentences in each of the forty-eight trials. These prompt sentences were uttered by the experimenter, and shared the structure of the target sentences. Prompt sentences used the same set of preposition forms as target sentences (i.e. *dano* 'under him/it', *dani* 'under her/it', *wrtho* 'next (to him/it', *wrthi* 'next (to) her/it', *arno* 'on him/it', *arni* 'on her/it').

Balancing of prompts and target sentences.

Prepositions.

The location of the two objects in prompt phases of trials (e.g. next to each other) was not the same as the location of the two objects in target phases (e.g. one above the other). Therefore, the elicited preposition form was always different from the prompt. In this way, participants' responses were not skewed towards a specific preposition form. Both prompt and target prepositions were further balanced for frequency of occurrence. This balancing procedure allowed for examination of the extent to which the participants took information from this cue. Examples of prompt and target sentences are shown below:

(51) MASC:

PROMPT:	*Mae'r*	*garddwr*	*efo*	*llyfr*	*dano*	*fo*
(EXP)	Is-the	gardener (m.)	with	(a) book)	on (him)	him
	"The gardener (m.) has a book (m.) on him."					
TARGET:	*Mae'r*	*taid*	*efo*	*teledu*		
(EXP)	Is-the	grandfather (m.)	with	television		
	"The grandfather (m.) has a television (m.)…"					
TARGET:	*arno*	*fo*				
(PART)	on (him)	him				
	"…on him."					

(52) FEM:

PROMPT:	*Mae'r*	*golomen*	*efo*	*gafr*	*dani*	*hi*
(EXP)	Is-the	Pigeon (f.)	with	(a) goat (f.)	on (her)	him

"The pigeon (f.) has a goat (f.) on it (her)."

TARGET:	*Mae'r*	*falwen (f.)*	*efo*	*oren*
(EXP)	Is-the	snail (f.)	with	orange (m.)

"The snail (f.) has an orange (m.)…"

TARGET:	*wrthi*	*hi*
(PART)	next (to her)	her

"…next to it (her)."

Nouns.

As in the ***Noun and Adjective Elicitation Task***, the gender of the subject noun in prompt sentences matched the gender of the subject noun in target sentences in half of the trials (congruent trials), and differed in half the trials (incongruent trials), (see *Figure 7.1* below). This was done to control for any cues that might be picked up by the child from the experimenter in prompt sentences.

The prompts were balanced in congruent and incongruent trials as follows:

- Half of the target masculine nouns appeared in congruent trials half were in incongruent trials
- Half of the target feminine nouns were in congruent trials, half were in incongruent trials
- Half of the morphologically marked nouns (with gendered endings) were in congruent trials, half were in incongruent trials

- Half of the morphologically unmarked nouns (without gendered endings) were in congruent trials, half were in incongruent trials
- Half of the animate nouns (i.e. humans and animals) were congruent, half were incongruent
- Within the animates category, half of the human nouns appeared in congruent trials, and half in incongruent trials (the same distribution applied to animal items)
- Half of the inanimate items were in congruent trials, half were in incongruent trials

7.3.1.2 Non-linguistic stimuli.

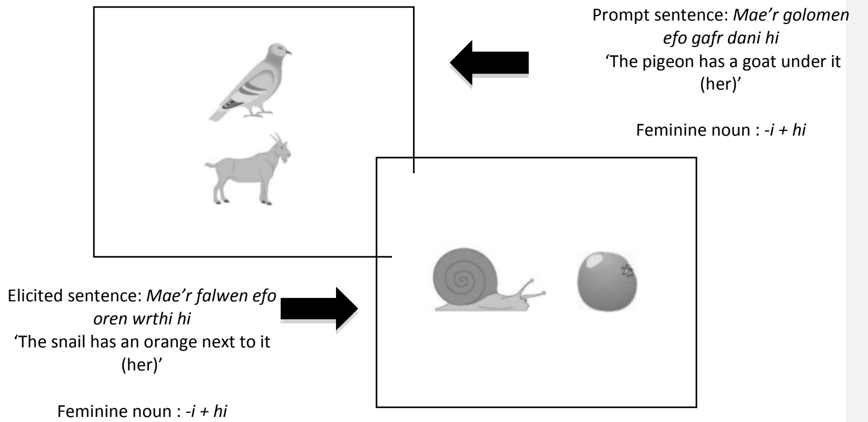
Images.

Ninety-six images were created. Forty-eight images were prompt images; the remaining forty-eight were target images. Each trial involved showing a prompt image with the prompt sentence and then a target image with the target sentence. (see Appendix 14 for more images). In both the prompt and eliciting images two objects were depicted (see *Figure 7.1*).

7.3.2 Participants.

The same participants that participated in the ***Noun and Adjective Elicitation Task*** participated in this task (see *Table 5.2,* above). In addition, 15 OWH 4-year-olds participated. All children (N = 150) and adults (N = 15) received all 48 trials.

CONGRUENT:



INCONGRUENT:

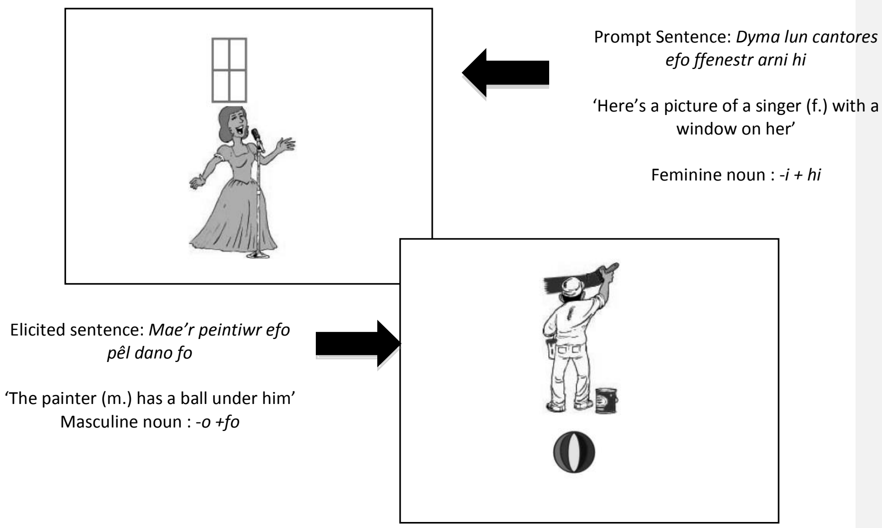


Figure 7.1. Examples of trials [congruent and incongruent].

7.3.3 Procedure.

Participants were told they would be playing a game in which they would see many pictures and say things about them. Participants were able to practise with a few pictures first. Before commencing with the main game (see Appendix 15 for full task instructions and Appendix 16 for examples of practice trials).

The task consisted of 48 trials. In each trial, the experimenter produced the prompt sentence first; and then began the partly elicited (target) sentence. Trials were completely randomised using the RAND command in Microsoft Excel ©. A total of five different randomisations of the trials were created (see Appendix 17 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 all possible combinations of inflected forms of the prepositions and pronominal objects, (see Appendix 18*),* and 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.

7.4 Results

7.4.1 Overview

Multiple analyses were performed on the data. Quantitative analyses examined, first, the adult and child data from the Only Welsh at Home (OWH) group, and, second, all of the child data from participants aged between 5- and 9-years from all home language groups. The quantitative analyses examined performance in the choice of pronoun only.

A third set of analyses examined all of the pronoun data quantitatively to explore the extent to which experimenter prompt sentences affected the response patterns of both the child and adult participants.

Finally, the fourth set of analyses focussed on a qualitative examination of the range of prepositions used by all age and home language groups.

7.4.2 Data Scoring.

Data were scored for correct/incorrect responses in the choice of pronoun. Preposition data were scored categorically from one to nine, based on nine qualitative response categories. As noted above, analyses were conducted separately for performance on the choice of pronoun and for the prepositional form.

7.4.3 Quantitative Analyses.

Pronouns.

<u>OWH PARTICIPANTS</u>

Preliminary Analysis

An initial mixed ANOVA was run, in which Gender (Masculine vs. Feminine), Animacy (Animate vs. Inanimate), Cue Condition (0, 1 or 2 cues), Word Form (Marked or Unmarked), and Age Group (4, 5, 7, 9, or Adult) were included as independent variables, and accuracy of pronoun production was the dependent variable.

A main effect of gender $F(1, 74) = 40.656$, $p < .001$, and significant interactions of Gender x Animacy, $F(1, 69) = 75.499$, $p < .001$; Gender x Cue Condition, $F(2, 138) = 7.592$, $p = .001$; Gender x Animacy x Cue Condition, $F(2, 138) = 11.225$, $p < .001$;

Gender x Animacy x Word Form, $F(1, 69) = 6.528$, $p =.013$, and Gender x Cue Condition x Word Form, $F(2 ,138) = 11.202$. $p < .001$ were observed. The effect of noun gender was due to the fact that participants showed a greater tendency to produce masculine pronouns, resulting in significantly higher performance rates for the masculine than feminine items (Masculine: M = 78.59, SD = 16.52 vs. Feminine: M = 54.98, SD = 19.75). Given the differences observed across gender categories and the interactions involving gender, it was deemed appropriate to split the dataset in two, and analyse the data for masculine noun trials and feminine noun trials separately in order to further explore the effects of the other manipulated variables under study.

Further Analyses

<u>MASCULINE DATASET</u>

A mixed ANOVA was run in which Animacy (Animate vs. Inanimate), Cue Condition (0, 1 or 2 cues), Word Form (Marked or Unmarked), and Age Group (4, 5, 7, 9, or Adult) were included as independent variables, and accuracy of pronoun production was the dependent variable.

______A main effect of Animacy, $F(1, 74) = 73.225$, $p < .001$,and significant interactions of Animacy x Cue Condition, $F(2, 69) = 8.134$, $p < .001$, Animacy x Word Form, $F(2, 138)$.= 23.993, $p < .001$, and Animacy x Cue Condition x Age Group $F(8, 138) = 2.574$, $p = .012$ were observed. The main effect of animacy reflected significantly higher rates of target responses for trials with animate nouns when compared to trials with inanimate nouns on average (Animate: M = 80.52%, SD = 10.42 vs. Inanimate: M = 53.37%, SD = 10.86).

Animate Nouns

The data were broken down further, so that the variables of Word Form, Cue Condition and Age Group were explored for trials with animate nouns and for trials with inanimate nouns separately. A further ANOVA with_Cue Condition (0, 1 or 2 cues), Word Form (Marked or Unmarked), and Age Group (4, 5, 7, 9, or Adult) as independent variables, and accuracy of pronoun production as the dependent variable, was run on the animate data only. A significant interaction of Cue Condition x Word Form was observed, $F(5, 74) = 19.387$, $p < .001$.

Post-hoc t-tests compared performance for marked versus unmarked noun trials across all three cue conditions. Significant differences were found in the 0-cue condition, t(1, 73) = 6.742,), $p < .001$, but not in the 1-cue and 2-cue conditions, t(1, 73) = 1.210, $p = .230$; t(1,73) = -.635, $p = .528$). Two final repeated measures ANOVAs compared performance across cue conditions for the marked and unmarked noun trial data separately. A main effect of cue condition was found for trials with unmarked masculine nouns, $F(2, 138) = 22.341$, $p < .001$, but not for marked masculine nouns, $F(2, 138) = 2.903$, $p = .058$.. Planned comparisons using the LSD test revealed significant differences between all pairings of cue conditions for unmarked nouns (0-cue (M = 70.11 ,SD = 30.75) vs. 1-cue (M = 83.47, SD = 27.52), $p =$ 001; 0-cues vs. 2-cues (M = 92.51, SD = 21.38), $p < .001$; 1-cue vs. 2-cues, $p =.008$). Performance was lowest in the 0-cue condition, and highest in the 2-cue condition.

Humans versus animals

Given the strong main effect of animacy observed, the masculine animate data were broken down into two datasets – data for trials with human nouns and data for trials with animal nouns – to determine whether the effect was related to the presence/absence of natural gender information. A repeated measures ANOVA with Animacy (Human vs. Animal) and Age Group (4, 5, 7, 9, Adult) as the independent variables and accuracy of pronoun production as the dependent variable revealed a significant main effect of Animacy, $F(1, 74) = 52.967$, $p < .001$. Performance for human nouns was almost at ceiling ($M = 94.77$, $SD = 15.33$) while performance for animal nouns was significantly lower on average ($M = 77.96$, $SD = 21.16$).

Inanimate Nouns

An ANOVA with Cue Condition (0, 1 or 2 cues), Word Form (Marked or Unmarked), and Age Group (4, 5, 7, 9, or Adult) as independent variables, and accuracy of pronoun production as the dependent variable, was run on the inanimate data. A significant interaction of Cue Condition x Word Form was observed, $F(5, 74) = 10.711$, $p < .001$. Post-hoc t-tests that compared performance for marked versus unmarked noun trials across all three cue conditions revealed significant differences in the 2-cue condition $t(2, 73) = -4.480$ $p < .001$), but not in the 1-cue condition, $t(2, 73) = -1.483$, $p = .142$, nor the 0-cue condition, $t(2, 73) = 1.939$, $p = .056$. This was different from the interaction of Word Form x Cue Condition observed for animate nouns, where differences by word form were observed in the 0-cue condition (see above).

Two final repeated measures ANOVAs compared performance across cue conditions for the marked and unmarked noun trial data separately. A main effect of cue condition was found for trials with marked masculine inanimate nouns, $F(2, 138)$

= 10.902, p < .001, but not for unmarked masculine inanimate nouns, F(2,138) = 1.615, p = .203. Planned comparisons using the LSD test revealed significant differences between all pairings of cue conditions for marked nouns (0-cue (M = 77.55 ,SD = 28.74) vs. 1-cue (M = 69.54, SD = 31.80), p = .034; 0-cues vs. 2-cues (M = 56.99, SD = 39.30), p < .001; 1-cue vs. 2-cues, p =.008). Performance in the 0-cue condition was higher than the 1-cue and 2-cue condition, and performance in the 2-cue condition was lower than the 1-cue condition.

FEMININE DATASET

A mixed ANOVA was run in which Animacy (Animate vs. Inanimate), Cue Condition (0, 1 or 2 cues), Word Form (Marked or Unmarked), and Age Group (4, 5, 7, 9, or Adult) were included as independent variables, and accuracy of pronoun production was the dependent variable. A significant main effect of Animacy, F(1, 138) = 421.550, p < .001, and significant interactions of Animacy x Word Form x Age, F(7, 74) = 3.311, p = .015, Animacy x Cue Condition, F(2, 138) = 7.163, p = .001, and of Cue Condition x Word Form x Age 2.441, p = .017, were observed. A significant main effect of Age Group was also present, F(4, 74) = 5.816, p < .001. Planned comparisons using Tukey's HSD test revealed significant differences between the adults (M = 72.46, SD = 13.81) and the 4-year-olds (M = 41.85, SD = 17.80, p = <. 001), the adults and the 5-year olds (M = 50.72, SD = 19.28, p = .017) and the adults and the 7-year-olds (M = 51.59, SD = 17.91, p = .022).

Given the main effects and interactions observed, the data were split into two datasets, one for the animate feminine noun trials, and one for the inanimate feminine noun trials. The data files were split by age group, so that effects of Cue Condition and Word Form were explored for each age group separately.

Animate Nouns

To explore effects of Word Form and Cue Condition for animate nouns, a repeated-measures ANOVA was run with Word Form (Marked vs. Unmarked) and Cue Condition (0, 1, or 2 cues) as the independent variables, and accuracy of pronoun production as the dependent variable. The data file was split, so that the analysis was run simultaneously for each age group separately. A significant main effect of Word Form was found in the 5-year-old data, $F(1, 14) = 6.323$, $p < .001$, with better performance observed for marked animate nouns as opposed to unmarked animate nouns (M =77.78, SD = 19.59 vs. M = 62.22, SD = 22.24). In the 7-year-old data, a main effect of cue condition was observed, $F(2, 14) = 10.897$, $p < .001$. Planned comparisons using the LSD test revealed significant differences between the 1-cue condition (M = 65.00, SD = 28.03) and the 2-cue condition (M = 88.33, SD = 15.99, p = .001) and the 1-cue condition and the 0-cue condition, (M = 73.33, SD = 19.97, p = .021) with significantly lower target production rates in the 1-cue condition in both cases.

Humans versus animals

Given the strong main effect of animacy observed, the feminine animate data were broken down into two datasets – data for trials with human nouns and data for trials with animal nouns – to determine whether the effect was related to the presence/absence of natural gender information. A repeated measures ANOVA with Animacy (Human vs. Animal) and Age Group (4, 5, 7, 9, Adult) as the independent variables and accuracy of pronoun production as the dependent variable revealed a significant main effect of Animacy, F(1, 74) = 114.458, p < .001. Performance for human nouns was close to ceiling (M = 92.24, SD = 13.52) while performance rates for animal nouns were significantly lower on average (M = 57.13, SD = 31.37). No interaction of Animacy x Age Group was observed, *F*(4, 69) = 1..608, *p* = .085.

Inanimate Nouns

A further ANOVA with Cue Condition (0, 1 or 2 cues), Word Form (Marked or Unmarked), and Age Group (4, 5, 7, 9, or Adult) as independent variables, and accuracy of pronoun production as the dependent variable, was run on the inanimate noun data only. The data file was split, so that the analysis was run simultaneously for each age group separately.

A main effect of Cue Condition was observed in the 4-year-olds, *F*(2, 28) = 6.582, *p* .005; the 7-year-olds, *F*(2, 28) = 3.688, *p* . 038, and the adults, *F*(2,28) = 11.379, *p* <.001. Planned comparisons using the LSD test revealed significantly higher (*p* = .028) performance rates in the 1-cue condition (M = 28.84, SD = 27.20) when compared to the 0-cue condition (M = 9.05, SD = 12.34) and significantly higher performance rates (*p* = .018) in the 2-cue condition (M = 31.66, SD = 28.03) when compared to the 0-cue condition in the 4-year-olds.

A significant difference (*p* = .023) was also observed between the 2-cue condition (M = 40.00, SD = 37.55) and the 0-cue condition (M = 16.67, SD = 20.41) in the 7-year-olds. Finally, in the adult group, significantly higher performance rates (*p*

= .004) for the 2-cue condition (M = 70.00, SD = 27.06) were observed when compared to the 0-cue condition (M = 35.00, SD = 22.76) and significantly higher (*p* = .003) rates in the 1-cue condition (M = 58.88, SD = 29.37) were observed when compared to the 0-cue condition.

ALL CHILD PARTICIPANTS

Preliminary Analysis

An initial mixed ANOVA was run, in which Gender (Masculine vs. Feminine), Animacy (Animate vs. Inanimate), Cue Condition (0, 1 or 2 cues), Word Form (Marked or Unmarked), Age Group (5, 7, 9) and Home Language (OWH, WEH, OEH), were included as independent variables, and accuracy of pronoun production was the dependent variable.

A main effect of gender $F(1, 134) = 46.884$, $p < .001$, and interactions of Gender x Animacy, $F(1, 126) = 72.759$, $p < .001$; Gender x Cue Condition, $F(2, 252) = 9.303$, $p < .001$; Gender x Cue Condition x Language Group, $F(4, 252) = 2.975$, $p = .020$; Gender x Animacy x Cue Condition, $F(2, 252) = 9.540$, $p < .001$; Gender x Animacy x Word Form, $F(1, 126) = 9.196$, $p = .003$; and Gender x Cue Condition x Word Form, $F(2, 252) = 25.786$, $p < .001$ were attested. The effect of noun gender was due to the fact that participants showed a greater tendency to produce masculine pronouns, resulting in significantly higher performance rates for the masculine than feminine items (Masculine: M = 72.19, SD = 18.52 vs. Feminine: M = 52.21, SD = 19.38). Given the differences observed across gender categories and the interactions involving gender, it was deemed appropriate to split the dataset in two, and analyse the data for masculine noun trials and feminine noun trials separately in order to further explore the effects of the other manipulated variables under study. A main effect of Home Language, $F(2, 134) = 9.143$, $p < .001$, was also observed in the initial analysis. Planned comparisons using Tukey's HSD test revealed a significant difference ($p = .001$) in the overall performance of the OEH group (M = 58.29, SD = 8.52) and the OWH group (M = 65.19, SD = 6.59) and a significant difference ($p = .012$) between the OEH group and the WEH group (M = 63.10, SD = 8.85) group, with performance for the OEH group being significantly lower in both cases, (see *Figure 7.2,* below).

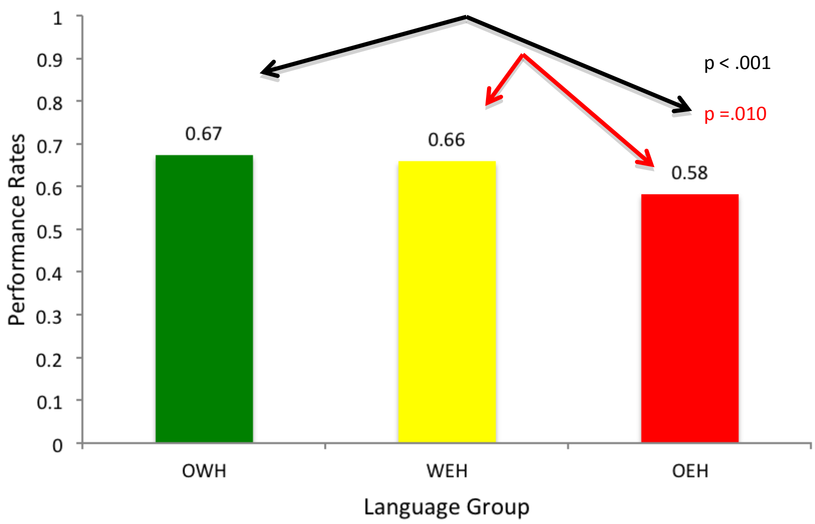


Figure 7.2. Significant differences across language groups reflecting lower performance rates in the Only English at Home group.

Further analyses

MASCULINE DATASET

A mixed ANOVA was run in which Animacy (Animate vs. Inanimate), Cue Condition (0, 1 or 2 cues), Word Form (Marked or Unmarked), Age Group (5,7,9) and Home Language (OWH, WEH, OEH) were included as independent variables, and accuracy of pronoun production was the dependent variable.

As with the OWH dataset, a main effect of Animacy, $F(1, 134) = 103.917$, $p < .001$, and significant interactions of Animacy x Age Group, $F(1, 126) = 5.492$, $p = .005$; Animacy x Cue Condition, $F(2, 252) = 9.721$, $p < .001$; Animacy x Word Form, $F(1, 126) = 22.885$, $p < .001$; Animacy x Word Form x Age Group, $F(2, 126) = 3.700$, $p = .027$ were observed. The main effect of animacy reflected significantly higher rates of target responses for trials with animate nouns when compared to trials with inanimate nouns on average (M = 79.38, SD = 18.57 vs. M = 65.00, SD = 21.97). Given the main effect of animacy and significant interactions involving animacy observed, the data were split into two datasets – one with the data for animate noun trials, and one with the data for inanimate noun trials.

Animate Nouns

To explore effects of Word Form and Cue Condition for animate nouns, a repeated-measures ANOVA was run with Word Form (Marked vs. Unmarked) Cue Condition (0, 1, or 2 cues) Age Group (5,7,9) and Home Language (OWH, WEH, OEH), as the independent variables, and accuracy of pronoun production as the dependent variable. A significant interaction of Cue Condition x Word Form was observed, $F(5, 134) = 23.708$, $p < .001$. Two post-hoc ANOVAs examined effects of cue condition for the marked nouns, and for the unmarked nouns separately. The analysis of the marked noun data revealed no significant effect of cue condition, $F(2, 134) = 1.349$, $p = .261$, while the analysis of the unmarked noun data did reveal a main effect of Cue Condition, $F(2, 134) = 33.881$, $p < .001$. Planned comparisons using the LSD test revealed a significant difference ($p < .001$) between the 0-cue condition (M = 64.81, SD = 30.58) and the 1-cue condition (M = 78.15, SD = 29.04), and a significant difference ($p < .001$), between the 0-cue condition and the 2-cue condition (M = 88.52, SD = 23.61),with lower performance rates for the 0-cue condition in both cases.

Humans versus Animals

Given the strong main effect of animacy observed, the masculine animate data were broken down into two datasets – data for trials with human nouns and data for trials with animal nouns – to determine whether the effect was related to the presence/absence of natural gender information. A repeated measures ANOVA with Animacy (Human vs. Animal), Age Group (5, 7, 9), and Home Language, (OWH, WEH, OEH) as the independent variables and accuracy of pronoun production as the dependent variable revealed a significant main effect of Animacy, $F(1, 134) = 363.795$, $p < .001$. Performance for human nouns was near ceiling, (M = 90.86, SD = 19.28), while performance for animals was significantly lower (M = 67.90, SD = 24.14).

Inanimate Nouns

A further ANOVA with Cue Condition (0, 1 or 2 cues), Word Form (Marked or Unmarked), and Age Group (4, 5, 7, 9, or Adult) as independent variables, and accuracy of pronoun production as the dependent variable, was run on the inanimate noun data only. A significant interaction of Cue Condition x Word Form, $F(5, 134) = 8.683$, $p < .001$ was attested. Two post-hoc ANOVAs examined effects of cue condition for the marked nouns, and for the unmarked nouns separately. The analysis of the marked noun data revealed a significant effect of cue condition, $F(2, 134) = 9.647$, $p =\ < .001$, while the analysis of the unmarked noun data did not reveal an effect, $F(2, 252) = 1.291$, $p =.277$ Planned comparisons of the marked inanimate noun data using the LSD test revealed a significant difference (p < .001) between the 0-cue condition (M = 70.00, SD = 31.26)and the 1-cue condition (M = 58.15, SD = 32.44) and a significant difference (p = .001) between the 0-cue condition and the 2-cue condition, (M = 56.67, SD = 37.05) with significantly higher performance rates for the 0-cue condition in each case.

FEMININE DATASET

A mixed ANOVA was run_in which Animacy (Animate vs. Inanimate), Cue Condition (0, 1 or 2 cues), Word Form (Marked or Unmarked), and Age Group (5,7,9) and Home Language (OWH, WEH, OEH) were included as independent variables, and accuracy of pronoun production was the dependent variable. As with the OWH dataset, a main effect of Animacy, $F(1, 134) = 403.482$, $p < .001$, and significant interactions of Animacy x Age Group, $F(2, 126) = 3.590$, $p = .030$; Animacy x Language Group, $F(2, 126) = 4.273$, $p = .016$, and Animacy x Cue Condition, $F(2, 252) = 5.441$, p

= .005 were observed. The main effect of animacy reflected significantly higher rates of target responses for trials with animate nouns when compared to trials with inanimate nouns on average (M = 69.14, SD = 21.67 vs. M = 35.25, SD = 22.37).

Animate Nouns

To explore effects of Word Form and Cue Condition for animate nouns, a repeated-measures ANOVA was run with Word Form (Marked vs. Unmarked) Cue Condition (0, 1, or 2 cues) Age Group (5, 7, 9) and Home Language (OWH, WEH, OEH) as the independent variables, and accuracy of pronoun production as the dependent variable. A significant interaction of Cue Condition x Word Form, $F(5, 134) = 6.239$, $p = .002$ was observed. Two post-hoc ANOVAs examined effects of cue condition for the marked nouns, and for the unmarked nouns separately. The analysis of the marked noun data revealed a significant main effect of cue condition, $F(2, 134) = 17.955$, $p < .001$. Planned comparisons of the marked noun data using the LSD test revealed a significant difference ($p < .001$) between the 2-cue condition (M = 65.93, SD = 32.69) and the 1-cue condition (M = 64.81, SD = 28.04), and a significant difference ($p < .001$) between the 2-cue condition and the 0-cue condition (M = 79.63, SD = 29.48) with significantly higher performance rates for the 2-cue condition in both cases.

The analysis of the unmarked noun data also revealed a significant main effect of Cue Condition, F(2, 134) = 4.674, p < .05. In this case, planned comparisons using the LSD test revealed a significant difference ($p = .013$) between the 0-cue condition (M = 62.96, SD = 28.62) and the 1-cue condition (M = 70.37, SD = 34.17), and a significant difference ($p = .003$) between the 0-cue condition and the 2-cue condition, (M = 71.1, SD = 30.21). In both cases, significantly lower performance rates were observed for the 0-cue condition.

Humans versus Animals

Given the strong main effect of animacy observed, the feminine animate data were broken down into two datasets – data for trials with human nouns and data for trials with animal nouns – to determine whether the effect was related to the presence/absence of natural gender information. A repeated measures ANOVA with Animacy (Human vs. Animal) and Age Group (5, 7, 9), and Home Language (OWH, WEH, OEH) as the independent variables and accuracy of pronoun production as the dependent variable revealed a significant main effect of animacy, $F(1, 134) = 160.647$, $p < .001$. This effect reflected high rates of target production for humans (M = 86.17, SD = 22.30), and significantly lower rates of target pronoun production in relation to animal nouns (M = 52.10, SD = 30.16).

Inanimate Nouns

A further ANOVA with Cue Condition (0, 1 or 2 cues), Word Form (Marked or Unmarked), and Age Group (4, 5, 7, 9, or Adult) as independent variables, and accuracy of pronoun production as the dependent variable, was run on the inanimate noun data only. The analysis revealed a main effect of Cue Condition, $F(2, 134) = 20.384$, $p < .001$, and a significant interaction of Cue Condition x Word Form, F 5, 134) = 5.777, $p = .004$.

Two post-hoc ANOVAs examined effects of cue condition for the marked nouns, and for the unmarked nouns separately. The analysis of the marked noun trials revealed a significant main effect of Cue Condition, $F(2, 134) = 10.423$, $p < .001$. Planned comparisons using the LSD test revealed a significant difference ($p < .001$) between the 0-cue condition (M = 28.89, SD = 32.01) and the 2-cue condition (M = 42.96, SD = 36.22), and a significant difference ($p = .019$) between the 0-cue condition and the 1-cue condition (M = 35.56, SD = 29.84) with performance for the 0-cue condition being significantly lower on average in both cases.

For the unmarked inanimate nouns, a significant main effect of Cue Condition was also observed, $F(2, 134) = 15.450$, $p < .001$. Planned comparisons using the LSD test revealed a significant difference ($p < .001$) between the 0-cue condition (M = 24.44, SD = 31.66), and the 1-cue condition (M = 43.33, SD = 38.53) and a significant difference ($p = .001$), between the 0-cue condition and the 2-cue condition (M = 36.30, SD = 32.57), with performance in the 0-cue condition being significantly lower in both cases.

QUANTITATIVE ANALYSES – PART TWO – EXPERIMENTER EFFECTS

A third set of analyses assessed the influence of trial congruency on participant responding. Given the common effects of gender observed in both the OWH and child datasets, analysis of congruency was assessed for the feminine and masculine datasets separately for each participant pool. Given the mixed effects of word form observed in above analyses, data were collapsed by this variable.

Preliminary Analyses

OWH PARTICIPANTS

Masculine Noun Trials

A mixed ANOVA was run, with congruency (Congruent vs. Incongruent), and Age Group (5, 7, 9, and Adult) as the independent variables and accuracy of pronoun production as the dependent variable. A significant main effect of congruency was found, $F(1, 69) =$, 63.004, $p < .001$. Performance for congruent trials was significantly higher than for incongruent trials (M = 87.07, SD = 16.79 vs. M= 70.12, SD = 20.96).

Animate Noun Data

Given the effects of animacy observed in previous analyses – two sets of analyses observed whether congruency effects were present for human masculine noun trials and for animal masculine noun trials separately. A repeated measures ANOVA with Congruency and Age Group as the independent variables, and accuracy of pronoun production as the dependent variable revealed no main effect of congruency for human masculine noun trials, $F(1, 69) = .683$ p =..411, as performance was at ceiling for human nouns in both congruent and incongruent trials (M = 94.04, SD = 19.38 vs. M = 95.50, SD = 14.39). A second ANOVA, run on the data for animal nouns, revealed a main effect of congruency, $F(1, 69) = 36.676$, $p < .001$, performance in congruent trials was significantly higher than performance for incongruent trials (M = 89.57, SD = 19.80 vs. M = 66.36, SD = 32.48).

Inanimate Noun Data

A repeated measures ANOVA with Congruency and Age Group as the independent variables, and accuracy of pronoun production as the dependent variable revealed a significant main effect of congruency, $F(1, 59) = 62.295$, $p <$ 001. Congruent trials resulted in much higher performance rates than incongruent trials, (M = 82.33, SD = 21.44 vs. M = 59.31, SD = 27.21).

Feminine Noun Trials

A mixed ANOVA was run, with congruency (Congruent vs. Incongruent), and Age Group (5, 7, 9, and Adult) as the independent variables and accuracy of pronoun production as the dependent variable. A significant main effect of congruency was found, $F(1, 59) = 48.195$, $p < .001$. Performance for congruent trials was significantly higher than for incongruent trials (M = 64.42, SD = 24.20 vs. M = 46.18, SD = 21.91).

Animate Noun Data

Given the effects of animacy observed in previous analyses – two sets of analyses observed whether congruency effects were present for human masculine noun trials and for animal masculine noun trials separately. A repeated measures ANOVA with Congruency and Age Group as the independent variables, and accuracy of pronoun production as the dependent variable revealed a main effect of congruency for human feminine noun trials, $F(1, 69) = 10.104$, $p = .002$, as performance was higher for human nouns in congruent trials than for incongruent trials (M = 95.43, SD = 11.46 vs. M = 89.05, SD = 19.93). A second ANOVA, run on the data for feminine animal nouns, revealed a main effect of congruency, $F(1, 69) = 5.746$, $p =.019$, performance in congruent trials was significantly higher than performance for incongruent trials (M = 63.01, SD = 37.39 vs. M = 51.24, SD = 38.45).

Inanimate Noun Data

A repeated measures ANOVA with Congruency and Age Group as the independent variables, and accuracy of pronoun production as the dependent variable revealed a significant main effect of congruency, $F(1, 59) = 50.162$, $p < 001$. Congruent trials resulted in much higher performance rates than incongruent trials, (M = 49.62, SD = 32.65 vs. M = 23.61, SD = 24.72).

ALL CHILD PARTICIPANTS

Masculine Noun Trials

A mixed ANOVA was run, with congruency (Congruent vs. Incongruent), and Age Group (5, 7, 9) and Home Language (OWH, WEH, OEH) as the independent variables and accuracy of pronoun production as the dependent variable. A significant main effect of congruency was found, $F(1, 134) = 138.067$, $p < .001$.

Performance for congruent trials was significantly higher than for incongruent trials (M = 84.07, SD = 17.85 vs. M = 60.31, SD = 25.38).

Animate Noun Data

Given the effects of animacy observed in previous analyses – two sets of analyses observed whether congruency effects were present for human masculine noun trials and for animal masculine noun trials separately. A repeated measures ANOVA with Congruency, Age Group and Home Language as the independent variables, and accuracy of pronoun production as the dependent variable revealed a main effect of congruency for human masculine noun trials, $F(1, 134) = .14.651$, $p = < .001$, as performance was higher for human nouns in congruent trials than for those in incongruent trials (M = 94.57, SD = 15.88 vs. M = 87.16, SD = 27.61). A second ANOVA, run on the data for animal nouns, revealed a main effect of congruency, $F(1, 134) = 72.024$, $p < .001$, performance in congruent trials was significantly higher than performance for incongruent trials (M = 81.48, SD = 25.96 vs. M = 54.32, SD = 34.49).

Inanimate Noun Data

A repeated measures ANOVA with Congruency, Age Group and Home Language as the independent variables, and accuracy of pronoun production as the dependent variable revealed a significant main effect of congruency, $F(1, 134) = 120.119$, $p < 001$. Congruent trials resulted in much higher performance rates than incongruent trials, (M = 80.12, SD = 22.81 vs. M = 49.88, SD = 30.77).

Feminine Noun Trials

A mixed ANOVA was run, with congruency (Congruent vs. Incongruent), Age Group (5, 7, 9) and Home Language (OWH, WEH, OEH) as the independent variables and accuracy of pronoun production as the dependent variable. A significant main effect of congruency was found, $F(1, 134) = 103.905$, $p < .001$. Performance for congruent trials was significantly higher than for incongruent trials ($M = 63.89$, $SD = 24.49$ vs. $M = 40.49$, $SD = 22.51$).

Animate Noun Data

Given the effects of animacy observed in previous analyses – two sets of analyses observed whether congruency effects were present for human masculine noun trials and for animal masculine noun trials separately. A repeated measures ANOVA with Congruency, Age Group and Home Language as the independent variables, and accuracy of pronoun production as the dependent variable revealed no main effect of congruency for human feminine noun trials, $F(1, 134) = 18.290$, $p < .001$, as performance was higher on average for human nouns in congruent trials than for incongruent trials ($M = 90.62$, $SD = 21.79$ vs. $M = 81.73$, $SD = 29.56$). A second ANOVA, run on the data for feminine animal nouns, revealed a main effect of congruency, $F(1, 59) = 31.990$, $p < .001$, performance in congruent trials was significantly higher than performance for incongruent trials ($M = 62.22$, $SD = 37.72$ vs. $M = 41.98$, $SD = 36.42$).

Inanimate Noun Data

A repeated measures ANOVA with Congruency, Age Group and Home Language as the independent variables, and accuracy of pronoun production as the dependent variable revealed a significant main effect of congruency, $F(1, 59) = 76.114$, $p < 001$. Congruent trials resulted in much higher performance rates than incongruent trials, ($M = 51.36$, $SD = 31.61$ vs. $M = 19.14$, $SD = 24.81$).

7.4.4 Qualitative Analyses.

Prepositions.

Qualitative analyses examined the types of preposition forms produced by participants. These fell into NINE categories:

1) (Appropriately formed Simple) Target masculine forms – i.e. *arno* 'on him/it', *dano* 'under him/it', *wrtho* 'next (to) him/it'

2) (Appropriately formed Simple) Target feminine forms – i.e. *arni* 'on her/it', *dani* 'under her/it', *wrthi* 'next (to) her/it'

3) (Appropriately Formed Compounds) Masculine Forms – i.e. *ar ei ben o* 'on his/its head', *wrth ei ymyl o* 'next (to) his/its side', *wrth ei ochr o* 'next (to) his/its side'

4) (Appropriately Formed Compounds) Feminine Forms i.e. *ar ei phen hi* 'on her/its head', *wrth ei hymyl hi* 'next (to) his/its side', *wrth ei hochr hi* 'next (to) his/its side'

5) (Appropriately Formed Compounds) Neutral Forms i.e. – *ar ben o/hi* 'on top of him (it)/her(it)', *ar dop o/hi* 'on top of him (it)/her(it)', *wrth ymyl o/hi* 'next (to) him(it)/her(it)', *wrth ochr o/hi* 'next (to) him(it)/her(it)', *uwchben o/hi* 'above him(it)/her(it)'

6) (Inappropriately formed) Neutral –*y* forms – i.e. *arny* ‘on’ *, dany* ‘under’ *, wrthy* ‘next (to)’

7) (Inappropriately formed) Neutral –*a* forms – i.e. *arna* ‘on’*, dana* ‘under’*, wrtha* ‘next (to)’

8) (Inappropriately formed) Non-inflected prepositions – i.e. *ar fo/hi* ‘on him(it)/her(it)’*, dan fo/hi* ‘under him(it)/her(it)’*, wrth fo/hi* ‘next (to) him(it)/her(it)’*, o dan fo/hi* ‘under him(it)/her(it)’

9) (Inappropriately formed) Compounds – i.e. *ar y fo/hi* ‘on the him(it)/her(it)’*, wrth y fo/hi* ‘on the him(it)/her(it)’*, dan y fo/hi* ‘under the him(it)/her(it)’*, ar ei ben hi* ‘on his/its head + feminine pronoun’*, ar ei phen fo* ‘on her/its head + masculine pronoun’

These response types are shown in schematic form for each of the three target prepositions in *Table 7.2*, (below). The dominant patterns in choice of prepositional form across the prepositions are presented first; some differences in performance by preposition type are then explored. Finally, agreement between the prepositional forms with co-occurring pronouns are examined. For each of these, data for the masculine targets are discussed first, then data for the feminine targets.

CHOICE OF PREPOSITIONAL FORM OVERALL

7.4.4.1 Masculine: overall patterns of responding.

The overall choices of form were as shown in *Figure 7.8*, (below) where responses of adults and children are displayed in separate columns. The dominant choice was the simple masculine *o*-inflected form. This was the target form to be elicited. However, other grammatically correct forms are also acceptable in Welsh, namely masculine and neutral compound prepositions. Some examples of these

Table 7.2

Types of forms produced by participants – arranged by form type

	Form type	AR	DAN	WRTH
Appropriate Forms	**(1) Simple -o forms**	*arno* 'on him'	*dano* 'under him'	*wrtho* 'next to him'
	(2) Simple -i forms	*arni* 'on her'	*dani* 'under her'	*Wrthi* 'next to her'
	(3) Masculine Compounds	*ar ei ben* 'on his head'	N/A	*wrth ei ymyl* 'next to his side'
	(4) Feminine Compounds	*ar ei phen* 'on her head'	N/A	*wrth ei hymyl* 'next to her side'
	(5) Neutral Compounds	*uwchben* 'above'	N/A	*wrth ymyl* *wrth ochr* 'next to'
Inappropriate Forms	**(6) Simple -y forms**	*arny* 'on'	*dany* 'under'	*wrthy* 'next to'
	(7) Simple -a forms	*arna* 'on'	*dana* 'under'	*wrtha* 'under'
	(8) Non-inflected forms	*ar* 'on'	*dan* 'under'	*wrth* 'next to'

types of forms were found in the child data, but not in the adult data. Both –*y* forms, and –*a* forms were found in both the child and adult data. As will be shown below, the –*y* forms occurred in the adults' speech, but only with masculine pronouns, suggesting that these -*y*-inflected prepositions were alternative forms of -*o*-inflected prepositions, or were simply an alternative pronunciation of them.

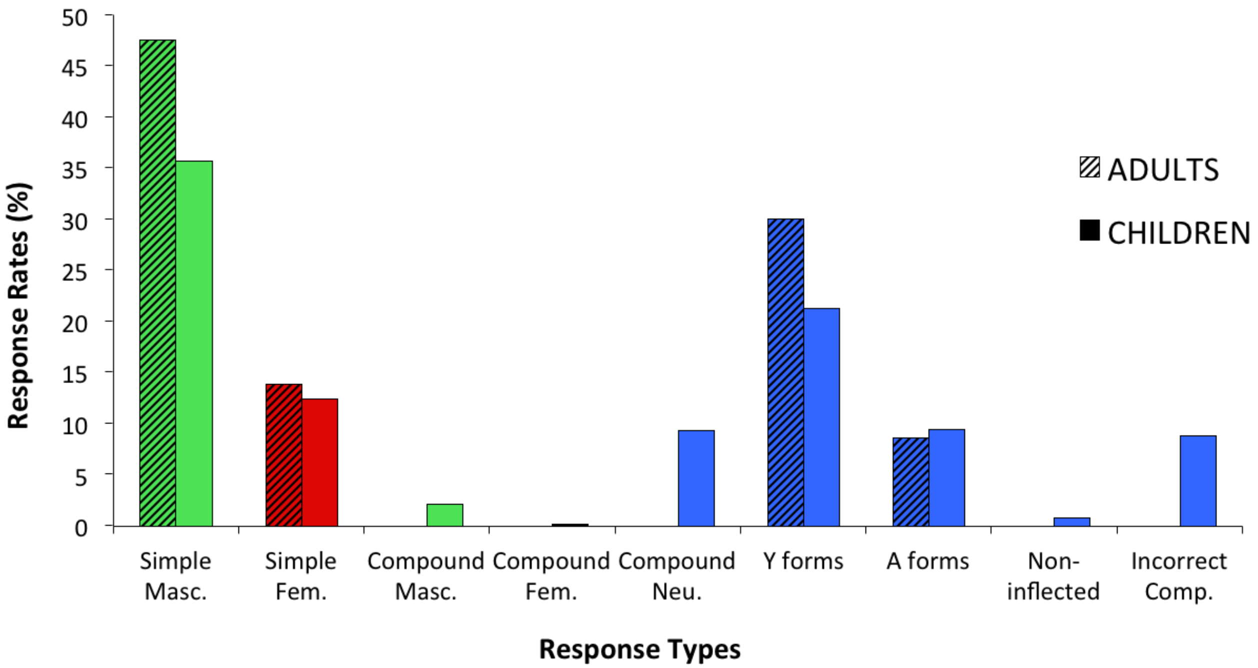


Figure 7.8. Percentages of responding accounted for by each preposition category (adult and child data separated)[10]

[10] Green bars indicate correct gender assignment, red bars indicate incorrect gender assignment, and blue bars indicate response types that did not apply gender assignment.

The –*a*-forms occurred less frequently, but appeared with both masculine and feminine pronouns (see section on feminine data, below) suggesting that they represented a neutral inflected category. Some –*i* forms also occurred in both the child and adult data, largely when participants produced feminine pronouns (this will be discussed further in a later section on agreement).

Neutral compounds occurred in the child data, but were absent from the adults' responses.[11] Children were also producing incorrect compound forms[12], while adults were not. Overall, the dominant choice in all groups was the appropriate ending, -*o*.

In terms of correctness, correct response types dominated both the child and adult data (see green bars, *Figure 7.8,* above). 77.5% of the adults' responses were accounted for by correct target –*o* forms (61.3%) or by alternative –*y* forms (38.7%), which seemed to also mark for masculine gender (at least for the adults) and so were also considered to be correct (they are shown in blue bars in *Figure 7.8*, above). The children's responses were more varied, but 68.47% of their responses were accounted for by correct responses. These responses were made up of target –*o* forms (52.15%), alternative –*y* forms (31.09%) and to a lesser extent masculine and neutral compounds (3.10% and 13.66% respectively). Viewed in this way, in terms of correct responses, the children performed slightly below the adults, and showed a wider variety of correct forms. Incorrect forms were primarily –*i* forms for the adults

[11] Post-testing, when queried, all adults stated that structures such as *uwchben o/hi*, and *wrth ymyl o/hi* (both of which fall into the neutral compound category) were acceptable forms, and were used by these adults more frequently. These are the kinds of forms that were produced by child participants.

[12] Some compound forms were considered to be incorrect at a prescriptive level, in that they were grammatically malformed, (see Category (9) in *Table 7.2* above), but may have been acceptable at a descriptive level in terms of their common use in spoken Welsh.

(13.89%) with some neutral –*a* forms (8.61%). The child data showed a wider variety of incorrect forms, most were errors of gender assignment (12.46% –*i* forms), use of neutral –*a* forms (9.47%) and malformed compounds (8.77%). A tiny proportion of errors were production of feminine compounds (0.03%) and uninflected forms (0.81%).

Figure 7.9 shows a breakdown of performance by age and home language group. All age and home language groups exhibited higher rates of correct responses than incorrect responses, and the general finding that –*o* forms were the most frequent response type held for all age and home language groups except for the 5-year-olds. The OWH 5-year-olds produced 61.39% of correct responses, (see green bars, all varieties). Two response types largely dominated these correct responses: target –*o* forms (34.85% of all correct responses) and neutral compound forms (38.91%). The WEH 5-year-olds' correct responses reached 74.4%, and included largely target –*o* forms (38.6% of all correct responses), and some neutral compounds (21.1%) and –*y* forms (23.9%). The OEH 5-year-olds exhibited 62.5% of correct responses overall, of these responses, the most prevalent were -*y* forms (64.4%) and 28% were target –*o* forms.

The OWH 7-year-olds produced 76.46% of correct responses, of these correct responses, 73.55% were target –*o* forms, 21.12% –*y* forms, and 5.45% were neutral compounds. The WEH 7-year-olds produced 58.34% correct responses, of these correct responses, 59.99% were target –*o* forms, 22.38% neutral compounds, and 17.62% were -*y* forms. The OEH 7-year-olds produced 55.32% correct responses overall, 51.90% of these were target –*o* forms, and 41.92% were –*y* forms.

The OWH 9-year-olds produced 86.73% of correct responses, of this number,

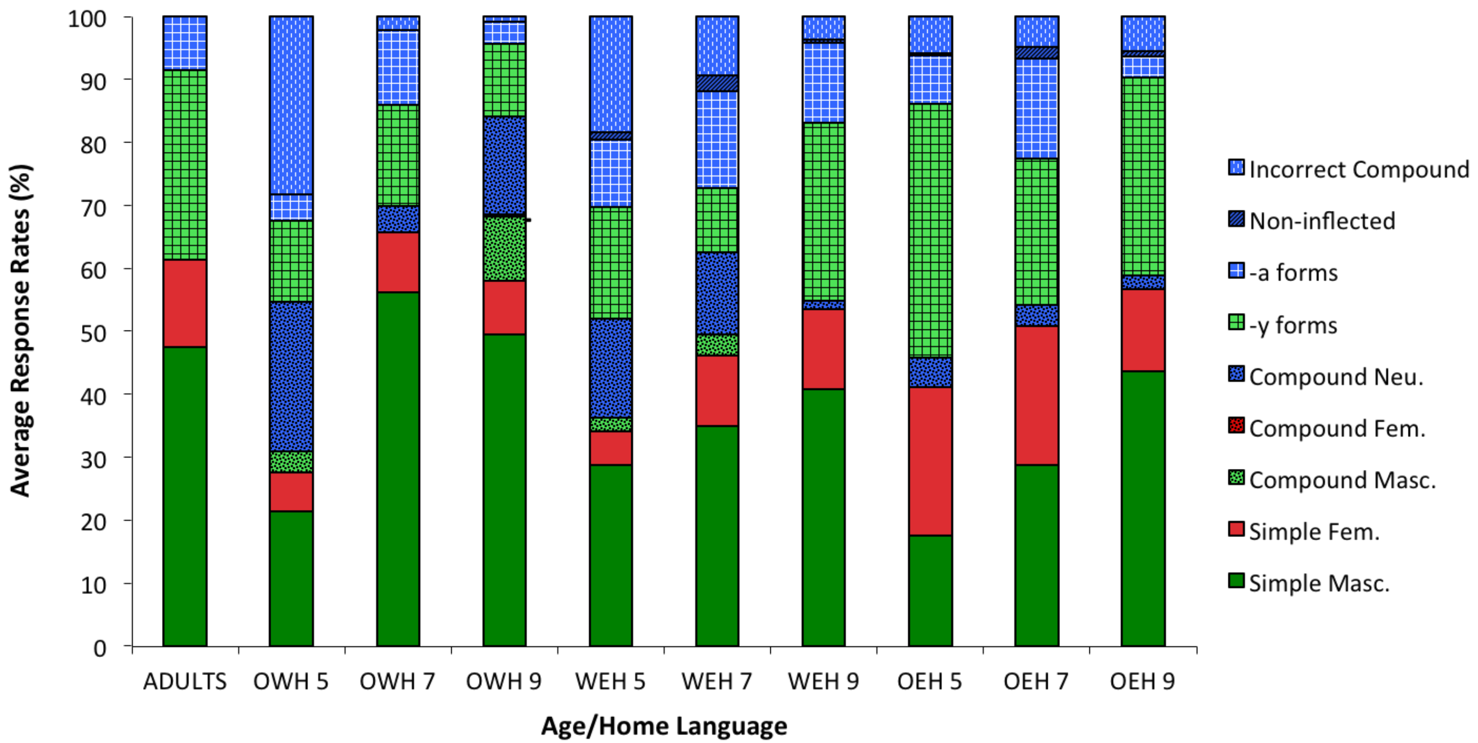


Figure 7.9. Percentage of forms of each type used at each age and home language.[13]

[13] Green bars indicate correct gender assignment, red bars indicate incorrect gender assignment, and blue bars indicate response types that did not apply gender assignment.

57.05% were target –*o* forms, 18.02% neutral compounds, 13.21% -*y* forms, and 11.71% masculine compounds. This was the only group that produced correct masculine compounds. The adult group produced only inflected forms as instructed by the experimenter. Children, however. deviated more from the forms they were instructed to use in practice trials, and opted for alternative, but often still correct, response types, such as the aforementioned masculine compounds.

The WEH 9-year-olds produced 70.40% correct responses. Of these correct responses, 57.83% were target –o forms, 40.20% -*y* forms, and 1.97% of responses were neutral compounds. The OEH 9-year-olds produced 77.22% correct responses, of these correct responses, 56.48% were target –*o* forms, 40.65% were –*y* forms, and 2.87% were neutral compounds.

Overall, the 9-year-olds' correct response patterns matched with those of the adults. For all language groups at this age, the largest proportion of responses was accounted for by target –*o* forms. The second largest proportion of responses for the adults and the WEH and OEH 9-year-olds were accounted for by –*y* forms. The OWH 9-year-olds however, produced high rates of compound forms. These compound forms included both neutral forms and masculine forms, and accounted for more responses than –*y* forms in this group.

The OEH 5-, 7- and 9-year-olds produced larger proportions of –y forms than their WEH and OWH counterparts overall. The higher proportion of –*y* forms might derive from an influence from English, resulting in the application of vowel reduction to the -*o*-final prepositions. The presence of this pattern across all age groups further suggests that an influence from English may be involved in this pattern of responding.

The data showed evidence of more use of neutral compounds in the OWH and WEH groups when compared to the OEH group. The reason for this difference is unclear, but seemed to reflect the fact that the OEH participants were more conservative in their preposition production, adhering more to the use of forms that they were instructed to use by the experimenter than their WEH and OWH counterparts. This more conservative use of the language may reflect the fact that it was only this language group that consisted of early L2 speakers of Welsh. The other language groups consisted of L1 speakers of Welsh. As L1 speakers they may be more confident in using forms that were not provided by the experimenter, while early L2 speakers may be more likely to "play it safe" and use forms they know the experimenter will accept.

Incorrect responses also varied across age and language groups. The 5-year-olds showed similar error rates, but showed varied patterns of errors across language groups. While both the OWH and WEH 5-year-olds' errors largely consisted of malformed compounds, (OWH 73.37% of all errors, WEH 51.54% of all errors); the OEH 5-year-olds errors were dominated by –*i* forms, (62.96% of all errors). These –*i* forms in the OEH group's responses often co-occurred with the feminine objective pronoun *hi* 'her'. This pronoun is homophonous to the nominative pronoun 'he' in English. This overlap in phonology may have been at the root of this difference in error patterns. This is supported by the fact that the OEH 7-year-olds also produced more –*i* form errors than their OWH and WEH counterparts, (OWH 23.44%, WEH 28.99%, OEH 54.51% of all errors). By age 9 differences in the rates of –*i* forms produced across language groups were minimal, (OWH 8.59%, WEH 12.75%, OEH

13.06% of all responses), suggesting that by this age, the homophonous English and Welsh pronouns are no longer an obstacle for successful gender assignment.

The 7-year-olds in all language groups produced similar rates of *–a* forms overall (OWH 11.75%, WEH 15.28%, OEH 15.83% of all responses), but this type of error accounted for more of the OWH group's errors than the WEH and OEH groups (-a form errors – OWH 50.13%, WEH 39.86%, OEH 31.87% of all errors). The OEH group's errors were characterised more by *–i* forms (as discussed above), while the WEH group's errors were largely made up of a combination of *–i* forms and malformed compound errors (53.61% of all errors when combined).

The 9-year-olds' errors were largely accounted for by *–i* forms (OWH 64.83%, WEH 43.07%, OEH 57.33% of all errors). These *–i* forms, though no more frequent in the OWH group, accounted for a larger proportion of errors in this group as the error rate for the OWH 9-year-olds was much lower overall (OWH 13.28% errors, WEH 29.6% errors, OEH 22.78% errors). The WEH and OEH groups' errors included *–a* forms and malformed compounds as well as *–i* forms, whereas errors other than *–i* forms were very scarce in the OWH group (4.69% of all responses).

Overall, the OWH group showed varied error patterns across age groups, while the 5-year-olds showed a high number of malformed compound errors, the 7- and 9-year-olds' errors include more *–i* and *-a* forms. The WEH group showed similar error patterns to the OWH group at age 5, and at age 7, but diverged at age 9, where more errors were contested, especially *–a* forms errors.

In relation to the adults' performance, the 9-year-olds exhibited equally high rates of correct responses, (adults, 77.5%, OWH 9s 86.73, WEH 9s 70.40%, OEH 9s 77.22%), with the OWH 9-year-olds even surpassing the adults due to high rates of target –*o* forms plus high rates of neutral compound forms (the latter of which were absent from the adult data). However, the types of responses made by the children were far more varied than those of the adults, though this may be a consequence of the task design, in that the adults took more care to adhere to the format outlined by the experimenter (i.e. inflected preposition + pronoun) while children produced alternative (non-inflected) preposition forms that were also grammatically acceptable.

Individuals' Dominant Response Patterns.

The above percentages do not reveal how individual children performed and whether those in a given subgroup performed in a similar fashion. In order to examine individual children's and adults' performance, overall dominant patterns were identified for each individual, according to the type of responding that was most frequent for that individual, and at least 10% greater in use than any other form. In those cases where two or more response types were equally frequent, both/all are counted as dominant patterns. *Figure 7.10* shows the number of individuals in each sub-group that showed a given pattern as their dominant pattern of responding.

The youngest children showed different patterns of correct responding across language groups. The OWH 5-year-olds largely had target -*o*-inflected forms and -*y*-inflected forms as their Dominant Response Patterns (DRPs), with a small number with the malformed compound DRP. Many of the WEH 5-year-olds also had target -*o*-inflected forms as they DRP, but also have DRPs for neutral compounds and incorrect (malformed) compounds. With the exception of the malformed compound

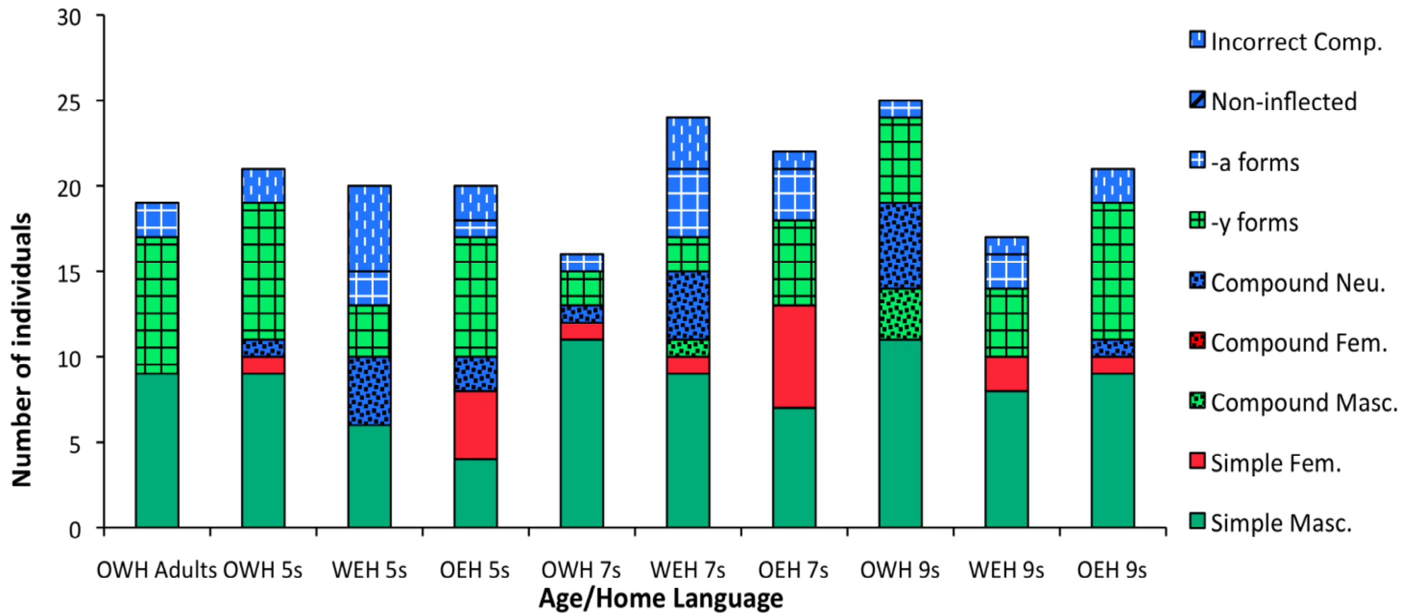


Figure 7.10. Number of individuals with each type of Dominant Response Pattern for Masculine Items: divided by Age and Language Group[14]

[14] Green bars indicate correct gender assignment, red bars indicate incorrect gender assignment, and blue bars indicate response types that did not apply gender assignment. Some children had more than one DRP, and so, for many columns, the total number of children/adults added up to more than 15 individuals per group.

category, all of the DRPs exhibited were acceptable prepositional forms in Welsh, though admittedly, not all of these forms were of the type targeted in the task paradigm. The OEH children showed a wider variety of DRPs. While the majority of children had –*y* forms as their dominant response, some had target –*o* forms and the same number of children had incorrect –*i* forms as their dominant response. The latter DRP assigns the incorrect gender, a pattern that was not observed in the WEH 5-year-olds and was observed in a single child in the OWH group. A number of OEH 5-year-olds also produced malformed compounds as their DRP. These Dominant Response Patterns reflected the proportion of each response reported in each of the language groups overall (see previous section).

At age 7, more children in the OWH group had target –o forms as their dominant response pattern. The WEH 7-year-olds also showed an increase in the number of individuals with -*o*-inflected forms as their DRP, but there were still a similar number of children with neutral compounds as their DRP (when compared to the 5-year-old WEH group). Neutral compounds are, however, correct preposition forms, though they lack gender assignment properties, leaving the gender assignment to the pronouns they are paired with. The OEH 7-year-olds had more individuals with -*o*-inflection as their DRP, but there were also more individuals with i-inflection as their DRP, thereby assigning the incorrect gender frequently.

At age nine, the OWH group had an even higher number of children with target *o*-inflection as their DRP. In addition, several children exhibited correct masculine compounds (e.g. *ar ei ben o* 'on his/its head', *wrth ei ymyl o* 'next (to) him/it') as their DRP. Such forms still marked for masculine gender, and so reflected the development of a more complex gender marking pattern, in that alternative valid methods of gender marking are being established.

The WEH 9-year-old group also had more children with *-o* and *-y*-inflection as their DRP (as opposed to at age 7), and there were fewer instances of neutral compound DRPs, suggesting a progression towards productive gender inflection. Only one OEH participant had *-i*-inflection at this age, suggesting that they were moving towards more consistent production of target masculine preposition forms, and reducing the amount of gender assignment errors they made.

Contrary to expectations, the dominant response patterns of the OWH 9-year-olds appeared to bear the least resemblance to the OWH adults, (when compared to the WEH and OEH 9-year-olds). This is because the OWH children produced more compound forms (both neutral compounds, and compounds that marked for masculine gender). Such forms were not the target forms elicited in the experiment, and so the adults refrained from producing them, adhering closely to the instructions of the experimenter.

However, post-testing, many adult participants commented that such compound forms would have felt more 'natural' to them than the target o-inflected prepositions. This suggests that the OWH 9-year-olds were reflecting what they are exposed to in the input (i.e. compound prepositions – both neutral and gendered). These forms did not appear in the OWH adult data, due to the way in which the adults had chosen to interpret the task instructions (i.e. by only producing forms specified by the experimenter and suppressing any other potentially valid response types).

Overall, the number of children in each sub-group with a given DRP mapped well onto the overall proportion of responding that was observed in each sub-group overall. In all child sub-groups correct responses predominated, though these correct responses were not always of the target type to be elicited. Correct forms often included a large proportion of neutral compounds, (which were correct grammatically, but lacked gender marking).

7.4.4.2 Feminine: overall patterns of responding.

The overall choices of form were as shown in *Figure 7.11.* Responses of adults and children are displayed separately. The adults showed a clear, and strong dominant choice of target -*i*-inflected prepositions, at 66% use. The remaining 34% of responses were accounted for by incorrect –*o* and –*y* forms, and by some neutral –*a* forms. These responses seem to reflect cases in which the adults produced masculine preposition forms along with masculine pronouns (see page 226 for an analysis of agreement patterns). The adults did not produce –*y* forms paired with feminine pronouns, suggesting that these forms were alternative pronunciations of masculine –*o* forms. In terms of correctness, the adults produced far more correct forms than incorrect forms overall (66% correct vs. 33% incorrect).

The children's responses were, however, very mixed in comparison to those of the adults. Target -*i*-inflected forms only accounted for 18% of children's responses overall, while -*o*-inflected forms accounted for 29%, -*y* forms for 20%, and –*a* forms for 11% of all responses. If one considers the –*y* forms to be phonological variants of –*o* forms; masculine inflected forms account for 49% of all children's

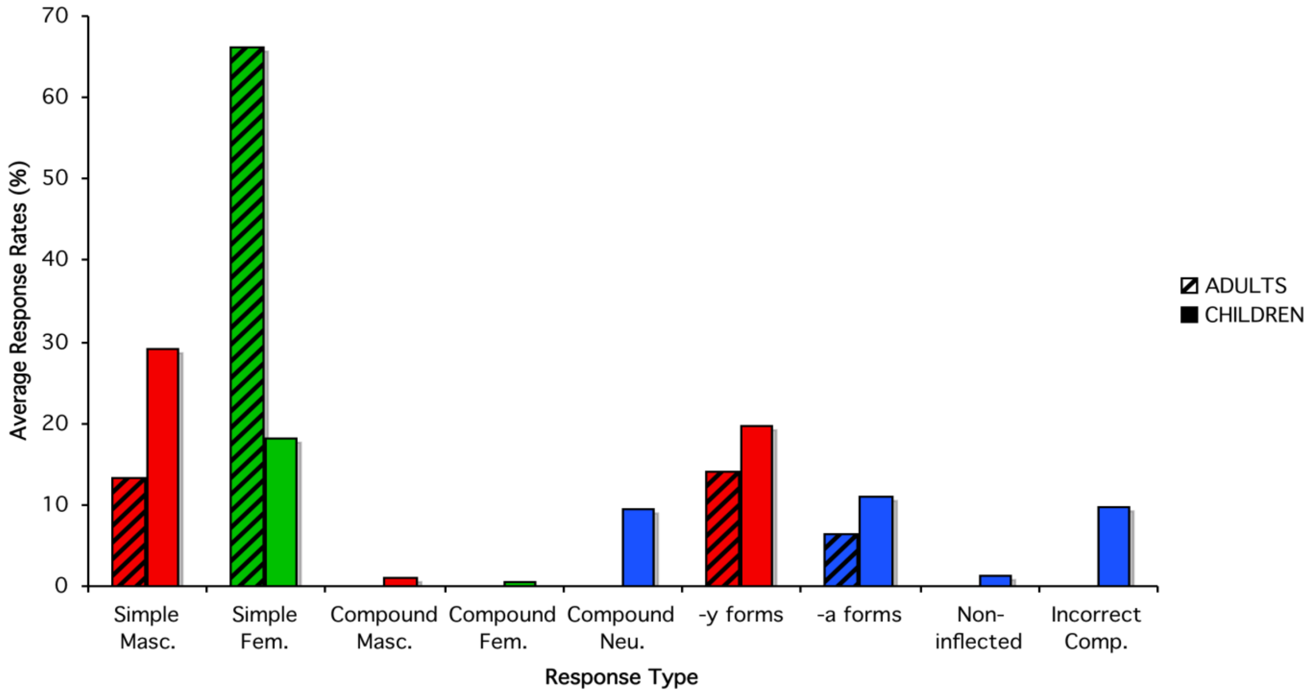


Figure 7.11. Percentages of responses for feminine items accounted for by each preposition category (adult and child data separated).[15]

[15] Green bars indicate correct gender assignment, red bars indicate incorrect gender assignment and blue bars indicate cases when gender assignment was not applied

responses. This is consistent with children's pronoun production, as will be shown below, in that rates of production of the masculine pronoun *fo*, were much higher on average than the feminine pronoun *hi* (61% *fo* vs. 39% *hi)*.

Overall, incorrect responses predominated over correct responses (60.78% incorrect vs. 39.22% correct overall), and this seems largely due to a predominance of masculine inflected forms. When children's responses are divided by age and home language group, various patterns of responding emerge, (see *Figure 7.12*, below).

Overall, the 5-year-olds showed mixed response patterns. The OWH group's correct responses included target –*i* forms (33.01% of all correct responses) and neutral compounds (66.21% of all correct responses). Incorrect responses largely consisted of malformed compounds (47% of all errors) and a combination of –*o* (28.63%) and –*y* forms (14.48%).

The WEH group showed similar response patterns. Correct responses accounted for 25.18% of all responses. 63.54% of correct responses were neutral compounds, while the remaining 36.46% were target –*i* forms. Incorrect responses (74.82% of all responses) consisted of a combination of –*o* forms (36.47% of all errors), –*y* forms (20.32%), malformed compounds (29.94%) and a small number of –a forms (12.62% of all errors).

The OEH group's correct responses accounted for 28.06% of all responses. The vast majority of correct responses were target –*i* forms (83.17%) and the remainder were neutral compounds (16.83%). Unlike the OWH and WEH groups, errors consisted of very high rates of –y-inflected forms (55.21% of all errors) and

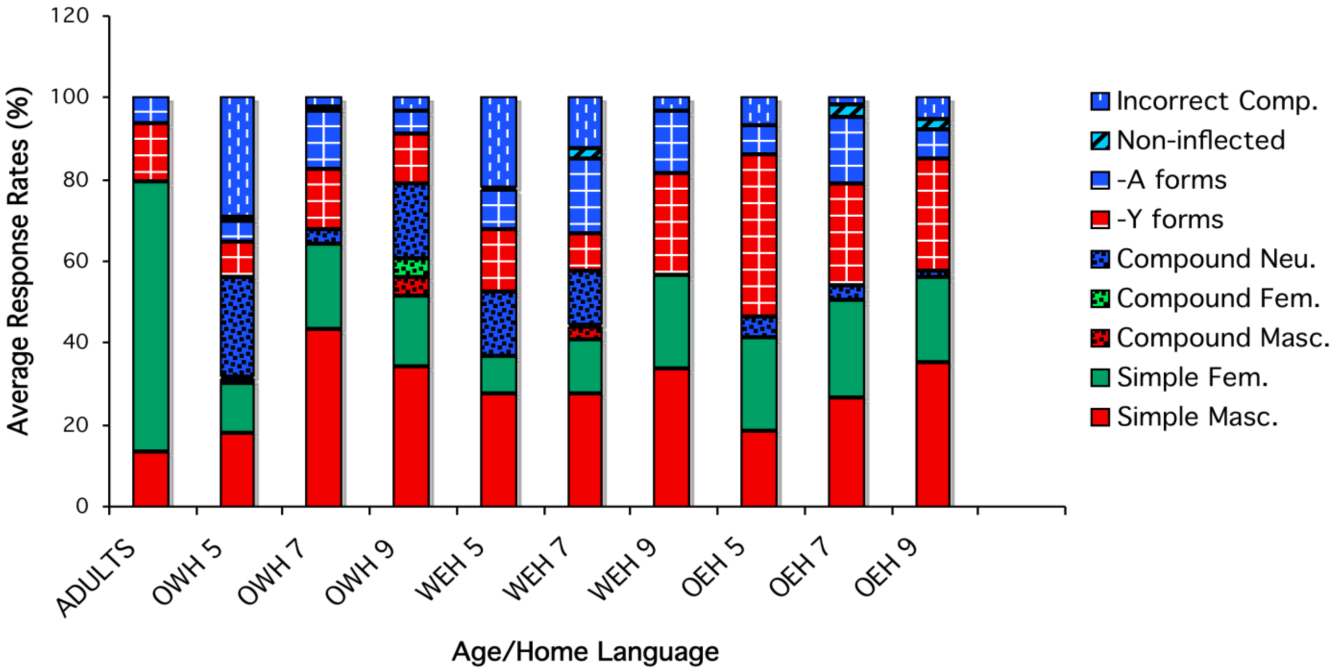


Figure 7.12. Percentages of forms of each type produced in response to feminine items at each age and home language[16]

[16] Green bars indicate correct gender assignment, red bars indicate incorrect gender assignment and blue bars indicate cases when gender assignment was not applied

some –*o*-inflected forms (25.10% of all errors). The small remainder were accounted for by –a forms (10.04%) and malformed compounds (9.65%).

The stronger predominance of inflected –*y* and –*o* forms in the OEH group and their low use of compound forms may have been due a more conservative response strategy, whereby they tended to interpret the instructions much in the same way as the adults, adhering to inflected forms and refraining from producing alternative forms (e.g. compounds).

The 7-year olds showed slightly different response patterns. The OWH 7-year-olds' responses involved fewer compound prepositions in general. Their correct responses accounted for 24.3% of all responses. Their correct responses almost totally comprised of –*i* forms (85.02% of all correct responses) and a small number of neutral compounds (14.98%). Errors were dominated by –*o* forms (57.01% of all errors), and an approximately equal proportion of –*y* forms (19.82%), and –a forms (18.41%). A very small number of malformed compound errors (1.84%), and masculine compound (2.93%) errors were also present.

The WEH 7-year-olds correct responses (26.95% of all responses) consisted of approximately equal proportions of –*i* forms and neutral compounds (49.46% and 48.46% of all correct responses respectively), mirroring the responses of the WEH 5-year-olds. Their incorrect responses were dominated by –*o* forms (37.26% of all errors), and some –*a* forms (25.48% of all errors), and malformed compounds (17.49%).

The OEH 7-year-olds exhibited similar patterns to their 5-year-old counterparts. 27.42% of all responses were correct. 86.83% of all correct responses were target –*i* forms, the remainder were neutral compounds (13.17%). Errors were predominated by –*o* forms (36.54% of all errors) and –*y* forms (34.31%) and smaller number of –*a* forms (22.66%).

At age nine, the OWH participants' correct responses reached 40.55%. 43.16% of correct responses were target –*i* forms, and 45.89% of correct responses were neutral compounds. A small proportion of feminine compounds were also produced (10.95%). Errors accounted for 59.45% of all responses. Of these errors, 57.51% were –*o* forms, and 20.56% were –*y* forms. The remainder of errors were more or less equally made up of –*a* forms, malformed compounds and masculine compounds. Notably, both feminine and masculine pronouns are produced by this group, (albeit in small numbers). These forms did not appear in the WEH and OEH groups.

The WEH 9-year-olds' responses were 23.05% correct and 76.95% errors. Their correct responses were almost entirely represented by –*i* forms (98.79%). Errors are dominated by –*o* forms (43.44%) and by masculine compounds (32.27%). Some –*a* forms were also produced, (19.95%) and a small number of malformed compounds (4.33%). Unlike, the 5- and 7-year-olds from this language group, the WEH 9-year-olds seemed to have progressed to a phase in which they were producing gendered preposition forms more productively, and produced less compound forms.

Finally, the OEH 9-year-olds showed a pattern of responding similar to the OEH 7-year-olds. Correct responses (22.68% of all responses) were almost entirely –*i* forms (92.54%). The remainder were neutral compounds. Errors were predominantly –*o* forms (45.21%), and –y forms (35.56%). A smaller proportion of –*a* forms were also produced (9.04%).

When compared to the adults, all of the child sub-groups showed a much greater tendency to produce masculine inflected prepositions. These patterns of responding tied in with their tendency to produce more masculine pronouns, as mentioned above. Moreover, these children also generalised both –*o* and –*y* inflections when producing feminine pronouns. This behaviour was consistent with their overextension of masculine pronouns when referring to feminine noun referents.

Individuals' Dominant Response Patterns.

In order to examine individual children and adults' performance, overall dominant patterns were identified for each individual. *Figure 7.13* shows the number of individuals in each sub-group that showed a given dominant response pattern (DRP). 14 out of the 15 adults' dominant response pattern was producing target feminine -*i*-inflected prepositions. The one remaining adult's DRP was producing incorrect masculine –*o* forms. The children, however, showed an overall tendency to favour masculine –*o* forms (this was the most frequent DRP in all child sub-groups with the exception of the OEH 5-year-olds who had more children with –*y* forms as their DRP). The second most frequent DRP overall was –*y* forms. This favouring of masculine inflected –*o* and –*y* forms as children's dominant response patterns seemed to be linked to a greater tendency to produce masculine pronouns more frequently than feminine pronouns overall.

examines the occurrence of the distinct forms across the three target prepositions, *ar*, *dan*, and *wrth*.

7.4.4.3 Masculine.

The overall choices of form by preposition type were as shown in *Figure 7.14* (below); responses of adults and children are displayed in separate columns. The percentage of responses for each of the preposition categories in response to masculine noun referents is shown. Data are divided by locative preposition type.

The adult and child data varied considerably across preposition types. The adults generally produced equivalent levels of both –*o*, and –*y* prepositions across the three types, and produced similarly low rates of –i forms across all three types. However, -*a* forms were more common for the *ar* prepositions, than for the other two types (18% *ar* vs. 4% *wrth* and 7% *dan*). This suggests a possible vowel harmony process, by which the final vowel of the *ar* preposition is changed to match the initial vowel. This same prevalence of –a forms in the *ar* category was also evident in the child data (19% *ar*, 6% *dan*, 3% *wrth*).

Overall, the children showed a great deal of variation across locative preposition types, with their response patterns differing significantly from the adults. The children showed higher rates of production of *dano* as opposed to *wrtho* and *arno*. The reason for the higher rates of inflected *dan* forms was probably due to the fact that there is not an alternative neutral compound form for *dan*, nor are there gendered compound forms. However, for *wrth* and *ar* there are common neutral and gendered compound forms that are both grammatically acceptable and widely used in spoken Welsh (i.e. *wrth ymyl o/hi* ‘next to him(it/her(it)’*, wrth ochr*

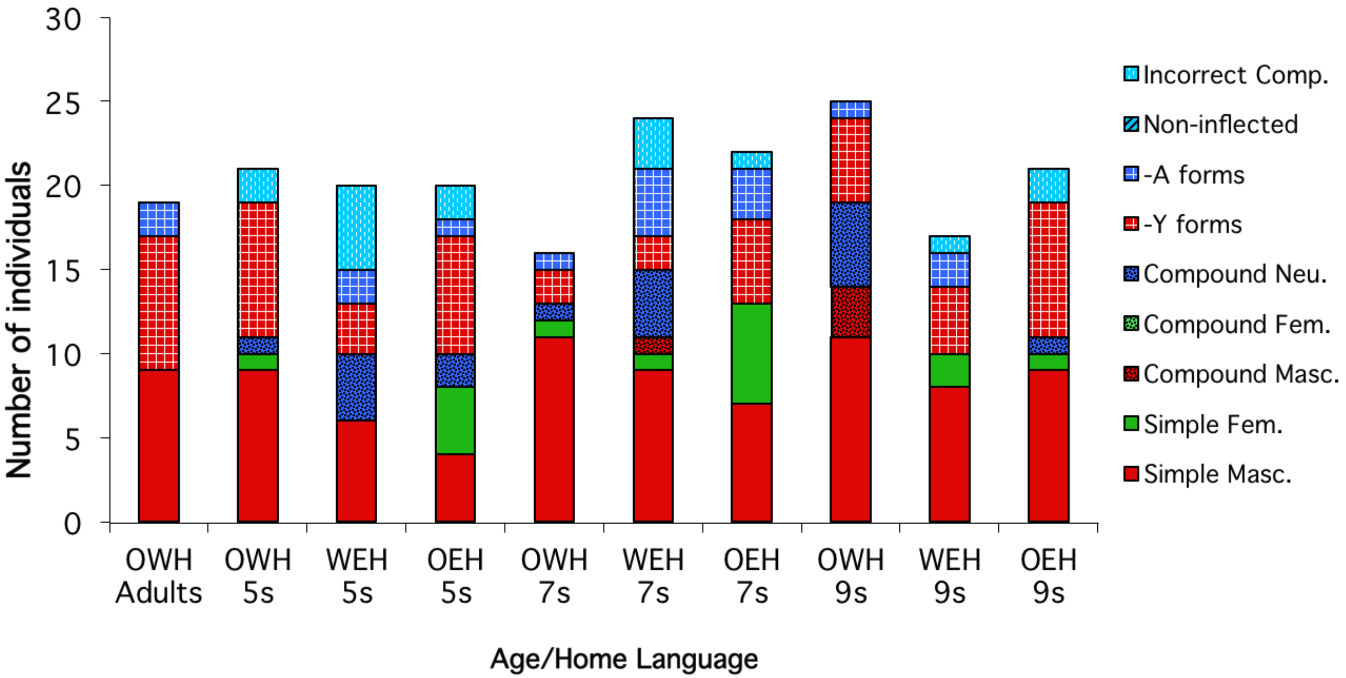


Figure 7.13. Number of Individuals with each type of DRP for feminine items: Divided by Age and Home Language Group.[17]

[17] N.B. Green bars indicate correct gender assignment, red bars indicate incorrect gender assignment and blue bars indicate cases when gender assignment was not applied

o/hi ‘next to him(it/her(it)’*, wrth ei ymyl o* ‘next to his(its)/her(its) side’*, wrth ei hymyl hi* ‘next to his(its)/her(its) side’*, ar ben o/hi* ‘on top (of) him(it)/her(it(‘*, ar ei ben o* ‘on his/its head’*, ar ei phen hi* ‘on her/its head’).

There was no evidence of compound forms for *dan* in the child data (0%), but for *wrth* ‘next (to)’ 21% of child responses were neutral compound forms. For *ar* ‘on’, only 5% of responses were neutral compound forms. However, a further 17% of responses were malformed neutral compounds, such as *ar ben y fo /hi* ‘on top of him(it)/her(it)’, which may be considered to be neutral compounds also.

These malformed compounds are so named as they have an additional element – y (e.g. *ar beny* as opposed to *ar ben*). This additional element may be interpreted in one of two ways. It could be that the definite article *y*, had been added to these constructions – leading to a construction that loosely translates as “on top of the him”, which seems somewhat awkward and malformed, but plausible. The second possibility is that this added –*y* form may have been an overextension of the -*y* inflection to forms that did not require inflection (i.e. *ar ben* --> *ar beny*). The adult and child data also differed in that adults did not produce any preposition forms that were either uninflected (*ar, dan, wrth*) or were compounds (*ar ben* ‘on top’*, wrth ymyl* ‘next (to)’*, o dan* ‘under’), while children did so for all three locative prepositions, (although much less so for *dan* ‘under’*)*.

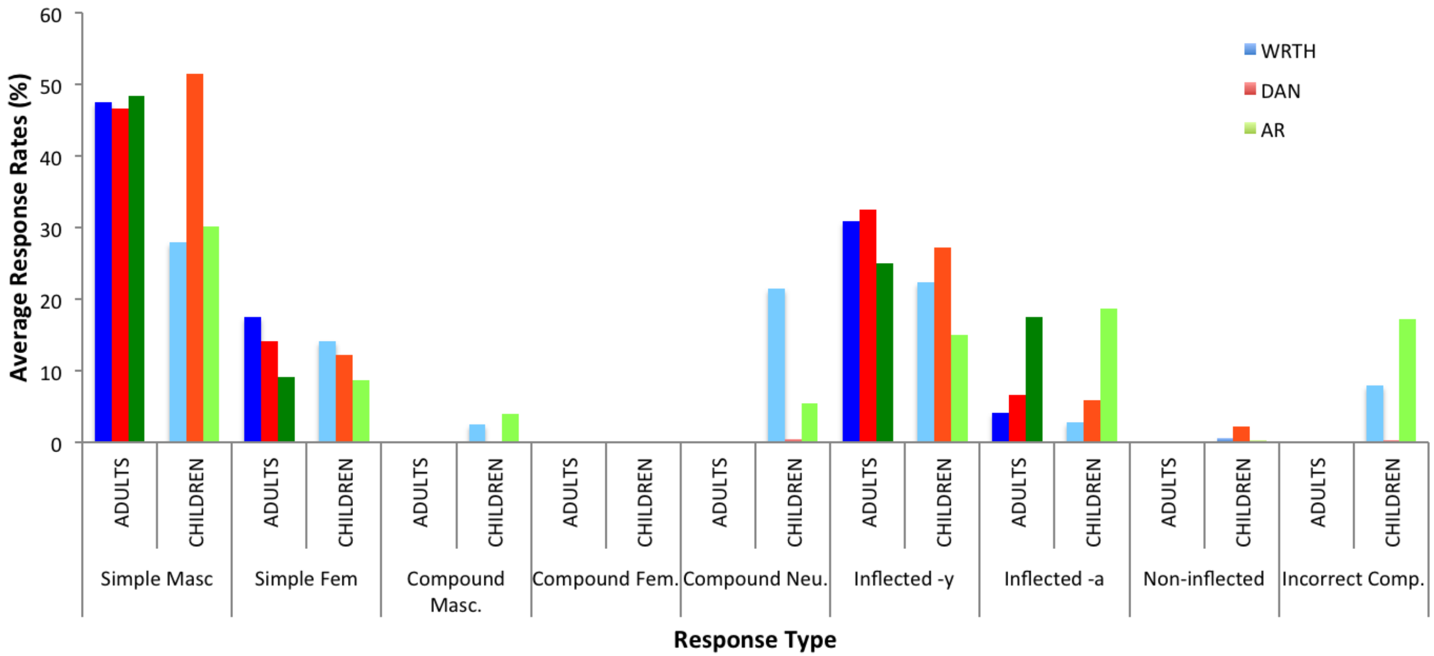


Figure 7.14. Rates of prepositions forms across preposition types in response to masculine noun referents: child and adult data separated.

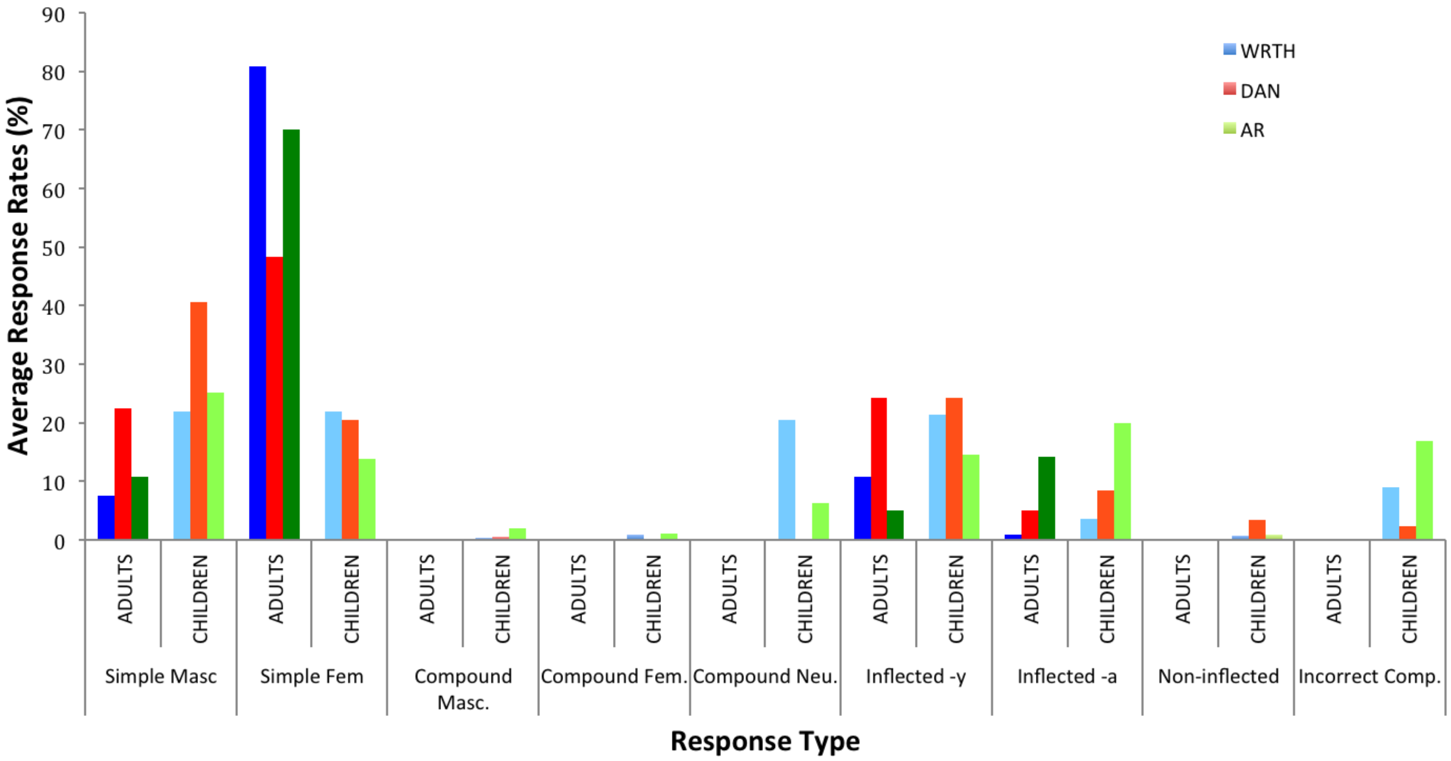


Figure 7.15. Rates of preposition forms across preposition types in response to feminine noun referents: child and adult data separated.

7.4.4.4 Feminine.

The overall choices of form for feminine items were as shown in *Figure 7.15* (above). Responses of adults and children are displayed in separate columns. The percentage of responses for each of the preposition categories in response to feminine noun referents is shown. Data are divided by locative preposition type.

The adult and child data varied considerably across preposition types. Adults' production of target feminine inflected prepositions (i.e. *arni* 'on her/it'*, dani* 'under her/it'*, wrthi* 'next (to) her/it') was much higher than children's on average, with higher rates of production of *wrthi* 'on her/it' *(81%)* and *arni* 'on her/it' (70%) when compared to *dani* 'under her/it' (48%). Higher rates of –*o* and –*y* forms were observed for *dan* 'under'. Occurrence of –*a* forms was significantly higher for *ar* (20%), than for *dan* (0%) or *wrth* (5%). This latter pattern was consistent with the pattern of responding observed in the adults' responses to masculine nouns.

The child data revealed similar rates of occurrence of –*i* forms for all three prepositions types – *wrth* 'next (to)' (22%), *dan* 'under' (21%), *ar* 'on' (14%). The occurrence of –*o* forms, as in the adult data, was more frequent for *dan* 'under' (41%) than for *wrth* 'next (to)' (22%) and *ar* (25%). As with the children's responses to masculine nouns, the lower rates of –*o* forms for *wrth* 'next (to)' and *ar* 'on' seemed to be mediated by the higher rates of neutral compounds for *wrth* (20%) and by higher rates for –*a* forms for *ar* 'on' (20%).

Of note is that the child data looked similar across gender categories. In response to both masculine and feminine noun referents, children produced more masculine inflected forms than feminine inflected forms, and showed similar

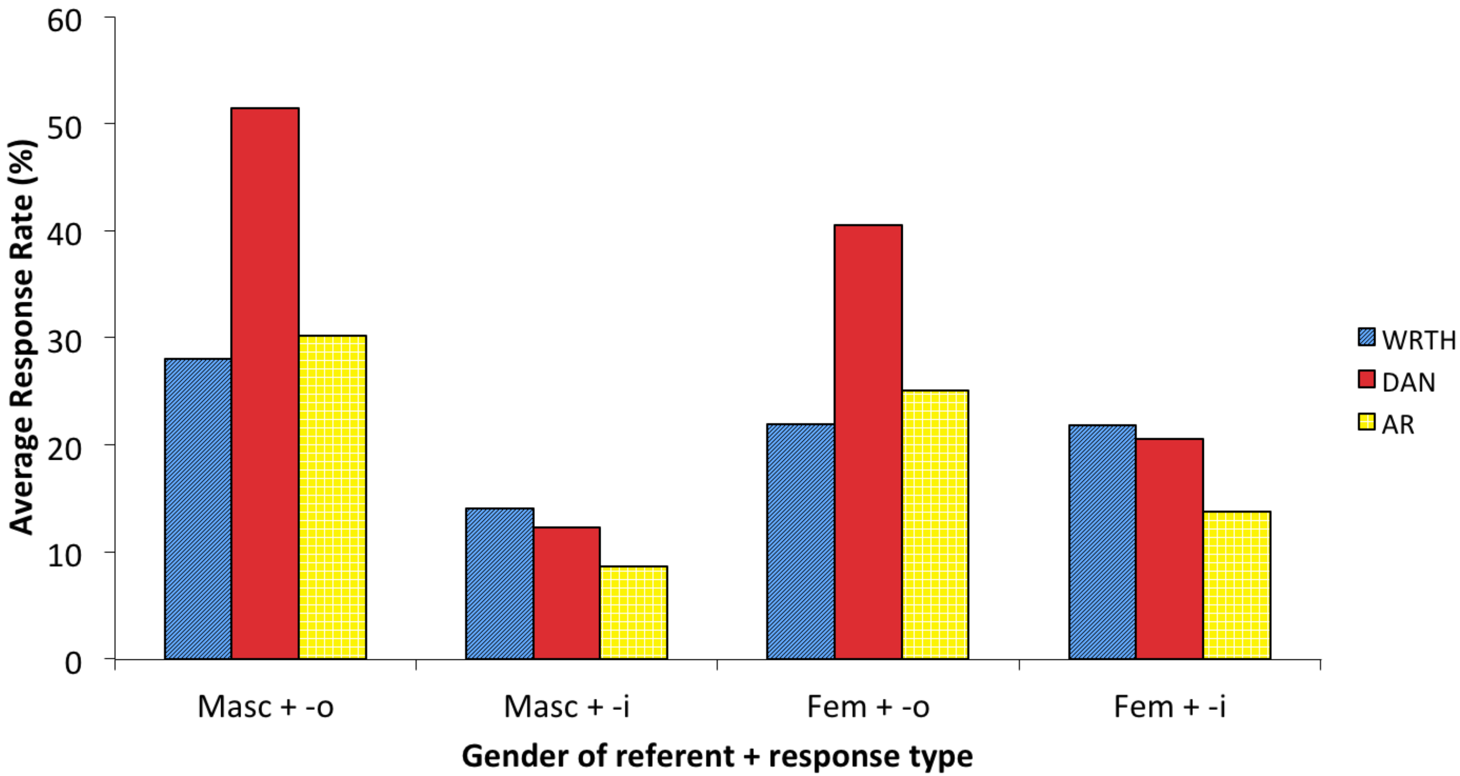


Figure 7.16. Similar patterns of responding across preposition types for both gender categories by child participants.

patterns of variation across prepositions types for both gender categories, as illustrated in *Figure 7.16*, (below). This contrasted with the data from the adults. In the masculine noun category, significantly higher rates of target –*o* forms were observed for all three locative preposition types when compared to feminine –*i* forms, whilst for the feminine noun category the reverse was true (see *Figure 7.17*, below).

AGREEMENT OF PREPOSITION AND PRONOUN

The final set of analyses explored the extent to which participants exhibited agreement between preposition and pronoun forms. Data were divided by gender category and presented in two sets.

Response Types.

For this analysis, the data were coded differently. Overall, the coding system consisted of ten response types. For some of these types preposition and pronoun agreement could be assessed, for other types agreement could not be assessed, either due to a lack of preposition/pronoun or due to the lack of a gender marker on the preposition, (see *Table 7.3,* below). Subsequent discussion of the data discusses only those responses in which agreement could be observed or not (i.e. categories 1-4, (as outlined in *Table 7.2,* above).

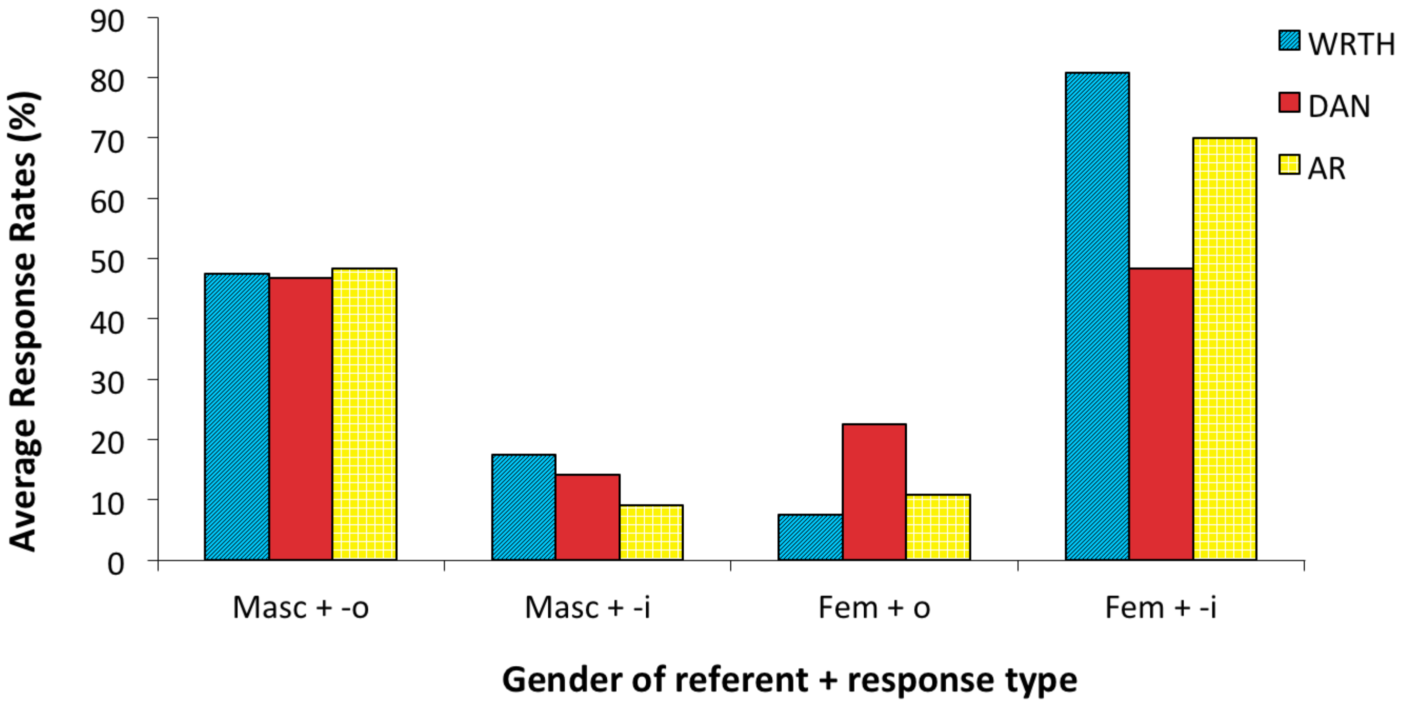


Figure 7.17. Differential patterns of responding across gender categories by adult participants reflecting knowledge of the gender system.

7.4.4.5. Masculine.

Agreement Patterns.

When the data are examined by sub-group, it was possible to observe that overall, the OWH and WEH participants from all age groups largely produced preposition-pronoun structures in which both elements were marked for the same gender (e.g. *arno fo* 'on him/it' and *arni hi* 'on her/it').

Table 7.3

Details of the coding system used to classify participants' responses

Coded Value	**Abbreviation**	**Description**
1	AGR CORR	Gender agreement of target forms
2	AGR INCORR	Gender agreement of incorrect forms
3	NO AGR PPC	No agreement – correct preposition
4	NO AGR PROC	No agreement – correct pronoun
5	-y with fo[18]	Final –y + masculine pronoun (Correct)
6	-y with hi	Final –y + feminine pronoun (Incorrect)
7	-a	Preposition with final –a + pronoun
8	NO PP	+ Pronoun -Preposition
9	NO PRO	-Pronoun +Preposition
10	NR	No Response

arni hi). Moreover, when the forms agreed, these forms were almost always appropriate in terms of the gender they marked (i.e. *–o + fo* structures in reference to masculine nouns), as shown by the blue bars (see *Figure 7.18*, below). However,

[18] N.B As –y seems to be a variant form of –o, -y is considered to be a masculine inflection

the OEH group, while largely producing preposition-pronoun structures that exhibited agreement, often marked for the wrong gender (i.e. *–i + hi* structures in reference to masculine nouns), as shown by the red bars.

Error Patterns.

The adults produced a miniscule proportion of agreement errors. Agreement violation was more evident in the child data, however. When broken down by language group and by age group, (see *Figure 7.18*, above) similar rates and patterns of errors were observed.

7.4.4.6 Feminine.

Response Types.

The same coding procedures and analyses applied to the data for the feminine items. Responses in which agreement patterns could be observed (responses types 1-4 as outlined above) were included. Overall agreement patterns and error patterns for each age/language group are shown in *Figure 7.19* (above).

Agreement Patterns.

As with their responses to masculine items; overall, participants from all age and language groups showed a greater tendency to produce preposition-pronoun structures that exhibited gender agreement rather than ones that did not. The occurrence of masculine preposition-pronoun pairs (e.g. *arno fo* 'on him/it') was more frequent than that of feminine form pairings (e.g. *arni hi* 'on her/it') in all of the child age and language groups. The adults, however, produced very high rates of

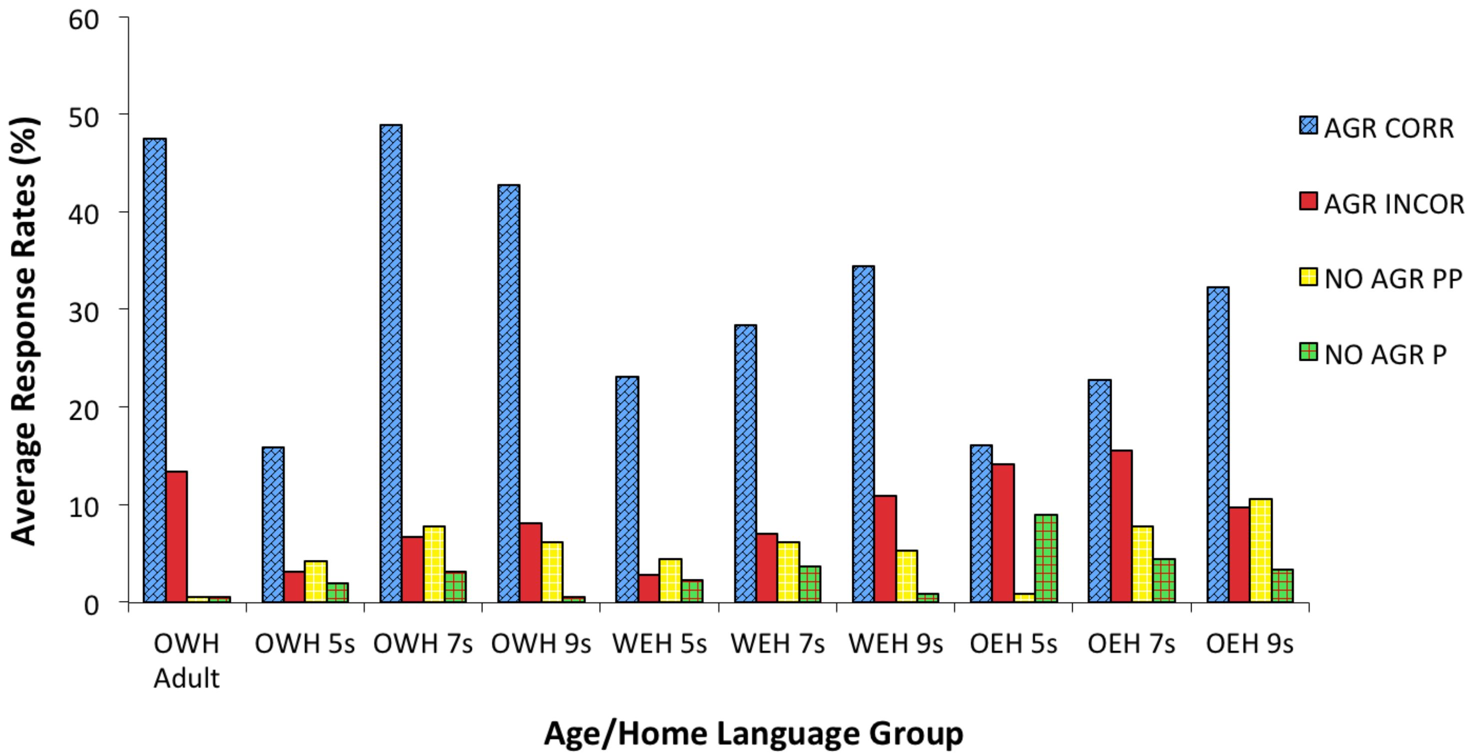


Figure 7.18. Rates of agreement in participants' responses to <u>masculine</u> nouns: Data split by age/home language group.

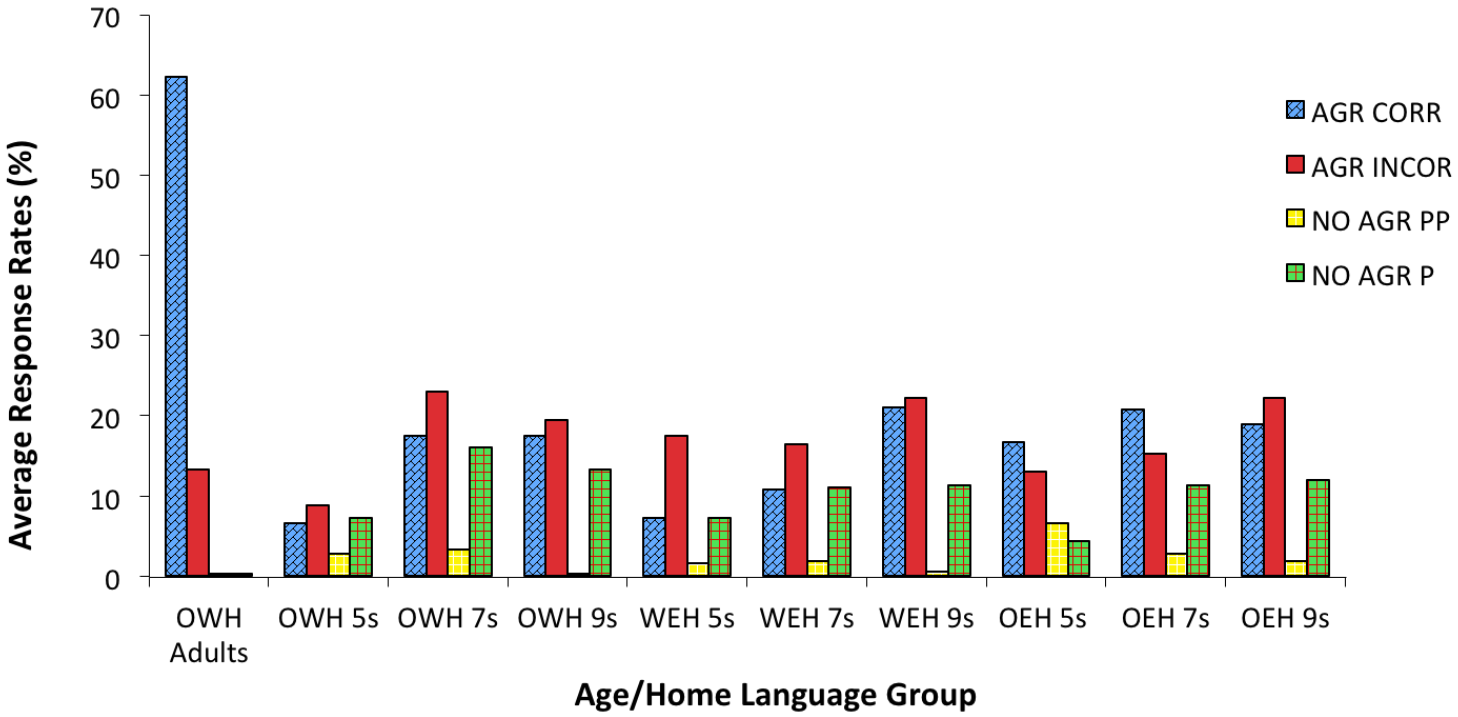


Figure 7.19. Rates of agreement in participants' responses to feminine nouns: Data split by age/home language group.

feminine preposition pronoun-pairs (82% accuracy for feminine trials on average).

Error Patterns.

Rates of mismatched preposition-pronoun pairs (eg. *arni fo* ‘on her + masculine pronoun’ or *arno hi* ‘on him/it + feminine pronoun’) in the child groups were higher when compared to their responses to masculine items (19.59% feminine items vs. 9.11% masculine items), and these errors were largely those in which they produced a masculine –*o* or –*y*-inflected prepositions with a feminine pronoun (18.15%). When the child data were viewed across language groups, and across age group similar patterns of errors were observed. The adults did not produce mismatched preposition-pronoun pairs at any point. This seems to suggest that even at age 9, these children still haven’t entirely established the link between gendered preposition forms and corresponding pronouns, resulting in the production of some mismatched structures.

7.4.5 Results Summary: Pronouns.

7.4.5.1 Observations.

Masculine as the default?

Children tended to produce masculine pronouns significantly more often than feminine pronouns (61% masculine vs. 39% feminine). The same pattern was observed in the adults, only to a lesser extent (56% masculine vs. 44% feminine). In this way, the children’s pronoun production did seem to approximate that of the adults, except that they had a stronger tendency for producing masculine pronouns, even in reference to feminine noun referents.

This bias for masculine forms could have derived from a number of factors. Firstly, masculine nouns are more prevalent in the Welsh language in general than feminine nouns (Surridge, 1989). In addition, though the bias observed was a small one, based on these data it seems that adults did produce masculine pronoun forms more frequently than feminine pronouns when referring to nouns in general, and so it is probable that children would do the same, based on the adult input. Moreover, though feminine nouns may be marked overtly as feminine, due to the nature of SM not all feminine nouns may take this overt feature, and so it may be that a lack of consistency in the marking of feminine nouns leads to a lack of consistency of use of feminine pronouns in reference to these nouns.

The role of noun semantics.

The animacy of nouns was an important factor in determining which pronouns both children and adults produced. For human nouns referents children produced both masculine and feminine pronouns with high levels of accuracy (94% masculine and 90% feminine) and adults were at ceiling for all human nouns. Adults maintained high levels of accuracy for animal noun referents (84%) and exhibited similar performance rates for masculine animal nouns (89%) and feminine animal nouns (80%), though these performance rates were lower than for human noun referents.

The children on the other hand, showed comparably much lower performance rates for animal nouns on average (63%) and they displayed distinct performance rates across gender categories (75% masculine vs. 52% feminine). These results serve to illustrate that though children are aware of and produce both masculine and feminine pronouns, for these children, their use of the feminine pronoun form seems to be tightly linked to noun semantics, in that they are only performing consistently well when referring to human nouns that possess clear feminine (or masculine) natural gender.

Both children and adults, however, exhibited markedly lower performance rates for inanimate items, (adults – 64%, children 50%) and for both groups, a tendency to produce masculine pronouns more frequently was evident (adults – 64% masculine vs. 36% feminine; children – 70% masculine vs. 30% feminine) resulting in lower performance rates for feminine inanimate nouns (adults 54.44%, children 31%) than masculine inanimate nouns (adults 74%, children - 70%).

The lower performance rates in response to inanimate nouns, exhibited by both adults and children alike, suggest that the animal nouns in this experiment possess some sort of semantic properties that make adults and children more likely to refer to animals (as opposed to inanimate objects) with both masculine and feminine pronouns. It may be simply that some of the animal nouns are domestic animals (e.g. cat, dog, rabbit) and so they are likely to be referred to as either masculine or feminine based on the gender of the pet(s) they have, or had Or simply that they have the understanding that animals can be biologically male or female.

The role of grammatical cues.

When differing numbers of syntactic cues indicating the gender of nouns were available, there appeared to be effects of cue condition present in both the OWH dataset and the data from the children from all three home language groups. Across multiple cross-sections of data, performance in the 0-cue condition, where no indication of the gender of the nouns being referred to were given, resulted in significantly lower performance rates than when one or two syntactic cues were offered by the experimenter.

Importantly, the cues presented in this task were indicative of the gender of the target noun, as cues were presented on the nouns (and sometimes corresponding adjectives) that participants were referring to with the preposition + pronoun structures. However, in the *Noun and Adjective Elicitation Task*, cues in prompt phases appeared on different nouns and adjectives from the targets (i.e. the indicated the gender of the prompt nouns but could give no clue as to the target form required for target nouns and adjetives.

In this way, cues presented in this task paradigm were more informative, and in turn appeared to be utilised more successfully by participants.

The role of the experimenter.

When participants did not have semantic gender information available to them, they showed a tendency to be influenced by the pronoun forms uttered by the experimenter in prompt phases of trials. This was especially true of trials where target nouns were inanimate objects. Essentially, when an experimenter referred to an inanimate object with a given pronoun (be it masculine or feminine), both children and adults tended to produce that same pronoun form in reference to an entirely different noun.

7.4.5.2 Main Findings.

The analyses of the adult and child data resulted in the discovery of SIX main findings:

1) Both children and adults tended to produce masculine pronouns more frequently than feminine pronouns
2) Both children and adults were significantly more accurate in their pronoun production when natural gender information was available
3) The extent to which the above points applied to children and adults varied in their degree – children had a stronger tendency to produce masculine pronouns more, and were more affected by the presence and/or absence of natural gender information than adults
4) Grammatical cues such as gendered noun endings,did not seem to have an influence on patterns of responding
5) The presence/absence of mutation on target nouns and adjectives appeared to affect the degree of success with which children and adults produced target pronouns – when one or more cues were present, performance improved
6) There seemed to be global differences across language groups, in that those children with the least exposure to Welsh had lower performance rates overall, but differences in the patterns of responding across items in the task were not evident across language groups
7) When unsure of which pronouns to produce, (especially in reference to inanimate objects), children and adults alike were influenced by the

experimenter's pronoun production in prompt phases. This effect occurred for both masculine and feminine pronoun forms.

7.4.6 Results Summary: Prepositions.

7.4.6.1 Observations.

Dominant response patterns.

The Dominant Response Patterns observed varied considerably across age and language groups. The 5-year-olds' responses were dominated by neutral compound forms (e.g. *ar ben, wrth ymyl*, etc) in the case of the OWH and WEH children, and by prepositions with alterative endings (-y or –a) in the case of the OEH 5-year-olds. The –*y* inflected forms are taken to be masculine forms that were subjected to vowel reduction, (but this may only really apply to the adults). Older children and adults showed a greater tendency to produce target inflected prepositions. In the OEH 7- and 9-year-olds, -*y*-inflected forms were especially common These inflections most frequently co-occurred with masculine pronouns, and this was the case in reference to both masculine and feminine nouns. Feminine inflected prepositions were very rare in the children's responses across all age and language groups. The adults, however, produced a large proportion of target feminine inflected forms in reference to feminine nouns.

Differences across preposition types.

Adults did not show differences in terms of the preposition forms they produced across preposition types, with one exception. For *ar, -a* forms were more frequent. This seems to be indicative of a vowel harmony process, in which the final vowels of *ar* prepositions were altered to match the initial vowels. The child groups showed various differences across preposition types. Inflected forms of *dan* (i.e. *dano* and *dani*) were most frequent in the children's responses, whilst for the other two preposition types, inflected forms were rare, and bare/uninflected forms and neutral compounds were far more frequent (i.e. *wrth, wrth ymyl, ar, ar ben*). This was due to the fact that *dan* does not have alternative compound forms, while *wrth* and *ar* do. In addition, feminine inflected forms were especially rare in the child data, and this contrasted with the adult data, where feminine inflected forms were produced often for all three preposition types.

To agree or not to agree?

When gendered prepositions were produced, by and large they agreed in form with the pronouns they appeared with. Adults were at ceiling in terms of agreement in reference to both masculine (98.2%) and feminine nouns (99.27%). Children were less productive in their agreement, (both in terms of accuracy in terms of rates of inflected forms), in reference to both masculine (79.99%) and feminine nouns (70.86%), but were performing far above chance level. Rates of agreement overall were consistent across language groups. However, differences emerged between the OEH group and the other language groups in terms of the gender that the agreed preposition-pronoun pairs marked for. OEH participants produced on average more feminine preposition-pronoun combinations, (33.33%) when compared to the WEH (22.29%) and the OWH (21%) groups overall, when responses to both masculine and feminine items are taken into account. The reason for this is unclear, but may derive from an influence from English, in that they may be confusing the Welsh feminine objective pronoun *hi*, with the English masculine subjective pronoun, “he”, which are homophones. Finally, adults displayed discriminative production of feminine and masculine preposition-pronoun pairs based on the gender of noun referents, whilst children showed patterns that reflected some level of discrimination, but generally showed a predominance of masculine preposition-pronoun pairs. In addition, agreement errors were more predominant in response to feminine noun referents, than to masculine noun referents. These agreement errors were largely errors where an o-inflected or y-inflected masculine preposition appeared with a feminine pronoun (18.15% of all responses on average), further showing overextension of masculine forms in reference to feminine nouns.

7.4.6.2 Main Findings.

The analyses of the adult and child preposition data resulted in the discovery of SIX main findings:

1) High numbers of responses in which uninflected prepositions and neutral compounds such as *ar, dan, wrth* or *ar ben, o dan, and wrth ymyl* were produced
2) Adults consistently produced inflected prepositions and largely produced target gendered prepositions in both masculine and feminine forms, as well as a smaller number of alternative inflected forms (i.e. –y and –a forms) which seemed to be by-products of adaptive phonological processes i.e. vowel reduction and vowel harmony respectively

3) When gendered prepositions were produced by children, they were produced most often by the OWH participants, and by older children in the WEH and OEH groups.

4) When gendered prepositions were produced by adults, they agreed with their co-occurring pronouns in almost all cases (98.7%), whilst children tended to produce more conflicting preposition-pronoun pairs such as *arni fo, wrtho hi,* etc (75.43% agreement, 24.57% no agreement)

5) Overall, higher rates of production of masculine preposition forms were attested in the children, (65.93% masculine vs. 34.07% feminine), and this bias was evident for all three locative preposition types. This is consistent with the bias for masculine pronouns forms attested in the pronoun data

6) Adults showed productive command of preposition-pronoun forms, displaying an appropriate 50/50 ratio of feminine and masculine forms across all of the items (47.87% masculine vs. 52.13% feminine) this differentiation was evident for all three locative preposition types

7.5 Discussion

Grammatical gender or natural gender?

The combined results of the preposition and pronoun data provide various insights into the acquisition of these gender features and the relation between the two. The pronoun results showed how both children and adults alike were only able to confidently produce pronouns that marked for the grammatical gender of nouns correctly when natural gender information was available, and how, in the absence of this information, both children and adults were easily influenced by the experimenter's production of pronouns in reference to entirely different nouns. These results suggest that pronouns are not established (either in children or adults) as a grammatical gender feature. Rather, they are treated as a marker of natural gender, presumably as they carry semantic load, and so the distinctions they make at a semantic level are particularly accessible.

Agreement.

When adults produced gendered preposition forms, they consistently agreed with the pronouns they appeared with. Children, however, achieved gender agreement of their preposition-pronoun structures only 75% of the time, suggesting that even at age 9 children are yet to establish a solid link between the gendered prepositions forms and pronoun forms, despite the fact that the gendered endings of prepositions derive from their corresponding pronouns. This use of a more economical form of preposition (i.e. multi-purpose forms that can refer to all nouns) is line with Slobin's Operating Principle F: "Avoid exceptions." Although the use of neutral compounds may partly derive from the fact that gendered preposition forms are not perceived as the most common or most frequent kind of preposition. The alternative option of using neutral compound prepositions appears to allow the late development of agreement of prepositions with pronouns. The theoretical implications of these findings are discussed in detail in the General Discussion (see **Chapter 10**).