PHONOLOGICAL AWARENESS, LITERACY, AND BILINGUALISM

Helen Baños Smith

Somerville College

A thesis submitted for the degree of Doctor of Philosophy in the University of Oxford, Hilary Term, 2000.



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Abstract

This thesis examines phonological awareness and literacy in monolingual and bilingual children.

Experiment 1 shows that 5-6 year old Spanish-monolingual, English-monolingual and Spanish-English-bilingual children show the same pattern of development of phonological awareness. However, the degree of awareness of each unit is influenced by linguistic background. Spanish children are more aware of vowels and rimes than English children. English children are more aware of syllables than Spanish children. Bilingual children are more aware of syllables in Spanish than Spanish-monolinguals and more aware of vowels in English than English-monolinguals. Hence they show transfer of phonological awareness across languages. All three groups also show a different relationship between phonological awareness and reading.

Experiment 2 shows that bilinguals are more aware than English monolinguals of vowels that exist in both languages (tense-vowels). Moreover, this enhanced awareness extends to vowels that do not exist in Spanish (lax-vowels). It is concluded that exposure to two languages enhances analysis of phonology as well as encouraging transfer of awareness.

Experiment 2 also shows that Spanish-speakers read and spell vowels more accurately than English-speakers. Bilingual children read English vowels more accurately than English-monolinguals. This suggests they understand the orthographic representations of English vowels at least as well as monolinguals. However, they spell vowels less accurately. This may be because bilinguals misapply Spanish phoneme-to-grapheme-correspondences when spelling English vowels.

The English and Spanish vowel systems differ more than their consonant systems. Experiment 3 shows that sensitivity to the four consonant types (stops, fricatives, nasals and liquids) is similar, and correlates with reading ability, in all groups. This suggests that bilinguals may only transfer awareness between English and Spanish of units that are linguistically dissimilar in each.

Experiment 4 compared the awareness of the two consonants in word-medial double-consonants (e.g. the 'c' and 't' in *mactan*). Although only Spanish-speakers used syllable boundaries to analyse these consonants they made a similar number of errors to English-speakers. However, all groups used syllable boundaries to read and spell word-medial double-consonants.

Collectively, these results suggest that differences in phonological and orthographic structure between languages encourage different approaches to the acquisition of literacy. Future research should investigate how these differences may be exploited to facilitate literacy acquisition in each group.

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ABSTRACT

This thesis compares phonological awareness (the awareness of sounds in words) and literacy acquisition in three groups of children: English-monolinguals, Spanish-monolinguals and Spanish-English bilinguals. There are three main questions of interest. The first is whether linguistic background affects phonological awareness. The second is whether bilingual children transfer phonological knowledge across languages. The final is whether each of the groups approach literacy acquisition differently.

In **Chapters 1-4** the questions to be examined in this thesis are set out. It is suggested that the differences in structure between the Spanish and the English sound (phonological) systems will mean that speakers of each language will show differences in phonological awareness. It is further speculated that exposure to two languages - being bilingual - may cause transfer of awareness across languages of those units that are made particularly salient in one language. Finally, it is predicted that differing writing systems (orthographies) will also have an impact on the nature of the relationship between phonological awareness and literacy acquisition for each of the groups.

In **Chapter 1** phonology is defined, and the relationship between phonological awareness and literacy acquisition is explained. Bilingualism is also defined and a case is made for why their phonological awareness and their approach to literacy acquisition may differ from monolinguals.

Chapter 2 begins with a review of the literature on phonological awareness in English children. There are two schools of thought. The first argues that awareness develops from large to small units, whereas the second suggests that it develops from small to large units. It is argued that the conclusions drawn by the latter school are a consequence of poor experimental technique, and are therefore difficult to interpret. The importance

given to rime as a constant phonological unit is also questioned, and the influence of word position and stress on phonological awareness is briefly explored.

The literature concerning phonological awareness in Spanish is then reviewed. The differences in phonological structure between English and Spanish are listed. It is explained that work on Spanish phonological awareness is in its early stages, but the emerging picture points to the syllable and the phoneme as being salient units. Evidence is also put forward suggesting that the syllable may have an internal hierarchy based around the body/coda divide. Comparisons are then drawn between phonological awareness in English and Spanish children and gaps in the research are identified.

Various alternative hypotheses are put forward for how bilingual children acquire phonological awareness in each language. The few experiments that have been conducted in this field are examined and their limitations discussed. It is argued that, although these studies tell us something about the quality of phonological awareness in bilingual children as compared with monolinguals, they fail to look at quantitative differences that might exist.

Chapter 3 reviews the developmental literature on reading acquisition. Two contradictory views of the relationship between reading and phonological awareness in English are identified. One is that the awareness of rimes plays a role in early reading, possibly through the use of analogies. Later, as reading skill develops, phonemic awareness begins to play a role. The other claim is that phonemic awareness is influential at the very earliest stages of reading and that the awareness of rimes plays a role, if at all, once reading is more fluent. Reasons for the disparate findings are discussed. Much of the work concerning the use of phonemic knowledge in early reading confounds the type of test with the unit that it tests for. This makes the results very hard to interpret. Rather than focussing on the size of unit involved in children's reading, a more fruitful approach might be to look at how each unit may affect reading at different stages of development. The

notion that two different forms of phonological awareness - 'epi-linguistic' and 'meta-linguistic' - may exist is also examined.

Research into the relationship between phonological awareness and reading in Spanish is reviewed next. From the limited evidence, it is concluded that syllable and phoneme awareness both play a role in Spanish reading, and that children do not rely solely on grapheme-to-phoneme-correspondences. The English and Spanish literature is then compared. The Spanish orthography is transparent whereas the English orthography is irregular. It is concluded that this entails that although the same strategies may be used in reading in English and Spanish, they are used to differing extents. Unanswered questions are identified and discussed.

The potential reading strategies employed by bilingual children are discussed in light of the work conducted on monolingual children. The little work conducted in this field suggests a causal relationship between awareness of Language 1's (L1) phonology and reading in Language 2 (L2). However, it is argued that this relationship may be mediated by L2 phonology. Since these studies do not look at the relationship between phonological awareness in L1 and L2, or at how L2 awareness and L2 reading are related, it is not clear what mechanism is involved in L2 reading. Nevertheless, it is concluded that children can build on the strengths they have in one language to help them acquire literacy in the other language.

Chapter 4 reviews the research on phonological awareness and spelling in English- and Spanish-speakers. Two different developmental trends are identified for the different groups. English-speakers begin by relying on phonemic awareness and later use analogical strategies based around the onset and rime units. Spanish-speakers begin by representing syllables with individual graphemes, and later move on to an approach based on drawing phoneme-grapheme correspondences. Analogical processes are also involved in Spanish spelling at the later stages. The implications for these different spelling strategies are

analysed in terms of how they may affect bilingual children's spelling strategies. Finally, the research questions the thesis attempts to answer are identified.

The first experiment, presented in **Chapter 5**, examined the development of phonological awareness and its relationship with reading ability in English-monolingual, Spanish-monolingual and Spanish-English bilingual children. Children aged from 5-6 years were given the 'oddity task', in which they had to decide which of three spoken words was the odd-one-out. The odd-word-out did not share a certain phonological unit with the other two words. The units tested for were rhyme, syllable, rime and vowel.

All the groups showed greatest awareness of rhymes, followed by syllables, then rimes, and finally vowels. However, the degree of awareness of each unit was dependent on linguistic background. Spanish-monolingual children were more aware of rimes and vowels than English-monolinguals. English-monolinguals were more aware of syllables. Furthermore, bilingual children were more aware of Spanish-syllables than Spanish-monolinguals, and more aware of English-vowels than English-monolinguals. It is concluded that language structure affects the degree of phonological awareness and that bilingual children transfer phonological awareness across languages.

The relationship between phonological awareness and reading was also examined. It was found that English-monolingual's reading ability was related to their awareness of rhymes and syllables. Spanish-monolinguals' reading ability was related to their awareness of syllables, rimes, and vowels. The bilingual children's English reading was correlated with English rime awareness, and their Spanish reading was correlated with Spanish syllable and English vowel awareness. It is concluded that Spanish- and English-speakers approach reading differently from one another, and that bilingual children use phonological awareness in a similar manner to, but to a lesser extent than, their monolingual counterparts.

Experiment 2 (**Chapter 6**) investigates the awareness of two different vowel types: tense vowels, which exist in both English and Spanish, and lax vowels, which only exist in English. If the bilingual vowel advantage found in Experiment 1 was due to transfer of vowel awareness across languages, then they should only show more awareness of tense vowels than English monolinguals. This is because lax vowel awareness could not be transferred across languages since lax vowels do not exist in Spanish. Children aged 7-9 years were given the oddity task to test for the ability to discriminate tense from tense vowels, lax from lax vowels, and tense from lax vowels. Bilingual children were found to be more aware of both lax and tense vowels than English monolinguals. However, they also showed more awareness of tense than of lax vowels, whereas English monolinguals showed equal awareness to these two types of vowel. It is concluded that the bilingual vowel advantage is caused both by transfer of vowel awareness from Spanish to English and by a greater ability to analyse vowels than English children.

Experiment 2 also examined whether the awareness of a vowel is directly related to the ability to read and spell it. This data was presented in **Chapter 7**. The children were asked to read and spell the same words used in the oddity task. Strong correlations were found between English children's vowel awareness and their reading and spelling of vowels. The only other group to show a correlation between vowel awareness and vowel reading were the bilingual children in Spanish. No correlations were found for any other group between vowel awareness and vowel spelling. It is concluded that only English children apply grapheme-phoneme-correspondences in reading and spelling vowels at this stage in literacy development.

It was also found that Spanish-speakers are better at reading and spelling vowels than English-speakers. The English-speakers made more reading and spelling mistakes on digraph vowels than single grapheme vowels. It is concluded that the relative complexity of the English orthography makes vowel reading and spelling harder in English.

Moreover, we found that bilingual children are better at reading vowels, but worse at spelling vowels than English-monolingual children. It is argued that bilingual children have a sophisticated understanding of the orthographic representation of English vowels, since they are good at reading them. However, their spelling errors indicate that their knowledge of the Spanish orthography hinders them from using their understanding of English orthographic representations in spelling English vowels.

Experiment 3 (**Chapter 8**) examined whether the greater awareness of vowels demonstrated by the Spanish children and the bilingual children in English extends to consonant phonemes. Two further aims were to determine whether consonant awareness is affected by consonant type and word position. Five-six year old children's awareness of stop, nasal, fricative and liquid consonants in word-initial (onset) and word-final (coda) position was tested using the oddity task.

All groups showed similar awareness to the four different consonant types. It is concluded that the vowel advantage does not extend to consonants, and that consonant type does not affect consonant awareness. It is argued that this is because the consonant systems of each language do not differ considerably.

English-monolingual and bilingual children (in both languages) were more aware of onset than coda consonants. Furthermore, Spanish-monolingual children were less aware of onsets than were English-monolingual children. This was taken as further evidence that the English syllable has an internal structure based around the onset/rime divide, but that this divide is not as important in Spanish syllables.

Experiment 3 also compared vowel and consonant awareness. English-monolinguals were less aware of vowels than consonants, whereas Spanish-speakers (including the bilinguals in English) were equally aware of consonant and vowel sounds. This finding suggests that vowels are not salient units in English. This may be because

phonetically they are highly variable and overlap one another in vowel space, making it hard to distinguish between them.

Experiment 3 also showed that consonant awareness was related to reading for all of the groups, suggesting that this awareness plays a role in the earliest stages of reading for each group.

In **Chapter 9** the first half of Experiment 4 is presented. This experiment looked at whether children use syllable boundaries to analyse the consonants of word-medial double-consonants (e.g. the 'b' and the 'l' in '*mablan*'). Spanish and English-speakers syllabify words differently. It was predicted that if they use their knowledge of syllable boundaries to analyse phonemes in the middle of words, there should be differences in their awareness of each consonant of word-medial double-consonants according to syllabification method. For example, *mablan* may be syllabified as *ma-blan* or as *mab-lan*. In the former syllabification, we would expect children to be more aware of the 'b' than the 'l', whereas in the latter syllabification we would expect the opposite pattern of results. The bilingual children were expected to perform similarly to the Spanish monolinguals in both of their languages since they syllabified English and Spanish words according to Spanish syllabification rules. Seven-nine year old children were given a word-medial double-consonant oddity task. Only the Spanish-speakers (monolingual and bilingual) used syllable boundaries in their analysis of these consonants. However, the use of this strategy did not make them more aware of these consonants than English-speakers. It is concluded that language structure influences the way in which an individual analyses language.

The second part of Experiment 4 is presented in **Chapter 10**. Children were asked to read and spell the same words that were used in the oddity task in order to examine the effect of syllable boundaries on reading and spelling word-medial double-consonants. If syllable boundaries affect reading and spelling then Spanish-speakers (including bilinguals

in English) should make a different pattern of errors from English children, since they were found to syllabify words in different ways. Furthermore, if phonological awareness has a direct affect on literacy, then there should be a relation between the oddity task scores and the reading and spelling scores.

We found that syllable boundaries affected all groups' abilities to read and spell word-medial consonants. Few correlations were found between oddity task scores and reading and spelling of word-medial double-consonants for any of the groups. It is concluded that children do not apply grapheme-to-phoneme-correspondences for word-medial consonants at this stage in literacy acquisition but that they do use their knowledge of syllable boundaries to help them read and spell.

Chapter 11 summarises the questions raised at the beginning of the thesis and discusses the extent to which they have been answered. It is concluded that differences in linguistic background affect both phonological awareness and the approach to literacy. In particular, it is argued that children analyse their language in ways appropriate to its structure: different structures result in relative differences in phonological awareness. Bilingual children are particularly adept at focussing on these contrasts and will hence show an enhanced awareness of those units that are different between their languages.

It is further argued that the differences in phonological awareness in speakers of English and Spanish coupled with the differences in each of their orthographic systems means that their literacy strategies are not the same. Bilingual children, being exposed to two phonological and orthographic systems are conservative in drawing links between language and writing, but where links are drawn, it is for those units that are most consistently mapped in each orthography. It is also argued that they may transfer reading strategies across languages.

Further research on the type of phonological awareness that children from different linguistic backgrounds possess and the possible differences and similarities in their reading strategies is then encouraged, including investigations on the impact different levels of awareness have on literacy acquisition in each language. Finally, research on bilingual children's methods of learning is urged, particularly in the field of phonological awareness and its use in literacy.

CHAPTER 1

INTRODUCTION

1.1 PHONOLOGICAL AWARENESS, LITERACY AND BILINGUALS

There are an estimated 31 million Spanish-English bilingual speakers in the world. They constitute over 11% of the US population, and their percentage is expected to almost double within the next 25 years. Only 53% of these bilinguals finish high school, compared with 82 % of non-Hispanic whites, whilst only 9% go on to any form of further education, compared with 50% of non-Hispanic whites (U.S. Bureau of the Census, 1999). One of the greatest indicators of school success is literacy ability. Low levels of schooling correlate with low employability, health problems, poverty and crime (The National Institute for Literacy, 2000; The National Literacy Trust, 1998). A recent study showed that 60 percent of the poorest readers aged ten had parents who were not functionally literate (The National Literacy Trust, 2000). Hence, literacy has profound repercussions for both academic achievement and social well being. To break out of this vicious cycle, literacy levels need to be improved in bilinguals. In order to do this we need to understand more fully how they approach the task of learning to read and spell.

It is often assumed that bilingual children behave as two monolinguals in one body. However, being exposed to two different languages and two different written systems could result in different reading strategies from either English or Spanish monolinguals. Hence this thesis compares bilingual children to both English and Spanish monolingual speakers.

Research into literacy acquisition has mainly concentrated on English-speakers. One factor that is known to greatly contribute to literacy ability in English is the awareness of sounds within words, or, phonological awareness. Despite the fact that there are some 400 million Spanish-speakers world-wide (CELADE, 1999), little research has been carried

out into how these people acquire literacy. It is generally assumed that the relationship between phonological awareness and literacy ability in English is applicable in other languages. There are at least two reasons why this link may not be the same.

Firstly, English and Spanish have different structures. If the awareness of sounds in words is determined by the structure of a language, then particular sounds may be differentially salient in English and Spanish. If phonological awareness differs across these languages, this could result in differences in the relationship between phonological awareness and literacy acquisition. Secondly, the level of phonology represented by the written system, or orthography, of each language may also be different. Hence, one would expect different types of phonological awareness to correlate with reading ability in different orthographies. The development of phonological awareness and its relationship with literacy needs to be studied in Spanish and compared to English.

This thesis investigates both the nature and degree of phonological awareness in Spanish children and in Spanish-English bilingual children, and determines how this awareness is related to literacy acquisition for each of these groups.

1.2 WHAT IS PHONOLOGICAL AWARENESS?

Before looking at phonological awareness and its relationship with literacy in these three groups, it is necessary first to understand what phonological awareness means. Phonological awareness is a blanket term that refers to the awareness of the sounds in a language. Different forms of this awareness exist, and each one may have a different relationship with reading and spelling.

Traditionally, words have been split into three different types of phonological unit, giving rise to the possibility of three different forms of phonological awareness.

Awareness of these units is thought to be related to the ability to read and spell. These three units are described below:

1) SYLLABLES: The Oxford English Dictionary's definition of 'syllable' is "a vocal sound or set of sounds uttered with a single effort of articulation and forming a word or an element of a word." Syllables give the language its rhythm. Most children have an awareness of this unit from an early (pre-school) age (e.g. Liberman, Shankweiler, Fischer, & Carter, 1974).

2) INTRA-SYLLABIC UNITS: ONSET, PEAK, CODA, BODY and RIME: Syllables can be further split into two units: an opening (the **onset**), and an end (the **rime**) section. More specifically, the **onset** refers to the first consonant or consonant cluster of a syllable, and **rime** refers to anything from the vowel to the end of the syllable. The rime can be further split into the **peak** and the **coda**. The **peak** refers to the vowel sound, and the **coda** refers to the final consonant or consonant cluster. For example, the word 'smell' has the onset '/sm/', and the rime '/el/', and this rime can be further split into the peak '/e/' and the coda '/l/'. Another unit of potential linguistic importance is the **body**. The **body** refers to the onset+peak. For example, the word 'smell' has the body /sme/.

3) PHONEMES: A phoneme is the smallest unit of sound that, if changed, will change the meaning of the word. For example, the word 'big' can be split into the three phonemes /b/, /ɪ/, /g/; the word 'book' into the three phonemes /b/, /ʊ/, /k/. Phonemes are rather abstract entities. What a native speaker perceives as a phoneme is dependent upon whether the acoustic differences between that particular sound and another are relevant in that language; phonemes only exist in contrast. To give a classic example, the acoustic differences between /l/ and /r/ are not important in Japanese: no two words depend on this contrast to determine their meaning. Hence, monolingual Japanese-speakers react to these two sounds as variants (allophones) of the same phoneme;

without training they do not hear the differences and are unaware of making them. In English [d] and [ð] (the first sounds of 'den' and 'then', respectively) are distinct phonemes, but in Spanish they are allophones of the same phoneme. Spanish-speakers do not hear the differences and are unaware of making them. While phonological structure is not entirely different from one language to another, what is phonemically contrastive in one language may be allophonic in another.

The reason why it is important to split phonological awareness into its component parts is because a child might have certain forms of phonological awareness whilst lacking others. For example, she or he might be aware of syllables whilst being unaware of phonemes. Each different phonological unit may interact with literacy ability in different ways and at different stages in the process of literacy acquisition.

Although the syllable, onset, rime and phoneme are the four phonological units classically discussed in research concerning reading and spelling, this tradition no doubt stems from the mass of research carried out on English literacy acquisition. These might be the units that are pertinent to the English phonetic (spoken) and orthographic (written) systems. However, these units might not be the only ones that are relevant to, or salient in, the Spanish language. For example, although Spanish words can be split into each of these four units, others might be equally, if not more "natural". The body unit, for example, may be a more useful unit to take into consideration when examining both phonological awareness, and the relationship that holds between this awareness and literacy acquisition in Spanish speakers.

1.3 MAPPING BETWEEN PHONOLOGY AND ORTHOGRAPHY

Even if there turns out to be a strong causal relationship between phonological awareness and reading and spelling in both English and Spanish, there could still be differences in the nature of the relationships in the two languages. This comes down to the mapping that exists between the spoken and the written systems in each language. In this thesis it is argued that a language's phonology will make certain units more 'salient' or 'available' to the child than other units. The language's orthographic system will also be structured such that there are certain phonological units that the child is required to be aware of if she or he is to become a proficient reader-writer. It is not necessarily the case that the Spanish and English phonological systems make the same units available to the child. Nor is it necessarily the case that knowledge of the same units is required to read and write in each language.

It is, therefore, important to look at two areas: Firstly, what units are made salient in each language by each phonological system; and secondly, how the phonological and the orthographic systems map onto one another in each of the two languages. To what extent are these similar? To what extent are these different? For example, if phonemes are highly salient phonologically, yet the orthographic system does not represent them systematically, then awareness of them will be of little use in reading and spelling. Once we ascertain at which level(s) the mapping between phonology and orthography lie(s), we can start to see where and how the processes of learning to read and write in each language differ from one another.

1.4 LITERACY AND BILINGUAL CHILDREN

This thesis does not only concern itself with English and Spanish monolingual speakers. A third group of interest are those who speak both English and Spanish:

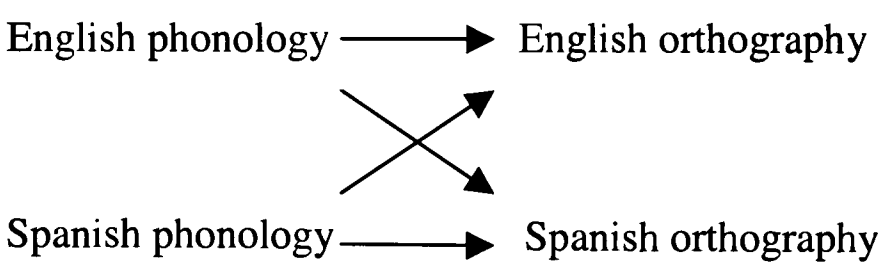
bilingual children. Here the process of literacy acquisition might be different again. There are at least three different possible hypotheses of how a bilingual child might learn to read and spell:

a) The bilingual learner may be the equivalent of two monolingual learners. Both the phonological and the orthographic systems of each language are kept separate in the child's mind, and hence the relationship that holds between phonological awareness and reading and spelling has to be learned for each language separately.

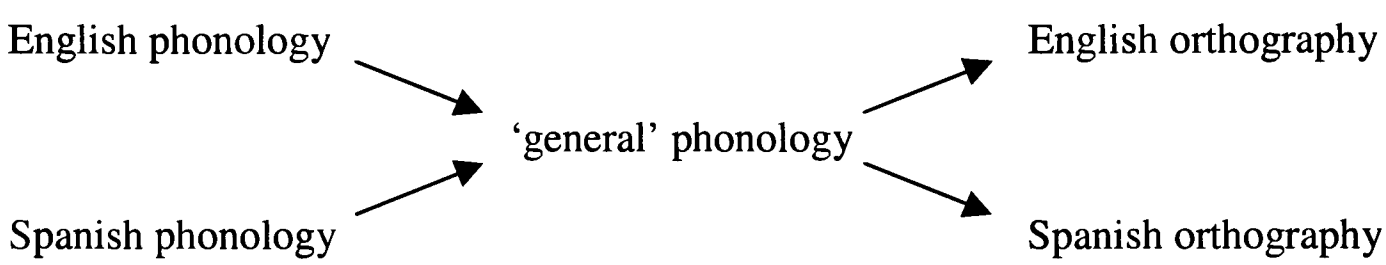
English phonology → English orthography

Spanish phonology → Spanish orthography

b) Alternatively, both the phonological and the orthographic systems of each language may be kept separate in the child's mind, but children can use their knowledge of the phonological systems of each language to help them learn to read and write in both Spanish and English. In other words they can, for example, use their knowledge of English syllables to help them identify the corresponding orthographic unit in Spanish. Note that it is possible for this to happen with the two phonological systems remaining separate in the child's mind. Those phonological units that correspond to orthographic units across languages can be utilised to learn to read and write, without the child at any point transferring phonological awareness from one language to another. In other words, they may not be able to use their awareness of sounds (phonological units) in one language to help them become more aware of that same unit in the other language.



c) The third possibility is that the phonological systems are integrated in the child's mind; they can transfer awareness across languages. If the two individual phonological systems differ, the bilingual child's overall phonological awareness would be greater than that of either of their monolingual counterparts, since they can integrate their knowledge of the phonology of both languages. They can then use this knowledge to tackle the orthographic systems of each language.



By looking at bilingual children's phonological awareness in comparison with that of their monolingual counterparts, and by comparing how this awareness is related to reading and spelling ability in the three groups, the thesis aims to verify one of these hypotheses.

1.5 BILINGUALISM

Which of these three possibilities actually occurs might depend on the 'type' of bilingual one is studying. It is possible that all three approaches may be taken, depending on the kind of bilingualism being studied. We first require a definition of what it is to be bilingual.

1.5.i Bilingualism defined

There is no clear definition of what it is to be bilingual. Some researchers maintain that bilingualism requires native-like control of two languages (e.g. Webster, 1961; Bloomfield, 1935) whereas other researchers require only minimal competence (e.g. Macnamara, 1967a). Between these two extremes one encounters a whole array of definitions. However, both methodological and theoretical difficulties arise when trying to pinpoint what counts as being bilingual because the vast majority of definitions lack precision and operationalism. For example, few have tried to explain what 'native-like competence' actually is. Furthermore, most definitions refer only to levels of (verbal) proficiency in each language and hence they fail to recognise that other linguistic (e.g. listening comprehension, reading and writing) as well as non-linguistic (e.g. cognitive, cultural) dimensions also need to be considered and included in any complete definition of bilingualism (Hamers and Blanc, 1989, Ch. 1).

It is not the aim of this thesis to provide an absolute definition of what it is to be bilingual, but there are certain aspects of bilingualism that are important to consider with regards to the nature of bilingualism under study here. These are outlined below:

1.5.i.a Balanced vs. dominant bilingualism.

A bilingual might be more proficient in one language (usually the mother tongue) than in the second language. This is termed 'dominant bilingualism'. Alternatively, a bilingual might be equally proficient in both of their languages. In this case they are said to be 'balanced bilinguals'.

It is important to note that in neither type of bilingualism is level of proficiency being compared to monolingual counterparts. Rather the type of bilingualism is determined purely by the relative proficiency in each language of that individual bilingual

person. It is also worth noting that balance or dominance are not always equally distributed for all domains and functions of language (Hamers and Blanc, Ch.1). For example, it is quite possible that a bilingual is 'balanced' concerning her or his oral proficiency, but 'dominant' when it comes to literacy.

The majority of bilingual children under investigation here have Spanish-speaking parents but are sent to an English-speaking school as soon as they are out of nappies. Hence these children are Spanish dominant in terms of oral proficiency. A sub-group of the children come from 'mixed parentage' backgrounds (one English-speaking, one Spanish-speaking parent). These children are more 'balanced' in their oral proficiency. There are also some children who have two English-speaking parents. These children are English dominant.

The differences in the linguistic backgrounds of the bilingual children might influence the way in which they both store and process linguistic (phonological) information. This might mean that each sub-group possesses different forms of phonological knowledge, which in turn could entail that their approaches to the acquisition of literacy in each language might differ.

1.5.i.b Context of acquisition

The context within which each of the languages is acquired may influence the proficiency of each language, by determining the motivation for learning a language. If both languages are viewed positively by society then this may have a positive effect on the learning of both. This is known as 'additive' bilingualism. If, on the other hand, one of the languages is undermined or holds little prestige within the society, then its acquisition might be hindered. Bilingualism under these circumstances is maybe 'subtractive' (Lambert, 1974).

Additive and subtractive bilingualism refer to the cognitive advantages from which a bilingual child might or might not benefit. Lambert's theory is that, if a child receives positive reinforcement concerning her or his bilingualism, then her or his bilingualism is additive and results in cognitive advantages over monolinguals. Positive reinforcement may take the form of community support, prestige of both languages, high parental and teacher expectations and well-balanced minority and majority language teaching, all of which usually go hand in hand with high socio-economic status (SES). Not only are these children more likely to achieve high levels of competence in each language, but they may also have cognitive advantages such as more metalinguistic awareness, more flexibility of thought, increased creativity, and a more diversified structure of intelligence. Subtractive bilingualism, on the other hand, is caused by a society where one of the languages is shunned (usually the mother tongue being shunned by the majority language of the community). This results in the child not becoming proficient in either language, and usually entails cognitive deficits.

The children in this thesis should in theory be additive bilinguals since they are learning English in a society in which the value of possessing this language is highly considered. If these children obtain cognitive advantages through their bilingualism, then they may be able to apply these when it comes to acquiring literacy. Not only might they have an increased knowledge base (as suggested above), but they may gain an insight into how to use this knowledge in order to learn to read and write in two languages.

1.5.i.c Literacy and schooling

One factor that we had wished to hold constant across groups and languages was literacy experience. Unfortunately this was an impossibility for two principal reasons. Firstly, the teaching methods appeared to be different in the schools: the English schools used a mixture of phonics and whole word teaching, greater relative emphasis was placed

on phonics for the bilingual schools, and Spanish schools only used phonics. Secondly, the amount of emphasis on literacy skills was quite different between schools. Generally, the bilingual schools gave a lot of importance to reading and writing ability, whereas some of the bilingual schools along with the English schools placed average amounts of emphasis on reading. The Spanish schools placed relatively little stress on reading and writing, particularly at younger ages because the Spanish national curriculum does not require formal teaching of reading until the child is around 6yrs of age. These differences in literacy training between the schools are merely relative, and probably reflect the concerns both of the government of the country (government policies concerning the teaching of literacy being quite different in the different countries), and of the children's parents. Furthermore, the amount of reading done at home with parents was not only difficult to determine, but also virtually impossible to control for.

However, we cannot verify the exact teaching methods that were used or how much these methods varied between schools. This is because we cannot be sure that what the teachers said and what they did were precisely the same thing. For example, at one school the Spanish teachers were adamant that they only used phonics training. Yet evidence was spotted on the blackboard of the use of syllables to draw analogies across words. Furthermore, all of the children received training in phonological awareness. Hence, the possible discrepancies did not prevent us from using reading ability data to answer the question of its relation to phonological awareness.

1.5.i.d Changes over time.

Lastly, it is important to remember that "bilingualism" is not a static state. How a child is categorised under each of the different aspects of what it is to be bilingual will change over time. A variety of factors, not least of which is the extent and quality of his or

her exposure to, and use of, each language will determine categorisation. Since literacy acquisition is a gradual process, we need to bear in mind that bilingual typology and strategy approach to literacy acquisition in each language may interact as a function of time.

1.6 OVERVIEW

So far it has been proposed that different processes might be required in literacy acquisition by children exposed to different language environments. It has been argued that different languages might make different phonological units 'salient' to different extents, and that different orthographic systems might require knowledge of different units in order for proficient reading and spelling. We have also seen that there are many alternative ways of 'being' bilingual, and that the different ways of acquiring the two languages might affect both an individual's phonological awareness of each language, and the way in which she or he learns to read and write in these languages.

The questions that arise, questions that this thesis attempts to answer, are:

a) how does English- and Spanish-monolingual children's phonological awareness differ?, and,

b) how do these two groups of children learn to read and write?

Once we know the answer to these questions, we can determine in which ways the bilingual child might use her or his skills and knowledge of one language to make the acquisition of literacy in the other language far easier. The questions that arise are:

c) how does bilingual and monolingual children's phonological awareness differ?

d) how does bilingual children's acquisition of literacy compare to that of monolinguals?

Chapter 2 reviews the literature on phonological awareness in English- and Spanish-speakers, and also examines the little evidence available for bilingual-speakers. Chapters 3 and 4 then discuss how monolinguals learn to read and spell, and what this might entail for bilingual literacy acquisition.

CHAPTER 2

PHONOLOGICAL AWARENESS

2.1 PHONOLOGICAL AWARENESS IN ENGLISH

2.1.i The development of phonological awareness in English

Given that there is a variety of differently sized phonological units, how does the awareness of these various units develop? There is currently much debate as to how this happens. Certain researchers believe that children are first aware of 'small' units, such as phonemes, and only as their phonological awareness develops do they become aware of the 'larger' units, such as syllables and rime. Other researchers believe that the development occurs in the reverse order: children first acquire phonological awareness of the 'larger' units, and it is only later (and probably as a consequence of experience with an alphabetic script) that they become aware of the 'smaller' units. We will examine below the evidence in favour of each of these cases.

2.1.i.a Large to small

Onset and rime

Rebecca Treiman first emphasised the possible psychological reality of units other than the syllable and the phoneme. Until then, the majority of research had concentrated on phonemes (Pisoni, 1981) and syllables (Mehler, Dommercques, Frauenfelder, and Sequi, 1981; Treiman and Baron, 1981; Liberman *et al.*, 1974; Hardy, Stennett, and Smythe, 1973). Treiman (1983), inspired by the work of MacKay (1972) on 'slips of the tongue' in German adults, noticed that when this sort of speech-error occurred within a syllable, the break was most often found between the onset and the rime (e.g. *nice* and *kind* → '*kice*').

She theorised that these intra-syllabic errors could tell us something about how we encode the syllable itself. She therefore set up a series of experiments to systematically investigate the nature of the underlying internal structure of the syllable in English. She asked adults to play novel word games that either required them to split words up across intra-onset (e.g. *th-rust*), intra-rime (e.g. *thru-st*) or intra-coda (e.g. *thrus-t*) boundaries or required them to split words such that the onset (e.g. *thr-ust*), rime (e.g. *thr-ust*) or coda (e.g. *thru-st*) unit remained intact. She found that adults were both faster at learning, and more adept, at those games that split words across the onset and rime unit than those that broke up these units. However, the participants found games that involved splitting consonant cluster (CC) codas as easy to learn as they did games that kept the coda intact. Nevertheless, when given the choice, they would opt for the game that kept the coda as a cohesive unit.

From these experiments we can see that the onset and rime are cohesive units in English: speakers of English will naturally break syllables at this boundary. This provides strong evidence in favour of a hierarchical internal organisation of the syllable in English, phonologically underpinned at the onset-rime level. The evidence for the coda as a salient unit, on the other hand, is ambiguous. Thus no firm conclusions can be drawn about the internal structure of the rime[1].

That the onset/rime boundary is a natural break in the syllable for English speakers is not surprising given the phonological constraints of English. For the most part, onsets and rimes can be selected independently of one another without violating the phonological structure of English. In contrast, there are severe restrictions on the co-occurrence of vowels and final consonant clusters (Fudge, 1969). The many restrictions between vowels and final consonant clusters motivate their treatment as part of one larger unit, the rime.

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[1] It might tentatively be suggested that internally we organise it as a peak+coda structure.

Treiman's study indicates that English-speaking adults internally organise the syllable into an onset and a rime. But can the same be said for children? If this is the case, then we would expect children to be more receptive to word-games that keep these units intact, than to games that split them up. Kirtley, Bryant, MacLean and Bradley (1989) conducted a study to look at this. They gave five-year-old children the 'oddity task'. The task consists of giving the child three words. Two of these words share a sound (the target unit), whilst the other word does not. It is the 'odd-word-out'. The child is then asked to tell the experimenter which word is the odd-one-out. Kirtley *et al.* reasoned that if the onset is a particularly salient unit to English-speaking children, then they should find it no easier to detect the odd-word-out in a sequence such as '*doll* - *dog* - *cap*' (in which the similar words share the CV sequence), than sequences such as '*doll* - *deaf* - *can*', (where the similar words share only the onset). Similarly, they reasoned that if the onset holds a special status, then it should be easier to detect than other single phonemes found in other word positions. Hence they also gave children oddity tasks in which the odd-word-out had a different coda from the two similar words (e.g. *fan* - *pen* - *cut*). If the children found this task harder than the onset task, then it could be concluded that the onset was a more salient unit for children than the coda.

They found that children find it easier to detect onsets than codas, and that adding a common medial vowel to the onset does not improve their performance on the oddity task. Both of these results point to the onset being a unit that even pre-reading children naturally home in on.

Kirtley *et al.* also gave the children a rime oddity task, and compared their performance on this to their performance on the coda task. They found that children were much more likely to correctly spot the odd-one-out in '*top* - *mop* - *rail*' than in '*mop* - *whip* - *lead*'. This indicates that the child is more able to spot rimes than they are codas.

From this study it would appear that the onset-rime division plays an important role in children's awareness of sounds, and that phoneme awareness (or at least the awareness of peaks and codas) does not develop until later.

Phonemes

Bruce (1964) conducted an experiment that measured a possibly more "explicit" awareness of phonology (see Chapter 3.1.vi for a discussion on 'explicit' and 'implicit' forms of awareness). He used 'deletion' tasks in which a child is asked to delete a certain phonological unit from a given word. For example, in a phoneme deletion task a child might be required to delete the first sound of the word '*cat*' to give '*at*'. Bruce tested children with mental ages from five-to-nine years for awareness of beginning, middle and end phonemes. He found that children with a mental age of five-years could not do any of the phoneme tasks. Children with mental ages of six- and seven-years fared a little better, but still found the tasks very hard. It was not until the children were at a mental age of around eight-to-nine-years that their performance indicated a more definite awareness of phonemes. This finding suggests that phonemes are particularly inaccessible phonological units for young (English-speaking) children. Why does it take so long for phoneme awareness to develop?

One possibility is that it is not until children are exposed to an alphabetic script that they begin to learn about phonemes. One way to examine this is to look at children who learn to read a logographic, rather than an alphabetic script. Mann (1986) compared American and Japanese six-to-eight-year-olds on a task that involved either adding or deleting initial syllables (/ta/ and /u/ from tri-syllabic pseudo-words) and phonemes (/ʃ/ and /k/) from pseudo-words. The American children who were learning to read an alphabetic script could do both the syllable and the phoneme task. On the other hand, the Japanese

children who were learning to read a logographic script could delete and add syllables, but not phonemes. This suggests that it is through learning to read in an alphabetic script that we learn about phonemes[2].

In conjunction these studies suggest that in English awareness of rimes and onsets precedes the awareness of phonemes (other than onsets), and is available to the child before they have started to learn to read. It looks very much as if phonological awareness develops from the larger to the smaller units[3].

2.1.i.b Small to large

So is it really the case that pre-reading children are unaware of phonemes other than the onset unit? Recently the interest in this field has become revived. The current studies have used different methodological approaches in their attempts to demonstrate phonemic awareness in pre-readers. One such study was that conducted by Duncan, Seymour and Hill (1997). They asked children who had been receiving formal reading instruction for seven months to perform the 'common unit' task. The task involves reading out two words that share a 'common unit' and asking the child to produce the common unit themselves. For example, if the child is given '*cat*' and '*mat*' she or he would have to respond with '/at/'. Duncan *et al.* looked at body (onset+peak), rime, onset, peak and coda awareness in five-year-old children. They found the children performed much better on phoneme tasks (onset, peak, coda) than they did on large unit tasks (body, rime). They took this as

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[2] This is not to say that alternative methods of learning about phonemes do not exist. Nevertheless, most English-speaking children learning an alphabetic script do appear to gain their phonemic awareness through learning to read.

[3] It should be noted, however, that the deletion studies discussed above require the explicit manipulation of sounds. These studies did not look at rime deletion, and hence we do not know whether pre-reading children are capable of explicitly manipulating this sound. Some researchers have argued that oddity and deletion tasks tap into distinct and unrelated forms of phonological awareness. If this is true, then we are left with inconclusive evidence concerning whether pre-reading children are explicitly aware of rimes. This is a point I will return to in Chapter 3.1.vi.

convincing evidence that children become explicitly aware of smaller units before they do larger ones.

Nevertheless, there are various problems with this study. Firstly, the children were asked to produce a sound that both of the words shared. They were never told to make this the largest sound possible. Hence, if a child responded '/t/' to the example given above, he or she would be scored as incorrect, even though it would be a perfectly legitimate response given the instructions provided. We do not know how many of the children produced answers that were perfectly legitimate but were scored as incorrect.

Secondly, the children who took part in the study received phoneme-based phonics instruction at school (letter-land), so they were quite accustomed to focussing on phonemes that were shared by words. They had never received training in rime-level correspondences, and hence it is hardly surprising that they performed less well on this task. Indeed, Goswami and East (in preparation) have found that even after five hours of training with a rime-based teaching programme, five-year-old children perform very well on the rime common-unit task.

Finally, the task used in the above experiment differs from the tasks used in the studies showing that rime awareness precedes phoneme awareness. It is possible that the different methodologies used might explain the differences found. We will return to this point in Chapter 3.1.vi.

2.1.ii Rime or rhyme?

So far the importance of the rime unit has been repeatedly emphasised. However, it is important to notice that in most of the studies mentioned, all of the experimental materials consisted of monosyllables. Thus, rime and rhyme are confounded. Hence, the status of onsets and rimes in multi-syllabic words or unstressed syllables is not known. Had the

authors used di- or poly-syllabic words, then the rime unit might not have had the same advantage. It is possible that rather than rime awareness being the early developer or the most salient phonological unit, it is in fact rhyme awareness that develops first. Dowker (1989) conducted a study that looked at pre-school children's spontaneous production of rhyme in poetry. She found that many of the poems produced by the children contained disyllabic words that rhymed where the rhyme crossed a syllable boundary (e.g. *mountain* and *fountain*). Although these words also share the rimes of both syllables, it is more likely that the child was choosing these words because of the 'overall' effect. Children usually do not spontaneously produce poems containing words that share, for example, the rime of the first syllable, but not of the second syllable (e.g. *garden*, *parlour*).

If we really want to claim that rime awareness does develop prior to phoneme awareness, and that rime awareness is used in learning to read, we need to do an experiment using di- or poly-syllabic words in which rime and rhyme are not being confounded.

The only study, to our knowledge, that looks at children's awareness of rime in words of more than one syllable, and hence whether rime is a constant linguistic unit, is an investigation carried out by Brady (unpublished).

There were three different conditions in the study:

1. Rhyme condition – words shared the stressed vowel and the rest of the word. Half of the words rhymed only within the second syllable (e.g. balloon, baboon), and half rhymed across both syllables (e.g. mountain, fountain).
2. Syllable condition – half of the item pairs shared the first syllable (e.g. garden, garlic), and half were pairs sharing the second syllable (teacher, nature).
3. Rime condition – assessed children's awareness of rimes that are in the stressed initial-syllable (e.g. pencil, tender), and rimes that are in the unstressed final-syllable of

disyllabic words (e.g. wizard, shepherd). Note that this task involves shared rimes that do not actually rhyme.

Four- and five-year-old children had to judge whether a puppet would be happy or sad depending on whether it heard pairs of words that conformed to the various conditions. Brady found that performance on the rhyme condition was significantly better than performance on the syllable condition, which was in turn significantly better than performance on the rime task.

From the results it appears that the rhyme unit is the most accessible for children at this early age. It would also appear that the rime unit might not be a constant phonological unit for these children. Children performed much worse on those tasks that shared the unstressed rime (e.g. wizard, shepherd) than those that possessed a stressed rime (i.e. that rhymed, e.g. saloon, baboon). What is more, performance on the rimes in first position (e.g. pencil, tender) was fairly low, despite the fact that a stressed vowel was incorporated in the shared segment. This suggests that rhyme status, and the corresponding availability of rhyme units goes beyond the presence of a stressed vowel.

The study does shed doubt on whether the syllable hierarchy hypothesis is the correct framework for explaining the development of phonological awareness in English. The lexicon, it would appear, seems to be organised at the word-unit level. These results point to the need to use the onset/rime terminology cautiously, particularly for monosyllabic words in which word-level units (word onset/rhyme) overlap with syllable-level units (onset/rime). This thesis investigates further this rhyme versus rime debate.

2.2 PHONOLOGICAL AWARENESS IN SPANISH

The first main question of this thesis concerns whether differences in linguistic background affect phonological awareness. Since the English and Spanish phonological

systems differ, a question was whether English and Spanish children analyse words in different ways. Brady (unpublished) has argued that

"...one would anticipate that for languages organised in terms of different structural principles than those for English, emerging awareness of the phonological structure would differ accordingly."

If differences in phonological awareness exist between speakers of different languages, these will presumably be determined by the differences in linguistic structure of the languages in question. The principal structural differences between English and Spanish are listed below:

Structural difference:	**English**	**Spanish**
stress	stressed time language; vowels are expanded and contracted to fit into the rhythmic pattern	not a stressed time language; the length (quantity) and articulation (quality) of vowels is not significantly affected by stress
manifestation of stress	stress equates to greater loudness, reinforced with higher pitch	stress equates to greater loudness
syllables	many words have 'murky' syllable boundaries. For example, 'butter' can be split as 'bu'- 'tter', 'butt' - 'er' or 'but' - 'ter'	syllabic language; each word has clear syllable boundaries
number of syllables	primarily mono- and di-syllabic words	primarily di- and tri-syllabic words
vowels	up to 21 different vowel sounds, with no distinct boundaries; affected by stress	only five highly distinctive vowel sounds, not affected by stress

(Stanley-Whitley, 1986).

Before we make predictions about how these structural differences might affect phonological awareness in each language, the literature concerning Spanish phonological awareness is reviewed.

2.2.i The development of phonological awareness in Spanish

2.2.i.a Syllables and phonemes

Which unit(s) does the Spanish language make salient? Which unit(s) are children aware of before they begin to learn to read? Relatively little research has been carried out in this area, but the evidence to date suggests that the Spanish phonological system makes different units available to the child from the English system.

Task	**Unit**	**Example**
Discrimination tasks	Phonemes	Are the syllables of each pair the same or not? /me/ - /me/, /ta/ - /sa/.
Matching tasks	initial syllables	Do these pairs share a syllable? /xaco/ - /xade/, /ʧala/ - /taxa/.
	rhymes	Do these pairs share a rhyme? /mepu/ - /pepu/, /feko/ - /pate/.
	onset phonemes	Do these pairs share a phoneme? /kar/ - /kos/, /til/ - /sun/.
Monitoring tasks	initial-syllables	Is the sound /sa/ in 'perro'? Is the sound /sa/ in 'sala'?
	onset phonemes	Is the sound /p/ in 'pal'? Is the sound /p/ in 'kal'?
Deletion tasks	syllable	Delete /de/ from 'kade'.
	phoneme	Delete /t/ from 'tal'.
Reversal tasks	syllable	How would you say /taro/ backwards? Answer /rota/.
	phoneme	How would you say /pal/ backwards? Answer /lap/.

One way of determining pre-reading phonological awareness is to look at illiterate adults. Adrián, Alegria and Morais (1995) compared 15 illiterate Spanish-speakers with a group of rudimentary readers. They gave them a series of different phonological tasks, listed above.

They found that the illiterates performed well on the discrimination task, but poorly on those tasks that required conscious awareness of phonemes (matching, monitoring, deletion and reversal). Adrián *et al.* concluded that this indicates that before exposure to an alphabetic script Spanish-speakers do have some phonemic awareness, although they are not yet able to directly manipulate individual phonemes. The illiterates also showed some ability to manipulate syllables and rhymes. This suggests that Spanish-speakers have some 'explicit' awareness of larger units before they learn to read and write. However, although the illiterate's awareness of syllables and rhymes was more sophisticated, their performance on these tasks was surprisingly low. One possible explanation is that the adults were not given enough time between tasks. If this is the case, then we must be wary of drawing strong conclusions as to what this study tells us about illiterate Spanish adults' phonological awareness.

Jiménez (1992) conducted a study to determine the nature of Spanish pre-readers' phonological awareness, but did not compare their performance on different tasks statistically. He gave four- and five-year-olds a series of phonological tasks, listed below.

Task	**Unit**	**Example**
Deletion tasks	initial and final-syllable	'*boca*' → '*/ca/*', '*boca*' → '*/bo/*'
	Vowel onset phoneme	'*oveja*' → '*/o/*'
Detection tasks	initial- and final-syllable	Which word begins with '*tam*'? *saco, tambor, barca*
	Initial and final vowel and consonant phonemes	Which word begins with '*/i/*'? *indio, reloj, pipa, chorro*
		Which word begins with '*/g/*'? *foca, gallina, tractor, dado*
Recognition tasks	Initial-, middle- and final-syllables	Does the pair of words share a syllable? *caña, carro; machete, lechero; sopa, pipa*
Counting tasks	syllables	*caballo* = three syllables, */ca/ /ba/ /llo/*
Blending tasks	syllable	blend *po – ta – je* to give '*potaje*'

However, he does tell us that children were best at the syllable counting task, followed by syllable blending, vowel detection, syllable detection, initial-syllable recognition, final-syllable recognition, consonant detection, syllable deletion, medial-syllable recognition, vowel deletion, with children scoring worst on the initial-syllable deletion task.

These results suggest several things. Spanish monolingual children appear to find syllable awareness both easy (counting, detection, blending, syllable-initial recognition) and hard (deletion, syllable-medial recognition). Similarly, the results concerning vowel phonemes seem to be ambiguous. On the one hand, children are poor at deleting these phonemes, but on the other hand they are good at detecting which words begin or end with these phonemes. Their consonant awareness was apparently quite poor (detection task).

Jiménez's results appear to be contradictory. He found awareness and lack of awareness of both syllables and phonemes. He fails to explain why this might have occurred. One possibility is that he used different tasks (detection, deletion, blending, counting) to test for the awareness of the same unit. Generally, he found that those tasks involving the direct manipulation of sounds were harder than those involving recognition of sounds. It is possible that the different types of task tap into different forms or levels of phonological awareness (see Chapter 3.1.vi). The contradictions in the findings may be caused by the different cognitive demands of the various tasks. However, his results indicate that Spanish children have some awareness of both syllables and vowel phonemes before they learn to read.

The results concerning vowel awareness are particularly interesting, since English children do not show awareness of phonemes until they begin to read (see Section 2.1.i.a). However, many of the vowels children were asked to detect (or delete) were in fact word-initial syllables. Any results concerning these particular exemplars tell us just as much about the child's syllable awareness as they do about their vowel awareness.

A further criticism of the study is that the detection tasks for vowels and consonants are not really comparable. The task required children to determine which of three words began with a particular consonant (consonant task) or a particular vowel (vowel task). However, in the vowel task there was only one vowel onset; the other two words began with consonants (e.g. *indio, pipa, reloj*). Hence in the consonant task, the child is being asked to discriminate consonants from other consonants, whereas in the vowel task they are being asked to discriminate vowels from consonants.

Finally, since Jiménez did not perform analyses to determine whether the differences in performance on each task were statistically significant, we cannot draw any strong conclusions concerning Spanish-pre-readers phonological awareness from his study.

Carrillo (1994) compared children's awareness of different units to decide whether or not they had achieved "analytical" (or 'metalinguistic') awareness before they learn to read. She gave kindergarteners (who had not yet started reading) and first-grade children (who had started reading) a variety of phonological awareness tasks, some of which required the direct manipulation of sounds and some of which did not. The tasks given are listed below.

She found that the first graders, who had started to read, performed equally well on all of the tasks, regardless of their cognitive demands. Kindergarteners, who had not, had difficulties with the 'total segmentation', 'reversal' and 'onset deletion' tasks. Carrillo concludes from these findings that two different types of awareness must exist, one more "holistic" and one more "analytical"[4]. "Holistic" awareness, which involves the ability to discriminate sounds, precedes learning to read. "Analytical" or "segmental" awareness, on the other hand, requires exposure to the alphabetic code.

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[4] The terms "holistic" and "analytical" found in the Spanish literature are the equivalents of the terms "epilinguistic" and "metalinguistic" awareness (respectively) that are found in the English literature (see Chapter 3.i.vi).

Task		Unit	Example
Oddity	1.	coda	*pan, dan, mal, san*
	2.	onset	*sol, voz, son, sor*
	3.	peak	*pez, tez, vez, coz*
Position segment identification	4.	onset	where is the /a/ in *ajo*?
		peak	
		coda	
Deletion	5.	coda	*dos* → /do/
	6.	onset	*pan* → /an/
Isolation	7.	onset	*mar* → /m/
	8.	coda	*sol* → /l/
Total segmentation	9.		*mar* → /m/ /a/ /r/
Reversal segmentation	10.		*sol* → /l/ /o/ /s/

There is at least one inconsistency in this conclusion. Several of the tasks that the kindergarteners performed well on required the direct manipulation of sounds: they could delete a coda, a rime, and a body unit (tasks 5, 7 and 8). Therefore, pre-reading children do have some segmental abilities. Is this, then, not a sign of "analytical" awareness in pre-readers?

Various other interesting conclusions, which Carrillo does not mention, can be drawn from the data. From the results we can see that, unlike English children, Spanish children do have phonemic awareness before they begin to learn to read. They are aware of onsets, peaks and codas. Not only can they discriminate these (tasks 2, 3, and 1, respectively), and identify them (task 4), but for the onset and coda they can also directly manipulate them (tasks 7 and 8)[5]. The only thing they cannot do is segment the word into its individual phonemes, or reverse these segments.

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[5] No task involved the isolation of the peak, so we do not know whether children are capable of this or not.

The kinds of segmentation tasks they can manage also tells us something about the way in which Spanish children might view the syllable unit. In English, as we have seen, it seems natural for children to break up the syllable into an onset and a rime unit. The data collected by Carrillo suggest that this is not the natural break for Spanish children. They can delete the coda of a word, i.e. they can produce the body unit (task 5); and they can produce the coda of a word, i.e. they can delete the body unit (task 8); but they cannot delete the onset of a word, i.e. produce the rime unit (task 6). This suggests that the Spanish syllable is broken into the body and the coda, not the rime and onset.

The fact that children are capable of producing the onset, i.e. of deleting the rime (task 7) appears to contradict this theory. However, it need not for two reasons. Firstly, producing an onset might be easy because it is simply the first sound of the word. Secondly, it is very hard to produce a consonant onset without producing the vowel that follows it; for example, produce a /p/ without proceeding it with some sort of vowel sound. Hence, in the onset isolation task, it is possible that the children were in fact producing the body unit.

2.2.i.b The body as a linguistically salient unit

Vernon (unpublished) looked at word segmentation by kindergarten and first grade children (age 5-6yrs), who were on the brink of reading and spelling. She asked children to segment words orally, and to put one token for each segment telling them that the more tokens they used, the better. She found a developmental trend in children's ability to segment words. At first, they repeat the vocalic nucleus (e.g. *mole* → /mo/-/o/-/le/ or *sol* → /so/-/ol/), keeping the body intact. In the next stage, they isolate the coda (e.g. *sol* → /so/-/l/), once more keeping the body intact. In the following stage they anticipate the onset of the second syllable (e.g. *mole* → /mo/-/l/-/le/), again keeping the body intact. In the

following phase they isolate parts of the second syllable; they will segment whatever comes after the initial body (e.g. *mole* → /mo/-/l/-/e/; *pan* → /pa/-/n/), yet again keeping the first body intact. It is not until the final phase that children are willing to segment the syllable entirely (e.g. *mole* → /m/-/o/-/l/-/e/; *sol* → /s/-/o/-/l/), finally splitting the onset from its proceeding vowel in both syllables. Hence, they have grave problems in splitting the onset from the rest of the syllable.

However, this finding is hardly surprising, since in all of the instances given the body (onset-plus-vowel) is in fact the initial syllable of the word, so we could equally argue that it is the child's reluctance to break up initial syllables that causes the developmental progression. It would be interesting to see what would happen if the child were asked to segment words that contained CVC initial syllables. Vernon does not offer us data with which to answer this question.

Nevertheless, the data that she presents still provide us with evidence that Spanish-speaking children perceive the body as a cohesive unit, and that they do not readily separate onset and vowel phonemes. It indicates that, although segmentation of the onset seems to be a natural intermediate step towards phonological segmentation in English-speaking children, this does not seem to be the case with Spanish-speakers. As languages differ in their phonological structure, so too we must expect some differences in the acquisition of phonological knowledge.

Structural differences between English and Spanish may explain why children adopt different approaches. The majority (56%) of Spanish syllables have a CV structure (Borzone de Manrique and Signorini, 1994). Only 20% of syllables have a CVC structure. Therefore, simply from looking at the phonological structure of the language it seems quite obvious that the onset and rime units are not the most salient candidates for phonological underpinning in Spanish. If the majority of syllables are CV syllables, then it seems far

more likely that the children would encode this whole syllable, which corresponds to the body unit.

2.2.ii Summary

From the research discussed above it would appear that Spanish children are aware of syllables before they learn to read.

It is tentatively suggested that the syllable is internally organised at the body-plus-coda level rather than as an onset-plus-rime. However, this suggestion is difficult to distinguish from the possibility that the salient unit is in fact the syllable, since in the majority of Spanish words the body corresponds to the syllable.

Nevertheless, there does appear to be a difference in the way Spanish and English syllables are phonologically underpinned. However, no research, to our knowledge, has looked specifically at onset and rime awareness in Spanish, so no strong conclusions should be drawn.

The research also indicates that Spanish-speakers possess phonemic awareness before they begin to read, albeit limited amounts. In particular, vowel phonemes seem more accessible than consonant phonemes.

One over-riding problem with the Spanish literature is that, to our knowledge, the majority of research has failed to test systematically for awareness of the various phonological units. Instead, the studies use different methodologies to examine the awareness of the various phonological units, thus confounding unit type with task. This makes it very hard to draw strong conclusions as to the nature of phonological development in Spanish. In order to clarify the issue, the same methodology is used here in testing for the awareness of various phonological units.

2.3 CONCLUSIONS AND QUESTIONS

We have seen how English and Spanish have different linguistic structures. We have also seen indirect evidence that English- and Spanish-speakers do not analyse their languages in exactly the same way. Our review of the literature indicates that the pattern of development of phonological awareness appears to be similar in both languages. We have seen how awareness (at least in an implicit form) of large units, such as syllables, develops before awareness of small units, such as phonemes. This is true for both languages. Furthermore, awareness of intra-syllabic units (onset, rime, body and coda) is intermediate between awareness of the larger and smaller units. This is also true for speakers of both languages. However, the literature also hints at the possibility that the extent of awareness of each unit is different in each language. English-speakers are particularly sensitive to onsets and rimes, but show a lack of awareness of phonemes. Spanish-speakers, on the other hand, find syllables particularly salient, and there is some evidence that phonemes are accessible at a pre-reading age.

However, although comparing the literature in each language may hint at differences in the extent of English and Spanish children's awareness of each phonological unit at different developmental stages, this proposition is purely speculative. Comparing the literature can really only tell us about differences in developmental trends between languages. To determine whether or not the exposure to different phonological systems entails differences in the extent of phonological awareness of each unit requires a systematic and direct comparison of phonological awareness in each language.

The first main aim of this thesis is to determine whether exposure to different languages, and hence to different phonological systems, entails differences in phonological awareness at the same stage in development.

From the differences in linguistic structure between English and Spanish, listed in Section 2.2, and from a comparison of the English and Spanish research, we can make

predictions about the relative salience of the different phonological units in English and Spanish.

2.3.i Syllables

Work in Spanish has focussed on the salience of the syllable unit. However, both English and Spanish-speakers appear to be aware of this unit before they learn to read, so it is difficult to say whether a relative difference in awareness would be found between the groups. However, syllables have clear-cut boundaries in Spanish, whereas their boundaries are more 'murky' in English. Their relative distinctness in Spanish may make them more salient than they are in English.

2.3.ii Intra-syllabic units

When it comes to intra-syllabic units the differences in phonological awareness across languages becomes more apparent. There is a lot of evidence that rimes are salient units in English. The dearth of experimental research on rime awareness in Spanish, on the other hand, may be a reflection of its insignificance in this language. Instead, studies examining Spanish-speakers' awareness of intra-syllabic units suggest that they split the syllable unit into a body and a coda. However, since, to our knowledge, no one has examined the internal structure of the Spanish syllable it remains unclear whether the rime unit is psychologically underpinned or whether it is the body or syllable unit that children are most sensitive to. Since most syllables are open in Spanish, Spanish children are not exposed to rimes (or at least VC rimes of CVC syllables) as frequently as are English children. Hence, we would predict that rimes might be less salient in Spanish than they are in English.

2.3.iii Phonemes

Spanish children show some phonemic awareness before learning to read. The evidence that the same is true for English children is questionable. Furthermore, a comparison of the linguistic structure of English and Spanish suggests that vowel phonemes would be more salient in Spanish than English, because of their relative phonetic stability.

However, one of the major problems with studies looking at phoneme awareness in both English and Spanish is that they have failed to distinguish between different types of phoneme. In particular, they have failed to distinguish between consonant and vowel phonemes. Different phonemes may be salient to different extents, and their relative salience may differ across languages. Salience could be dependent on factors such as the acoustic-phonetic properties of the phoneme; we may be better at picking up certain acoustic-phonetic cues than others. Those phonemes that contain these will be more easily detectable. It might be how crowded a phoneme's portion of acoustic-phonetic space is that determines salience. If there are a number of phonemes that share many acoustic-phonetic properties, then distinguishing between them might be difficult, and hence their salience will decrease. Alternatively, it might be the extent with which phonemes vary according to the context in which they are found that affects people's awareness of them. People might be less aware of phonemes that have many allophones (variants of the same phoneme) than those that have few. Alternatively, salience may be dependent on the interaction of these three factors.

One of the aims of this thesis is to examine more carefully the development of phonemic awareness in children, by explicitly looking at the awareness of consonant and vowel phonemes.

2.3.iii.a Vowel awareness

Vowel phonemes have not been studied in nearly as much depth as consonant phonemes, particularly in English. The vast majority of research has equated 'phoneme awareness' with 'consonant awareness', disregarding the possibility that there may be differences in the awareness of these two types of phoneme. Vowel phonemes are of particular interest to us because of the differences in the acoustic-phonetic properties of vowels in English and Spanish. Whereas English has up to 21 vowel sounds (depending on accent), Spanish has only five (O'Connor, 1973). The difference in the number of vowel sounds in each language may make them salient to different extents in each language. It is predicted that the fewer the number of vowel sounds, the more likely a child is to be aware of them.

2.3.iii.b Consonant awareness

When examining consonant awareness, researchers have mainly ignored the fact that there are four principle consonant types: stops (/p, t, k, b, d, g/), fricatives (/s f v θ ð ʧ z h/), nasals (/m n ŋ/) and liquids (/l r/). These consonants are distinguished by their differing acoustic-phonetic properties. For example, nasals are characterised by the flow of air being blocked in the oral cavity by the lowering of the soft palate, and thereby being deflected through the nasal cavity. Stops on the other hand, are characterised by the air-stream being obstructed completely. More specifically, there is a rapid release of compressed air leading to a short, sharp explosion (O'Connor, 1973, Ch. 5). Given that the four consonant types differ in their acoustic-phonetic properties, it might be that some are more readily perceived than others. Furthermore, the extent to which children are aware of them might differ across languages, in accordance with the differing acoustic-phonetic properties each consonant type has in each language.

However, in contrast with vowel phonemes, English and Spanish share many of the same consonants. There are 24 consonant phonemes in English and 20 consonant phonemes in Spanish. The two systems are constructed similarly: both make voiceless/voiced distinctions in their stops (/p t k/ vs. /b d g/), both distinguish two glides (/j w/) and three nasals, and there is much direct overlapping in that /p t k b d θ r j w f m l s ʧ n g / occur in both, (Stanley Whitley, p.16).

Nevertheless, some shared phonemes have different articulations in each language. For example, /t d/ are alveolar in English but dental in Spanish. There are also consonant sounds that exist in Spanish but not in English (/ɲ/, as in '*España*'; /x/, as in '*jarra*' – between the 'ch' of '***Bach***' and a raspy /**h**/; /ɹ/ vs. /r/, as in '*caro*' vs. '*carro*'; /ʎ/ as in '*pollo*' – a bit like a mix between an English /l/ and /j/). There are also consonant sounds that exist in English but not in Spanish (/v, ð, z, ž, ʧ, ʤ, h, ŋ/). Nevertheless, in general the two systems are constructed similarly and there is direct overlapping for the majority of consonants (Stanley-Whitley, Ch. 2, pp. 16-17).

Hence, one would not expect the differences in consonant awareness between languages to be as great as those for vowel awareness, simply because the consonant systems of each language are much more similar to one another than are the vowel systems.

Treiman and Baron (1981) were interested in whether English-speaking children are more aware of certain types of consonant than others. They asked pre-school and kindergarten children to isolate the initial phonemes of words. These words either began with consonants that can be pronounced in isolation, such as fricatives (e.g. /f/, /s/), or, they began with consonants that require a proceeding vowel when pronounced, such as stops (/b/ or /k/). They found that children are significantly better at isolating onset consonants that can be pronounced in isolation than they are at isolating onset consonants that cannot

be pronounced in isolation. This suggests that they are more aware of certain consonants than others.

In Spanish, Jiménez González & Haro García (1995) were interested in the effects of word linguistic properties on phonological awareness. They looked at pre-school and kindergarten children's ability to isolate word-initial consonants. The children found it easier to isolate consonants that can be pronounced continuously (fricatives, nasals and liquids) than to isolate consonants that cannot (stops).

However, to our knowledge, these are the only experiments that have distinguished between different types of consonant when examining phonemic awareness. In both experiments, the only consonants to be contrasted were stops and fricatives. Hence, we do not know whether it is because stop consonants cannot be pronounced in isolation that they are harder to isolate than fricative consonants, or whether it is some other linguistic property that makes them difficult to isolate. Furthermore, we do not know where nasal and liquid consonants stand in this issue. Finally, being aware of a consonant does not necessarily require an ability to isolate it from the rest of the word. The studies in this thesis concerned consonant awareness as opposed to the ability to directly manipulate these phonological units. Hence, we wanted to further examine the role consonant type might play in phonemic awareness for speakers of each language.

2.3.iii.c Awareness of word-medial consonants

Another area that the literature of both languages has ignored is the awareness of consonants in the middle of words. The awareness of these consonants might be influenced by the way in which you split a word up into its constituent elements. In other words, whether or not a consonant is perceived might be effected by the hierarchical organisation of the word's internal structure.

There is some evidence of this with consonants found at the beginning (onsets) and at the end (codas) of words. Treiman (1985) was interested in whether children treat the onset as a unit. She theorised that children would be less aware of the first consonant of a word when that consonant belongs to a cluster than when it does not. Four-to-six year-old children were told that a puppet only likes words that begin with a certain sound. She then presented children with words, (all of which started with the target sound), that either started with singleton onsets or consonant clusters. She found that children had more difficulty in recognising a target consonant when that consonant was the first consonant of a consonant cluster than when it was a singleton. For example, children find it easier to recognise that 'sem' begins with a /s/, than to recognise that 'sme' begins with a /s/.

Barton, Miller and Macken (1980) also found that some children treat initial consonant clusters as units. When asked to provide the first sound of 'swing', for example, they would say '/sw/' rather than 's'. However, when asked to provide the first sound of 'sing' they would always say '/s/', rather than '/sI/'.

In a similar study, Treiman and Weatherston (1992) found that pre-school and kindergarten children had more problems isolating the first consonant of a consonant cluster onset than they did in isolating a singleton onset.

Furthermore, children find it harder to identify the second sound of a word if it is the second consonant of a consonant cluster. For example, children find it harder to identify the /l/ in 'blee' than in 'alee'. Therefore, for word initial consonant clusters at least, it is the second consonant of the cluster that children have problems with.

However, the opposite seems to be true for word final consonant clusters. Rather than the second consonant being the one that gets "ignored", it is the first consonant that children have problems with. For example, children find it harder to identify the /n/ in 'sink' than in 'tiny'. This is presumably because they treat the final consonant cluster as a

unit: the coda. Hence, word position has an influence on how consonant clusters are analysed by children.

All of these studies looked at double-consonants that are consonant clusters. The theory is that if two consonants form an onset or a coda unit, then children will have difficulty in perceiving the individual components of this unit. In other words, a child's hierarchical internal organisation of a word's structure influences her or his ability to 'hear' the component sounds of that word. An interesting question that arises from this theory concerns how children will perceive double-consonants found in the middle of words. These consonants are of particular interest because of the different 'phonological unit status' they can hold within a word. A word-medial double-consonant can either belong entirely to one of the word's syllables, in which case it would constitute either a second syllable consonant cluster onset (e.g. sa-ffron), or a first syllable consonant cluster coda (e.g. post-age). Or, it could be split between the word's syllables. In this case, the double-consonant would be a singleton onset of the second syllable and the singleton coda of the first syllable (e.g. den-tist).

The choice of where to place the syllable boundary of a word might have an influence on the ability to analyse it into its constituent phonemes. If the double-consonant is part of an onset consonant cluster, then the first consonant may be easier to detect than the second (e.g. the /f/ in 'sa – ffron'), as was found in the above studies. If it is part of a coda consonant cluster, then the second consonant may be easier to detect than the first (e.g. the /t/ in 'dent – ist'). If, on the other hand, the double-consonant is split between syllables, then the first consonant would be a singleton coda and might be harder to detect than the second consonant, which would be a singleton onset (e.g. the /t/ in 'den – tist' would be easier than the /n/).

2.3.iv Stress and word position

Each phonological unit may be found in different positions within a word, and it may be found either in a stressed or an unstressed syllable. The majority of researchers have concentrated on phonological units found in stressed syllables, and often in word- or syllable-initial positions. Where researchers have broken with tradition, they have found that both word-position and stress influence phonological awareness.

In Spanish, Domínguez (1996) found that phoneme identification was easier for word-initial phonemes (onsets) than for word-final phonemes (codas), (although phoneme addition or deletion was easier for codas than for onsets).

In English we know that consonant sounds in word initial positions (onsets) are the easiest to detect, followed by consonant sounds in word final positions (codas), with those sounds found in the middle of words being the hardest to detect (Kirtley *et al.*, 1989; Skjelfjord, 1987; Zhurova, 1963-4).

The present investigations examined further the role that stress and word-position may have on the awareness of phonology. In particular, since Spanish is not a stressed-time language, there is relatively little difference between the pronunciation of stressed and unstressed syllables in Spanish as compared to English. Hence, we predicted that stress may play a lesser role in phonological awareness in this language than in English.

2.3.v Bilingualism

The work conducted in English and Spanish show that phonological awareness might differ in speakers of these two structurally different languages. This possibility raises some interesting questions for the development of phonological awareness in bilingual children. Do they act like two monolinguals in one person, or is their awareness of phonology in each language influenced by their exposure to, and consequent possible

differences in, their awareness of the phonology of each of their languages? Below we examine the various alternative possibilities.

2.4 PHONOLOGICAL AWARENESS AND BILINGUALISM

The second main aim of the thesis is to determine how being exposed to two linguistic environments - in other words, how being brought up bilingual - influences phonological awareness. In this section we will propose four possible alternatives of the way in which this may occur. We will then discuss the research conducted in this area, and finally, we will discuss how the evidence from monolingual studies helps us predict how phonological awareness develops in Spanish-English bilingual children.

How might bilingual children's phonological awareness develop? Firstly, relatively limited exposure to each language (in comparison with monolinguals) might result in limited phonological awareness in each language. The second alternative is that phonological awareness might be the same for bilingual children in each language as it is in monolingual children for each respective language.

The third possibility is that bilinguals will pay special attention to the form of language, which might enhance their development of phonological awareness in comparison with monolinguals. Hence, if monolingual children of different linguistic backgrounds are aware of different phonological units to differing degrees, bilingual child might transfer phonological awareness across languages, and consequently show relatively more phonological awareness in each language than their monolingual counterparts. This would only occur for those units that are made relatively more salient in one of their languages than in the other. For example, if syllables are more salient in Spanish than in English, bilingual children should show greater awareness of them in English than their English monolingual counterparts because they could use their knowledge of Spanish

syllables in English. If syllables are equally salient in English and Spanish, then one should find no differences in bilingual and monolingual children's awareness of syllables in either language.

The fourth possibility is that bilingual children might focus more on the phonological structures of each of their languages in order not to confuse them. This would enhance their development of metalinguistic abilities (Galambos and Goldwin-Meadow, 1990). Hence, rather than an increased phonological awareness being purely a consequence of the structures of the languages to which these children are exposed, it might be more global. They might show more awareness, not only of those units in L1/2 that are particularly salient in L2/1, but of phonology as a whole.

Simply from speaking to a few bilinguals the first possibility can be discarded. The second and the third and fourth possibilities distinguish between whether the bilingual person is the 'sum' of two monolinguals (possibility 2) or a specific speaker-hearer in his or her own right (possibilities 3 and 4), (Grosjean, 1985).

Given that bilingual children are exposed to two different phonetic systems, it seems unlikely that they will use the same processes in speech production and perception as their monolingual counterparts in each language. From a linguistic perspective, there is some evidence that they do not do this. Watson (1991; see his chapter for an excellent review of this work) argues that the limited evidence available suggests that

> "...there may genuinely be more variability in the perceptual use of acoustic cues by bilinguals. ...bilinguals modify the same variables in the production of both their languages as monolinguals, within approximately the same limits, but within these limits the details of their use of these variables may differ. Their perceptual use of acoustic cues to phonemic identity may differ, although it may be less that they use different cues, than that they attribute different weightings to them." (pp. 43-44).

Although far more detailed study of the responses of bilinguals to different cues is needed before clear conclusions can be drawn, at present we have good reason to believe

that bilinguals analyse their languages differently from monolinguals. The suggestion is that the bilingual is a specific speaker-hearer in her or his own right.

Linguistic evidence, thus, advocates the rejection of the second alternative possibility. However, it does not distinguish between possibilities three and four. Bialystok (1996) argues for alternative four. She says that bilingual children take a more analytical approach to language than do monolingual children. The bilingual child lives in a world of two phonologies that cannot be used interchangeably. Consequently, it is important that bilinguals learn to separate or distinguish between the phonological systems of each language if they are not to sound foreign (production), or fail to understand what is being said to them (perception). The need to navigate constantly between two linguistic environments might make the child focus on the distinctive features of the linguistic structures of each language. Watson agrees. He too argues that "...exposure to two different systems [helps you in] focusing attention on those features which are most distinctive in each language." (p.43).

Bialystok (1996) studied French-English bilingual children's developing awareness of phonology from kindergarten (5yrs) through second grade (7yrs). She asked children to replace the initial phoneme of one word with the initial phoneme of another word under three different conditions. In the first condition the words and sounds were given orally to the child (take the '/c/' of '*cat*' and replace it with the '/m/' of '*mop*'); in the second condition the children were given pictures of the objects (to reduce the load on working memory) but the sounds were not provided for them; and in the third condition, no cues were given. She found that the bilingual children, at all ages, performed well under all three conditions. Monolinguals, on the other hand, performed best on the oral task and worst on the 'no cues' task, with performance on the picture task being intermediate. Furthermore, the differences between the different conditions decreased as age increased. Bialystok took this as evidence that bilingual children approach language in a different way

from monolinguals, and are far more analytical right from the outset; whereas the monolingual children needed help in analysing the phonemes of the words, the bilingual children did not.

Notice that Bialystok is arguing here for a qualitative and not a quantitative (which is what alternatives 3 and/or 4 above would predict) advantage for the bilinguals. She claims that they are more able to manipulate sounds directly (phonemes in this instance) than their monolingual counterparts.

Although Bialystok mentions that even the youngest bilingual children performed well on the task, she does not compare performance across the groups and so we cannot tell whether the bilingual advantage is quantitative as well as qualitative. We have no information as to whether the bilinguals' performance was better overall than the monolinguals, which would have demonstrated a phonemic awareness advantage.

Campbell & Sais (1995) compared phonological awareness in English-Italian bilinguals and English monoglot children. The two groups of 'rising fives' were given an onset oddity task, a morpheme deletion task (e.g. 'ice-cream' → 'cream'), a syllable deletion task and a letter detection task. They found that the bilingual children performed better on all of the tasks apart from the letter detection task. They took this as evidence that exposure to a second language increases your phonological awareness. However, as they point out, it is unclear whether the bilingual children's advantage is a consequence of their exposure to Italian in particular, as opposed to another language. The syllabic and phonological structure of Italian is more regular than that of English. It is possible that "Italian presents the pre-schooler with a simpler, more reliable 'test-bed' for the development of [phonological] skills." (Campbell and Sais, p.67).

Cossu, Shankweiler, Liberman, Toal and Katz (1988) (reported in Campbell and Sais, 1995) compared the performance of Italian bilinguals with that of American monolingual children on a variety of phonological tasks. They also found that, although

the bilingual children showed a similar pattern of development as the monolingual children, they achieved competence on many of the phonological tasks one year ahead of the Americans. Interestingly, these bilingual children were bilingual in Italian and Sardi, suggesting that the increased phonological awareness is a consequence of being exposed to two languages rather than (or as well as) the possible benefits of being exposed to Italian in particular. Hence, there is some evidence that exposure to two languages enhances the quantity as well as the quality of phonological awareness.

The above investigations were carried out on French-English, Italian-English and Italian-Sardi bilingual children. We were interested in whether a phonological advantage exists in Spanish-English bilingual children. Cisero and Royer (1995) conducted a study in which kindergarten and first-grade Spanish-English bilinguals were given rime, onset and coda detection tasks in English and Spanish. They found that performance was significantly faster and more accurate on the rime task than the phoneme tasks, and that, although performance on the onset task was better than on the coda task, this difference did not reach significance. Moreover, the first-grade bilingual students made larger accuracy gains in the initial and final phoneme detection tasks than on the rime task. This suggests that there is a developmental progression that begins with the awareness of rime and moves onto the awareness of onsets and then codas, just as is the case with English monolingual children. However, Cisero and Royer fail to tell us how the bilingual children's performance compared to that of their monolingual counterparts. Hence, we only have evidence that Spanish-English bilingual children's phonological development mimics that of their monolingual counterparts in terms of size of unit, but we do not know whether there are any differences in terms of degree of awareness of each unit. As mentioned in Section 2.1.v, what is truly of interest is bilingual children's phonological awareness relative to that of their monolingual counterparts in each language.

If we argue that some form of transfer of awareness occurs, the research conducted into monolingual children's awareness of phonology allows us to make some tentative predictions as to how bilingual children's awareness develops. As discussed in Sections 2.3.i and 2.3.iii, we predict that syllables and vowels will be more salient to Spanish-speakers, whereas rimes will be more salient to English-speakers. Hence, we expect bilingual children to show more awareness of English syllables and vowels than English monolingual children, and more awareness of Spanish rimes than Spanish monolingual children. We examine the relationship between monolingual and bilingual phonological awareness in more detail in this thesis.

CHAPTER 3

READING

Learning to read in different orthographies may give rise to different orthographic representations (Wimmer and Goswami, 1994). The level of phonology that underpins the orthographic representations that young children are developing may vary according to the phonological units that each language makes salient, and the level of phonology that is consistently and systematically represented in the orthography. The third main aim of this thesis is to determine how the relationship between phonological awareness and literacy differ as a consequence of linguistic background.

This question is further split into three parts. The first issue of interest is how phonological awareness and literacy are related at a general level. The second issue is how phonological awareness and literacy are directly related. In other words, we aim to determine to what extent each group uses grapheme-phoneme correspondences (GPCs) at different stages in reading development, and whether these correspondences are similar for both vowel and consonant phonemes. The final question concerns whether bilingual children acquire literacy in the same way as their monolingual counterparts. More specifically, we ask whether bilingual children use their knowledge of the phonology of each language to help them read and spell in both languages.

In this chapter we review the research conducted on reading in monolingual children and discuss the differences in Spanish and English children's approaches to reading. We then review some research conducted on bilingual reading and look at how monolingual reading might affect bilingual children's reading strategies.

3.1 READING IN ENGLISH

3.1.i Predictive studies

We have already seen how the awareness (albeit implicit) of rime, and to a lesser extent onset, is something that appears to develop naturally in English-speaking children at an age before they start to learn to read. If this is a natural unit for the child to break words into, then it is possible that they use this unit to help them learn to read. They might note that many words that rhyme (and consequently share a rime) also share the same spelling sequence. This would indeed be a particularly efficient and effective way of learning to read[1], since learning the pronunciation of sequences of letters would give rise to faster reading than having to learn the spelling of each individual word. Is there any evidence that suggests that children use their pre-reading knowledge of rime to help them learn to read?

One way of looking at whether onset and rime are related to reading ability is to look at whether children's awareness of these units before they begin to learn to read is predictive of their future reading ability. Of course, the evidence discussed in Chapter 2.1.i.a also suggests that children do become aware of phonemes once they start learning to read. This awareness might, in turn, have an influence over future reading skill. Hence, it would also be interesting to look at the predictive value of phonemic awareness in children's reading. Stuart and Coltheart (1988) conducted a study encompassing all of these phonological units, which we describe below.

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[1] especially given the nature of the English orthography; see Section 3.1.iv.

3.1.i.a Phonological awareness as a predictor of reading skill.

Stuart and Coltheart (1988) were interested in whether pre-reading phonological awareness is related to future reading ability. They conducted a longitudinal study that lasted four years and began when the children were just four-years-old. They gave these four-year-old kindergarten children a battery of phonological awareness tasks which included rhyme production, rhyme oddity, final syllable and final phoneme production, and onset oddity. Over the following year, when the children entered school, they were given letter sound (what sound does this letter make?) and letter name (what is the name of this letter?) tests at intervals of two months, and their reading errors were also looked at. One year after the initial phonological awareness tasks (at the end of their first school year when they were five-and-a-half-years-old), Stuart and Coltheart looked at how their phonological awareness had developed by administering the same tasks to the children. Over the second school year their letter-sound knowledge was again repeatedly tested, a standardised reading test administered, and further reading error data was collected. In the children's third and fourth years at school reading tests were given.

Stuart and Coltheart found that children's pre-school phonological awareness, in conjunction with their letter-sound knowledge predicted their reading age, even within the first year of schooling, and continued to do so until the very end of the study when the children were eight-years-old. This is a very interesting finding. The only problem is that Stuart and Coltheart chose to analyse their data by lumping all of the phonological awareness tasks together to look at their joint ability to predict reading skill. This is a limitation because the study could have taught us which types of awareness (whether syllabic, phonemic or onset/rime) were most predictive of future reading ability. Furthermore, they also fail to tell us whether phonological awareness was by itself a predictor of reading ability, or whether letter-sound knowledge was a crucial component of the predictive variable at each age. In fact, the first time the reading test was administered,

phonological awareness by itself did not predict reading age: it only predicted it in conjunction with letter-sound knowledge. This sheds doubt on the claim that phonological awareness and early reading are connected: from the data it would appear that phonological awareness has a stronger causal relationship with reading once the children have already started to read.

3.1.i.b Onset and rime as predictors of reading ability

MacLean, Bryant and Bradley (1988) were also interested in how pre-reading phonological awareness was related to future reading ability. They conducted a similar study to Stuart and Coltheart's but looked only at one type of phonological awareness: the awareness of the intra-syllabic units onset and rime. They asked whether three-year-old children's knowledge of nursery rhymes was related to their awareness of rhyme and alliteration (onset and rime) and how this, in turn, was related to initial reading ability. Controlling for differences in parental background and education and the children's IQ, they found that even three-year-old children had some awareness of both rhyme and alliteration, although there were large individual differences. Most interestingly, they found that three-year-olds' knowledge of nursery rhymes was a strong predictor of their onset/rime awareness over a year later. This suggests that it may be exposure to nursery rhymes that draws children's attention to the phonological unit 'rime' and consequently increases their awareness of it[2]. Furthermore, the three-year-olds' rhyme and alliteration (rime and onset) oddity task scores were related to the beginnings of reading words, but not to the recognition of alphabetic letters or mathematical skill. This is a good indication that onset and rime awareness are related to reading ability and that "...rhyming and alliterative

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[2] alternatively it is possible that those children with phonological (or at least onset and rime) awareness at an early age were more likely to remember nursery rhymes than children with less awareness.

skills play a greater part in learning about written words, and perhaps sequences of letters, than about isolated letters" (p. 35).

Bradley and Bryant (1983, 1985) also studied the predictive power of onset and rime awareness in reading. They conducted a longitudinal study in which 368 four-and-five-year-old children were tested on rime and onset awareness using the oddity task prior to learning to read. Three to four years later the same children were tested for reading (and spelling) ability. Bradley and Bryant found that awareness of onset and rime at four-and-five-years predicted their reading (and spelling) ability three-four years later. This is an important finding since these children had doubled in age at the time of re-test, and yet a significant relationship was still found.

Together these results indicate that pre-reading onset and rime awareness is related to future (early) reading ability.

3.1.i.c Phonemes as predictors of reading ability

If onset and rime awareness predict reading, does phonemic awareness have any extra influence?

Muter, Hulme, Snowling and Taylor (1997) looked at this. They conducted an experiment in which 38 three-and four-year-old non-reading children were given a variety of phonological awareness tasks, in order to determine the influence that each type of unit has on learning to read. At Time 1 the tasks given were:

1. Rhyme Detection: the children had to indicate which of three words (e.g. fish, gun, hat) rhymed with or sounded like a target word (e.g. cat).
2. Rhyme Production: children were asked to produce words that rhymed with each of two target words (day and bell), both words and non-words being permissible answers. The children were given 30secs for each of the target words.

3. Phoneme Identification: children were shown pictures of familiar objects that had one syllable names. The experimenter would provide the first two phonemes of the word (e.g. '/ca/') and the child was asked to "finish off" the word by providing the final phoneme (in this example '/t/').
4. Phoneme Deletion: The children were shown a picture of a common object and asked to say the word after removing the first phoneme. For example, they would be shown a picture of a bus and the correct response would be 'us', which is also a word in its own right.
5. Letter Knowledge: the children were asked to read the 26 letters of the alphabet.

At Time 2 (one year later) all of the above tasks were repeated, along with a phoneme blending task in which the examiner gave the constituent sounds of mono- and multi-syllabic words and non-words and the children were asked to "join them together to make the word". They were also given two different standardised reading tests.

At Time 3 (one year later) the same tests were given as in Time 2, with the addition of two arithmetic tests.

They found that the two rhyming tasks were highly correlated with each other but not with the phoneme identification, phoneme deletion and letter knowledge tasks (what Muter *et al.* refer to as the 'segmentation' tasks[3]). Similarly, they found that the 'segmentation' tasks were highly correlated with one another, but not with the rhyme tasks. From this they concluded that the tasks were tapping into two "distinct and more or less independent" (p. 386) underlying abilities, one related to rhyme awareness, and one to phoneme awareness. Furthermore, 'segmentation' ability at Time 1 and 2 was more highly correlated with reading (and spelling) abilities at Times 2 and 3, respectively, than were the

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[3] note that Muter *et al.* refer to these tasks as 'segmentation' tasks erroneously. Segmentation tasks can, in theory, involve splitting words across any boundaries (onset/rime, body/coda etc. etc.). Hence segmenting ability need not imply the ability to split words into their individual phonemes as Muter *et al.* try to imply.

rhyme tasks. This led the authors to conclude that it is 'segmentation' ability, and hence phoneme awareness, that is most important in the early stages of reading. It was not until the second year that rhyming ability started to exert an influence over reading (and spelling) ability. Indeed, reading ability at Time 2 predicted rhyming ability at Time 3 suggesting that learning to read promotes children's awareness of onset-rime boundaries within words, which in turn further develops their skills in dealing with rhyme relationships. Regression analysis showed that segmentation ability is a better predictor of reading (and spelling) ability than is rhyme awareness. Letter knowledge also correlated very highly, and was a good predictor of reading ability at Times 2 and 3, (and spelling ability at Time 3), independently of segmentation ability. Importantly, the product "segmentation x letter" knowledge made a specific contribution to reading (and spelling) ability over and above the sum contribution of each of these variables independently. Muter *et al.* argue that this product term is proof that "phonological linkage" is necessary for good reading and spelling. Knowledge of each of the variables separately is not enough; rather, in order to acquire literacy successfully, it is necessary to be aware of the relationship that holds between the phonology (phonemes in this instance) and the orthography (letters in this instance).

Muter *et al.* looked at the beginning stages of reading. Yopp (1988) conducted a very similar study with more advanced readers. She gave five-to-six year-old children tests of phoneme blending, segmentation, counting, isolation and deletion, a test of rhyming ability, and a 'learning test'. This latter test involved teaching the children to blend sounds to create words and was supposed to be a measure of reading performance.

Yopp carried out principal components analysis to examine the validity and reliability of the phonological awareness tests. She found that the phoneme blending, segmentation, counting, and isolation loaded highly on one factor. The phoneme deletion tests loaded heavily on a second factor. The two factors were highly correlated and seemed

to reflect two levels of difficulty rather than two qualitatively different kinds of skill. Rhyme ability was only minimally involved in these two factors, which led Yopp to suggest that rhyming ability might tap into a different underlying skill from these other tasks. The tests that loaded highly on the two factors were also highly correlated with the 'learning test', whereas the rhyming tasks did not correlate highly with this test. Yopp argues that this suggests it is phoneme awareness and not rime awareness that is related to reading ability. These results are remarkably similar to those of Muter *et al.*, and suggest that it is phonemic awareness that plays the most important role in reading at the early stages.

3.1.i.d Rimes or phonemes?

The findings of Muter *et al.* and of Yopp differ in two fundamental ways from Bryant's (and colleagues') findings concerning the importance of rime. Bryant and colleagues argue that rhyme ability is fundamental to reading ability, particularly at the beginning stages of reading. Phoneme awareness is also important, and its importance might increase as the child's reading improves (as they become more fluent readers), but phoneme awareness, and its relationship to reading ability springs from the initial awareness of rhyme that is being used. Yopp and Muter *et al.* argue that it is phoneme awareness that is influential in early reading ability; rhyme awareness is only marginally, if at all, influential. Why the contradictory findings?

The differences in the results might be a consequence of the different methodologies employed by each of the research groups. We will deal first with the Muter *et al.* study.

On the one hand, we have seen that some studies (see Chapter 2.1.i.a) have not found phonemic awareness in pre-reading children[4]. If Muter *et al.* are claiming that pre-reading phonemic awareness predicts reading ability, then they must have found some evidence of pre-reading phonemic awareness. If we look closely at their data we find that, in fact, the pre-reading phonemic awareness scores were generally extremely low: many children scored zero on these tasks. Hence, the few children who had acquired some (pre-reading) phonemic awareness were using this to help them learn to read. The majority of the children, however, who had no phonemic analysis ability could obviously not use phonemic knowledge to help them read. Children no doubt use phonemic knowledge in reading as soon as they acquire it. However, since a large quantity of research suggests that the acquisition of phoneme awareness does not occur until children have started reading, it is inevitably the case that at the initial stages of reading this type of knowledge cannot be employed.

The above reasoning might explain why Muter *et al.* found a relationship between phonemic awareness and reading, but it does not explain why no relationship was found between rime awareness and reading. There are several reasons why this might have occurred. Firstly, there were ceiling effects in Sessions 2 and 3, which make it impossible to compare the predictive power of the rhyme and phoneme tasks given in those two sessions. The conclusions drawn by Muter *et al.* about the relative significance of rhyme and phoneme segmentation measures in these two sessions should be discarded (Bryant, 1998). This might explain the lack of a relation in later reading, but what about rime awareness and early reading? The lack of relation can be explained by both the methodological procedure used and the analysis carried out on the data. In the rhyme

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[4] indeed, Bryant (and colleagues) agree that phonemic awareness is (extremely) important in reading, but argue that it can not have a great influence until after the initial stages of reading, simply because children do not become aware of phonemes until they have had some experience with the alphabetic script.

detection task the children were asked which of the three choice words "rhymes or sounds the same as" the target word. Bryant (1998) pointed out that in seven of the 10 trials, one of the choice words shared an onset with the target word. Muter *et al.* scored the data such that, if the child gave the choice word that shared the onset with the target word (as opposed to the rhyming word) they were scored as incorrect. This entails that many children might have been scored as incorrect on this task, even if they were giving an answer that was a legitimate interpretation of the instructions. Bryant therefore re-scored the children's choices in the rhyme detection tasks, counting as correct every choice of a word either with the same onset or the same rime as the target word. He found that, on scoring the data in this way, the Onset-plus-Rime score was a much better predictor of reading ability than the Rime score had been, and more importantly, "it compared favourably with the two phoneme measures in its predictive ability concerning reading and spelling" (p.33).

Therefore, Bryant's re-analysis suggests that both onset/rime and phonemic awareness are important for reading in English.

Similar methodological flaws can equally explain the discrepancies between the findings of Yopp and those of Bryant and colleagues. Yopp found that the children in the study who did well on the phoneme tasks also did well on her test of reading ability: the 'learning test'. This led her to the conclusion that it was phonemic, as opposed to rhyme awareness that was important for reading. There are two criticisms of this conclusion. Firstly, it is hardly surprising that the children scoring highly on the phonemic awareness tasks also did well on the 'learning test' since the majority of the phoneme tasks involved some form of blending or segmenting. The learning test was a measure of how easily children could learn to blend phonemes to create words, so both types of task were measuring the same ability. What is more, phoneme blending is not the only way (and in fact would, on its own, be an inadequate way) in which to read in English. Hence it is

questionable whether Yopp's 'learning test' is an adequate measure of reading ability, especially given that no standardised reading test was included in the study! Secondly, many of the children in the study scored at ceiling level on the rhyme task. This might explain the lack of correlation between the 'reading test' and rhyme awareness.

There is a second issue on which the studies of Muter *et al.* and Yopp differ from those of Bryant and colleagues. This concerns the relationship between awareness of phonemes and awareness of rhyme (rime). Muter *et al.* and Yopp claim that awareness of rhyme is unrelated to awareness of phonemes, whereas Bryant and colleagues argue that the two are, not only related, but causally connected. Rhyme awareness partly causes or leads onto phoneme awareness.

However, in both the Muter *et al.* and the Yopp experiments, the tasks involving phonemes are not necessarily directly comparable with the rhyme tasks. The segmentation tasks involved specific manipulation of the sounds in the words, whereas the rhyme tasks did not. It would appear that both of these authors have confounded a method with the unit for which they are trying to test. If strong conclusions want to be drawn concerning the role of the different phonological units in reading ability it is essential that the same tasks are used for each of the units. This would ensure that any differences found are truly caused by differences in awareness of the various phonological units, and are not simply artefacts of the different cognitive demands of the various tasks. For example, claiming that rhyme ability is distinct from phonemic ability is only possible if the same method is used to test for awareness of these two phonological units. If rhyme ability is found not to be correlated with phonemic awareness, or that they load on different factors, this provides more concrete evidence that different constructs might underlie them. Neither study did this. Hence neither study can be sure of their claim that rhyme and phoneme awareness are two distinct abilities.

3.1.i.e Prediction and cause

There are two final points that should be mentioned concerning possible general flaws in predictive studies. Firstly, although predictive studies do tell us something about the relationship between the awareness of phonology and reading, they cannot tell us exactly how children are reading. In particular, longitudinal predictive studies by their very nature require there to be a gap between the time at which the phonological awareness measures are taken, and the time at which the reading measures are taken. If a relationship is found then it is concluded that that type of phonological awareness is causally related to reading ability. However, this conclusion is too strong. We can not be sure which units are actually being used, since the studies do not directly look at this. One of the aims of this thesis is to examine more closely the direct relationship between the awareness of a particular unit and the ability to read and spell it.

The second point is that it could equally be that early phonological awareness causes something else, and it is this 'something else' that is involved in reading skill. In other words, children whose early phonological awareness is advanced are most likely to develop this awareness further and hence be equally 'ahead of the game' (in terms of phonological awareness) at the time when they begin formal schooling. If this is the case, they will have more to 'play with' to help them learn to read. Therefore, although studies show correlations between early awareness of various phonological units and future reading ability, our understanding of the mechanism(s) involved in reading remain sketchy.

To establish a direct causal link, we need to train the children in a certain phonological skill and then examine whether this changes their reading ability. We will look next at studies that have tried to do this.

3.1.ii A causal link between phonological awareness and reading

Bradley and Bryant (1983, 1985) conducted a training study to try and find a causal link between phonological awareness and reading. Over a period of two years they trained four groups of six- and seven-year-old children who were at least two standard deviations below the mean on sound categorisation scores and who could not read. The first group was taught to categorise objects with CVC names according to common onsets, peaks and codas (e.g. *pen*, *pip*, and *pot* all begin with /p/). The second group received the same training, only, in the second year of training they were taught as well how to represent the shared sounds of the words with alphabetic letters. The third group was taught nothing about sounds. Instead they were taught to classify things according to semantic categories. The fourth group received no training at all.

At the end of the two years, when the children were eight-years-old, the ones who had improved most were those in Group 2 (sound categorisation and alphabet). Although the children in Group 1 (sound categorisation only) were consistently three-four months ahead of the children in Group 3 (conceptual categorisation) in reading (and spelling), this difference did not reach significance. Indeed, the only group to improve significantly more than control Group 3 was Group 2. Therefore, despite Bradley and Bryant's claims for a strong suggestion "training in sound categorisation affects progress in reading and spelling", it is unclear as to what the crucial factor in improving reading and spelling capacities is. Is it the realisation that sounds are represented by the alphabet? After all, the only group whose reading (and spelling) improved significantly more than the control group was the group who were taught not only to categorise words according to the sounds they contain (in this case, phonemes), but also taught the explicit connection between these sounds and how they are represented by the alphabet. Or, do children require both sound categorisation and letter-sound training to improve? We cannot tell from this study, since there was no group that received only letter-sound training.

Furthermore, we must treat the results of this study with caution, since only 15 children were trained in each of the groups, too few for strong conclusions to be drawn. Moreover, only backward readers were trained. If we want to claim that a certain type of phonological awareness influences reading ability, then we should ideally train normal readers to see if their reading improves. Including only backward readers leaves you not knowing whether the children improved simply because they were developmentally delayed and would have improved anyway. It is also possible that backward readers read in a different way from normal readers, and hence showing that they improve as a consequence of a certain type of training does not necessarily entail that this same strategy is used by normal readers, or would even be useful for them.

McGuinness, McGuinness and Donahue (1995) were also interested in whether training in phonemic awareness improves reading skill. They conducted a study in which 31 children in Primary 1 and Grade 1 (5yrs, 10mnths – 6yrs, 9mnths) were taught to read using the "Auditory Discrimination in Depth" program (ADD: Lindamood and Lindamood, 1975). This program involved teaching children to discover and categorise phonemes (both vowels and consonants) that either have corresponding single graphemes (e.g. /b/, /d/, /n/, /o/) or corresponding digraphs (e.g. /ʃ/ → 'sh', /ʊ/ → 'oo'). They were also taught how these sounds are represented alphabetically. Children were made to add, delete, substitute, reverse and duplicate sounds in nonsense-words and show how these sound manipulations also changed graphemic representations. For example, in a substitution task, they might be asked to substitute the initial sound of /ets/ with an /a/ to produce /ats/. They further had to change the written sequence 'ets' to 'ats'.

A control group, consisting of 14 children aged between 6yrs, 1mnth – 7yrs, 0mnths were given no special training. At school they received whole language training which was supposed to build on previous GPC training.

At the beginning of the study (before the experimental group started their ADD training) and at the end of the study (one year later) all of the children were given a series of tests. These were a standardised reading test, a standardised vocabulary test, an oral comprehension task, a short term memory task for rhyming and non-rhyming words, RAN colour and picture naming task, "Probe Test" for visual segmentation memory, and the "Lindamood Auditory Conceptualization Test (LAC)" (1971). This final task consisted in children using coloured blocks to represent phonemes in either consonant sequences (e.g. /b/ /v/ /b/) or nonsense words in a series or chain (e.g. "show me /i/"; "if that is /i/, show me /ip/"). The children had to place one block for each phoneme.

McGuinness *et al.* found that the experimental group's performance on the standardised reading task improved significantly more than would have been expected given their initial reading scores. What is more, they improved significantly more than the children in the control group. Differences between the experimental and control groups cannot be accounted for by differences in the development of phonological awareness since their was no difference in performance between the groups on the LAC test either at the beginning or at the end of the study. McGuinness *et al.* argue that it is teaching children both how to discriminate phonemes and how these sounds are related to the alphabet that is essential for proficient reading. Each by itself is not sufficient.

These two studies provide strong evidence that phonemic training along with GPC knowledge improves reading in children. However, neither of these training studies included a group taught solely about letter-sound correspondences. Hence, although we know that phonemic awareness is probably in itself important, but not enough, we are still left without knowing whether knowledge of GPCs by itself would be sufficient for proficient reading.

Ball and Blachman (1988) were interested in whether phoneme training improves reading readiness. In their study they trained 90 non-reading kindergarten children under

three different conditions. The first experimental group was taught phoneme awareness through learning to represent individual sounds in words with counters. They were then shown how these sounds are represented with letters. The second experimental group was given general language (vocabulary development, semantic categorisations, story listening) and letter-sound training. The third, control group, was given no special training.

At the beginning of the training, there were no differences between the groups on phoneme segmentation ability or word recognition. After the training, the group taught both to discriminate phonemes and letter-sound knowledge were significantly better than the other two groups at both phoneme segmentation and reading regular words. What is more, these children could also read some irregular words.

From this study it would appear that letter-sound training by itself is not sufficient to improve reading. What is crucial is both the awareness of phonemes and the understanding of how these phonemes are represented orthographically. However, the children in this study had not yet started reading at the beginning of the study. It would be interesting to see whether children who were at the early stages of reading could benefit from letter-sound training alone.

One criticism of training studies as a whole is that we do not know exactly what it is that the children are learning, or how they are using this knowledge to improve their ability to read. The implication seems to be that increasing phonemic awareness and showing children how sounds correspond to letters of the alphabet allows children to use their new-found knowledge of the link between individual phonemes and graphemes directly to read words. However, it is quite possible that giving these children an insight into two crucial pieces of knowledge – that words are made up of chains of sounds, and that sounds are represented by letters – teaches them a lot more than simple grapheme-phoneme correspondences. It is possible that children extrapolate from their training to realise that different sizes or types of phonological unit exist and that these are also

represented orthographically. If children are taught about the alternative strategies available to them in reading, it is not all that surprising that their fluency in reading augments.

3.1.iii The use of analogy

So far we have looked at studies that have indirectly tried to ascertain reading strategies, either through predictive power or through training. Neither type of study tells us exactly what strategies are being employed when reading: they cannot tell us what the children are doing with their phonological knowledge that helps them read. A more direct approach to looking at actual reading strategies was used by Marsh, Desberg and Cooper (1977). They gave 10- to 16-year-olds nonsense words that could either be read by drawing analogies across the rime unit to words they knew how to read, or could be read by using GPCs. For example, they might be given the word '*puscle*' which could be read by drawing an analogy with '*muscle*', or by using GPCs to produce '*puskle*'. They found that the younger children tended to use GPC whereas the older children would draw analogies. Hence we have evidence that children do use their knowledge of rime (or rhyme) spelling sequences to help them learn to read new words, although this may not occur until reading ability is quite advanced. At the earlier stages of reading it would appear that children rely on converting individual graphemes into individual phonemes to read words.

Does this mean that younger children do not, or worse still, are incapable of drawing analogies across the rime unit to help them learn to read? It is possible that the younger children were not able to draw analogies simply because their lexicon did not contain the appropriate words with which to draw the analogies. If they were not sufficiently familiar with reading the word '*muscle*' it is unlikely that they would draw an analogy with this word in order to help them read '*puscle*'. Furthermore, the use of

nonsense words, although guaranteeing that the children had never seen the words before, might also have encouraged the use of a GPC strategy (Bryant and Bradley, 1980).

Goswami (1986) also looked at whether children at the early stages of reading could spontaneously draw analogies in order to help them read. She began the experiment with a pre-test in which she asked kindergarten through second grade children (between five- and seven-years) to read the experimental materials she was going to use: this was to establish which words each child could read. She then taught them to read a 'clue' word (e.g. *beak*), and asked them to read 'target' words that either shared the same rime (e.g. *peak*), the same body (e.g. *bean*), or an equal number of common letters (e.g. *lake*) with the clue word. She also asked them to read 'control' words that shared no phonemes with the clue word.

If analogies are drawn spontaneously, then we would expect the children's performance on the analogous words to improve from pre- to post-training with the clue words. Goswami found that children in all three age groups read the analogy words that shared the rime unit with the clue word. However, the younger children did not make any analogies across the body: their performance on these tasks did not differ from their performance on the common letter or the control words. The older children, on the other hand, improved most on the target words that shared the rime with the clue word, but also improved significantly on the body target words, but not the common letters or the control words.

This suggests two things: Firstly, children will spontaneously draw analogies when reading, and this improves their reading abilities. It appears that initially analogies are only drawn across the onset-rime boundary, indicating that this unit is one that is particularly salient to children. Hence, Goswami's study shows the importance of rime in the development of reading in English. However, it also shows that children can draw analogies across other word boundaries. Since children did not perform any better on the common letters words, it seems that lexical analogies "are dependent on intact orthographic

sequences at both the beginnings and ends of words" (p.81), but are not drawn across individual letters.

Goswami and Mead (1992) asked whether a similar pattern of results would be found for the onset unit. Do children spontaneously draw analogies across this unit as well? To find out they gave six-year olds a task which was like the above mentioned study in every respect except that the two kinds of analogy words were different. One kind of analogy shared the onset (always a consonant cluster) with the clue word. So if '*tr*im' was a clue word, then '*tr*ap' would be the analogous word. The other type shared only part of the rime, the coda (again a consonant cluster) with the clue word. So if '*wi*nk' was the clue word, then '*ta*nk' would be the analogous word. Goswami and Mead found that the children had greater ease at drawing analogies across the onset unit, and that they did not actually perform any better on the second kind of analogy than on the control words. Hence it would appear that from a very early age, children are capable of using their knowledge of the onset unit in order to help them learn to read[5].

One criticism of Goswami's experiments is that the children were tested on the 'target' words immediately after they had learned to read the clue words. Although their ability to read these target words increased, we do not know whether this advantage lasted any significant length of time. It is quite possible that the following day the children would no longer be able to use their knowledge of the 'clue' words to help them read the analogous words.

Bruck and Treiman (1992) carried out a study to investigate this. They asked whether teaching young children to read new words based on analogies to the rimes of known words results in faster learning, better long-term retention, and better generalisation

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[5] note that this study is in accord with Treiman (1983) in which the data concerning the cohesiveness of the coda as a phonological unit were ambiguous.

to other unfamiliar items than does teaching children to make analogies based on body units or analogies based on only vowels.

The children (all first graders, average age 6yrs, 6mnths) chosen to partake in the study were those considered to be 'ready' to learn to read, (although they do not specify exactly what they mean by this). The children were given a battery of phonological awareness tasks to assess their ability to segment spoken CVC non-words into C + VC segments, CV + C segments, and individual phonemes. They were then taught to read a list of 10 'clue' words. After reaching criterion on the clue words, the children were assigned to one of three training groups: the first group were taught to draw analogies based on the rime unit; the second group were taught to draw analogies on the basis of the body; and the third group were taught to draw analogies across the vowel. After the children had successfully completed the training, they were given a retention test the following day, in which they were asked to pronounce each of the 10 target words without seeing the clue words. On the next testing day, a generalisation test was given in which the children were asked to pronounce 20 non-words that were derived from the clue words. All three groups of children received the same non-words on the generalisation test.

They found that the rime group was the fastest to learn to draw analogies. The other groups also learned to draw analogies across their respective units, but it took them longer to do so. However, when it came to the retention test, the children in the rime group did not remember (read) the words as well as the children in the other two groups. Furthermore, the rime group were also the worst at generalising their knowledge in order to help them read words that they had not seen before. They were just as bad at drawing analogies across the rime unit as across the CV unit, and they made many mistakes in pronouncing the vowels. Similarly, the children in the body group also performed badly on the generalisation tasks that involved drawing analogies across the rime or the body, and they made many vowel errors. Neither of these two groups of children appeared to be

using the analogy strategy that they had been taught in the training session. The children in the vowel group, on the other hand, although performing less well on the retention task than the children from the other groups, performed much more successfully than them on the generalisation tasks, and this was true for those words that required generalisations across rime, body and vowels only. In other words, the children from the vowel group were the ones who learned most, or were most able to use what they had learned to draw analogies spontaneously to words they had previously been unable to read.

The authors concluded from these findings that rime-based analogies have a limited utility in children's early learning strategies. Instead, the children who had been taught about vowel-analogies were able, not only to retain the knowledge they had acquired concerning vowels (retention test), but to also retain the strategy that they had learned and to generalise this strategy across different units (generalisation test).

However, there might be a reason for these results that does not discredit Goswami's theory that rime analogy is an important learning tool in children's early reading. Firstly, in Goswami's study the children were never taught to draw analogies: they did it spontaneously. In this respect, the two studies differ fundamentally, since Goswami was interested in looking at the children's natural abilities or strategies, rather than at the strategies that they can be taught to use.

Secondly, if in the Treiman and Bruck study the children were at a stage where they were spontaneously drawing analogies across the rime (and onset-plus-vowel) unit(s) by themselves, the training that they were given to help them do this will not have actually taught them anything. Hence, these children may not have realised the purpose of this training. Indeed, Bruck and Treiman point out that these children were the fastest at learning how to draw analogies in the initial training session, suggesting that they found rime analogy easy. The vowel group, on the other hand, really had to make an effort to learn how to draw analogies across the vowel unit. It strikes us that the vowel group was

actually learning two very important and useful skills in this training session. Firstly, they were learning about vowel phonemes. Since vowel phonemes cause children the greatest difficulty of all of the phonological units (Goswami, 1993), it seems that, once a child has mastered this troublesome unit, other aspects of phonological awareness are going to be much easier. Consequently, teaching a child about vowel phonemes might also improve their awareness of all the other phonological units. The second skill that these children might have learned was the usefulness of using analogies to help read new words. If the children truly had to learn how to do this for the vowel units, their attention might have been drawn to a method that they had previously not even realised they used. Given the nature of the English orthography, Bruck and Treiman might inadvertently have been teaching children far more than they had anticipated; they might have been equipping these children with the knowledge and the flexibility of strategy that is an essential requisite for successful reading in English.

Hence this study does not necessarily undermine the importance of rimes in reading, it simply points to the benefit of phonemic knowledge and the understanding that reading involves mapping phonological units onto orthographic sequences.

Another criticism of Goswami's studies is that many of the control words (that children had difficulties in reading) contained consonant clusters and long vowels (e.g. *lake*, *cast*, *real*). Both of these are notoriously difficult for young children beginning to read (Mason, 1976; Taylor and Ehri, 1984: in Ehri and Robbins, 1992). This might have made these words harder to recode phonologically. Hence Goswami's claim that drawing analogies across the onset/rime unit is a strategy children apply before they use sequential decoding (decoding individual graphemes from left to right) might pertain more to the types of words that she was asking the children to read, than to their everyday strategies. Ehri and Robbins (1992) argue that at the early stage of reading, rather than children underpinning rime orthographically and hence using their rime awareness to help them read

new words, they instead process and remember only some of the letters that correspond to sounds in pronunciation. These sounds usually correspond to the first and last consonants of words (Ehri, 1987; Ehri and Wilce, 1985, 1987a, 1987b; Stuart and Coltheart, 1988). Ehri and Robbins argue that it is not until children have some decoding skill that they will use their rime awareness to read new words.

They tested this hypothesis by comparing kindergarten and first-grade children who could read some CVC non-words and some real words, (who they label 'decoders'), with children who could not read any CVC non-words and could read very few real words, who they call ('non-decoders'). They split each of the 'decoder' and the 'non-decoder' groups into two. All of the children were trained to read 'training' non-words. One 'decoder' and one 'non-decoder' group was then trained to read 'transfer' non-words that shared the rime unit (analogous words) with the training words, and the other groups (one decoder, one non-decoder) were trained to read 'transfer' non-words that shared only the vowels (control words) with the training words. The theory was that the non-decoders should have equal difficulty with the analogous words as with the control words, because they lacked the decoding knowledge necessary to underpin any phonological unit with an orthographic representation. Instead, they should read the words by remembering partial letter-to-sound correspondences. This approach should not be sufficient to read words by onset/rime analogy because the memory representation (being only partial) does not contain enough letter detail to identify rimes. Decoders, on the other hand, should perform better on the analogous words than on the control words, since they had some decoding skill and hence they should be able to draw analogies across the rime unit.

They found that the decoders learned to read the analogy words more quickly than they did the control words, and often they did not require any training to read these analogous words (i.e. they did it spontaneously). The vast majority (90%) of non-decoders, on the other hand, were unable to read any of the transfer words on the first trial. With

further training and feedback they eventually managed to read approximately half of the transfer words. The analogy group performed equally badly as the control group, suggesting that some decoding skill is necessary to be able to read novel words by analogy to known words. Furthermore, the non-decoder analogy group often misread the transfer words as the training words. For example, if the training word was *SĪĪNE*, and the target word was *MĪĪNE*, they would read it as *SĪĪNE* (for an explanation of the 'odd' vowel representations, see later). Ehri and Robbins concluded that these children lacked the decoding skill necessary to blend a new onset with an old rime. If non-decoders notice that known and new words share some letters, they would misread the new words as the old words rather than analogise, exactly as was found.

However, Ehri and Robbins failed to look at the non-decoders onset/rime awareness. Goswami (1986) has shown that the ability to draw analogies across the rimes of words is related to their knowledge of the onset/rime division. If the decoders lacked onset/rime awareness, it is unlikely that they would draw analogies across these units. As it happened, the majority of the non-decoder analogy groups' errors involved some analogy since they read the rime unit of the target word in the correct way. Their mistake was to fail to read the new onset of the target word accurately. This finding could equally be argued to be an indication that these children are not using a 'partial representation of letter-to-sound correspondences', as Ehri and Robbins claim, since if they were doing this then they should have accurately read the onset of the target word, which is precisely what they failed to do. Instead, they managed to accurately read what Ehri and Robbins (rightly) point out is the hardest part of the word to read, namely, the long vowel.

The reason the control group might have done equally well as the analogy group might have been as a consequence of the training the children received. Ehri and Robbins used a rather bizarre method of creating the non-words. Before the children were trained to read the 'training' words, they were taught how to spell the vowels. The long vowels were

represented by double vowels with a line on top. They were told the vowels were pronounced as the name of the letter. For example, JĀĀZ would be pronounced /ʤeiz/. Since the children were trained intensely in how to read the vowel sounds, it is hardly surprising that when it came to the transfer trials, the control group were just as successful as the analogy group, since they had received training in precisely those units across which they could draw analogies.

So, this experiment could be taken as further evidence that children are naturally drawn to the rime of the word, and use their knowledge of this unit to help them read new words[6]. It could be argued that the reason the non-decoders failed to read the target words might be because of an inability to draw an analogy across the onset. However, this is hardly surprising, since the onsets of the target words were single phonemes, and this group of children was not familiar with grapheme-phoneme-correspondences (GPCs), as shown by their inability to read any of the pre-test CVC non-words.

Goswami's work has received yet further criticism from Duncan *et al.* (1997) who are not convinced that children did spontaneously draw analogies across the rime unit from the earliest stages of reading. They wanted to know whether children were more likely to use their awareness of phonemes in early reading. From a list of words with which the five-year-old children in their study were familiar, they created non-words of various different types. Some were created from the onset and rimes of familiar words (e.g. '*han*' from *h*elp and *c*a*n*), some from the body and coda (e.g. '*calp*' from *c*a*n* and *help*), some from the body and rime (e.g. '*stot*' from *stop* and *not*), and some from the onset, peak and coda (e.g. '*yat*' from *y*es, *c*a*n* and *no*t). The theory was that if children use their awareness of rimes to help them learn to read, then they should find those non-words with familiar

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[6] note that the non-decoder control group's eventual ability to draw analogies across the vowels indicates that training also has a (major) influence on the strategy employed in reading.

rimes easier to read than the other non-words. In particular, good pre-reading rhymers should capitalise on this strategy. If, on the other hand, children at the earliest stages of reading rely on GPCs, there should be no difference in performance on any of the different non-word types. They found that the children in the study, who had been at school for seven months had greater difficulty in reading the 'body + rime' non-words than the 'body + coda' non-words, but that there were no other differences between the various non-word types. Moreover, the children whose pre-reading rhyme awareness was particularly good performed exactly as the rest of the children.

Duncan *et al.* concluded from this that children cannot be drawing analogies across onset/rime units early in reading, since they did not find it easier to read non-words that shared rime units with familiar words. Instead, they must be using GPCs.

However, there are various alternative explanations of this result. Firstly, the non-words that had been created from non-rime sub-syllabic units (body + coda, onset + peak + coda) could have contained onsets and rimes with which the children were familiar. For example, the non-word *yat*, (created from *yes*, *can* and *not*) contains the rime 'at'. Children could have drawn an analogy across the rime unit of another word they knew (such as *hat*) rather than using GPCs to read this word. Hence we cannot be sure that children really were utilising GPCs for all of those non-words which Duncan *et al.* claimed they had to be. Furthermore, all of the children who took part in the study were formally being taught to read using a phonics (GPCs) method. These children had been taught nothing about rime-level correspondences. Hence, if the children really were reading using GPCs then this would hardly be a surprising finding: teaching methods probably affect reading strategy (Barr, 1974; Wimmer, Landerl, Linortner & Hummer, 1991). Yet this study does not provide conclusive evidence that only a GPC strategy was being employed. It would be interesting to see if the same results would have been obtained with children learning to

read using an onset/rime approach. Finally, the good pre-reading rhymers also had good phonemic awareness before they arrived at school. So it could equally be argued that, if children rely on GPCs when they start to read, why were this sub-group not better overall at reading the non-words than the rest of the children?

Our review of the work done on analogies suggests that children from the earliest stages of reading will (spontaneously) draw analogies across the rime unit, and as their knowledge of both the phonological and the orthographic system increases, through experience with the alphabetic script, they will begin to create orthographic representations of the units which they have recently phonologically underpinned, until eventually they can start to underpin the smallest of the phonological units and work out how these are orthographically represented.

The fact that children focus on the rime unit to help them learn to read is not at all surprising if you consider the nature of the English orthography. There are 26 letters that map onto (at least) 44 phonemes (McGuinness *et al.*, 1995) and so the use of GPCs will not be a successful reading strategy. However, if you look at the English orthography at the level of the onset/rime it is actually quite regular; the majority of rimes are spelled in the same way (Treiman, Mullennix, Bijeljac-Babic, and Richmond-Welty, 1995). The uncertainty in the pronunciation of a vowel is reduced if the following consonant is taken into account. In contrast, the preceding consonant does not usually help to specify the pronunciation of the vowel. Furthermore, the number of alternative spellings of a rime influences the ability to pronounce it properly: the more alternatives, the more likely a mistake. There is evidence that young children are influenced by this when they read. For example, Leslie and Calhoon (1995) conducted a study looking at how beginning readers (first- and second-graders) read non-words that have real-word rime-neighbours (words that share the rime). They found that the way in which participants read the words was determined by the number of real word neighbours that they had. For example, a non-word

like '*keed*' has many real-word rime-neighbours (e.g. need, seed, feed, weed, heed). A non-word like '*keem*' has fewer real-word rime-neighbours (seem, deem). Children were more likely to correctly read '*keed*' than they were to read '*keem*'. Furthermore, the better the children were at reading, the more rime-neighbourhood size affected their reading.

The number of alternative pronunciations of the body, on the other hand, has no effect on whether or not you will pronounce it correctly.

3.1.iv Reading vowels, reading consonants

We have seen a variety of studies that indicate an important role for phonemic awareness in reading. However, all of these studies treat phonemic awareness as a somewhat blanket-term. None of them tackle the possibility that phonemic awareness itself might be split into various categories, and that each category may play a different role in learning to read. What exactly is meant by 'different categories' of phonemic awareness? Broadly speaking, there are two different types of phoneme, vowel phonemes and consonant phonemes. Just as it was argued in Chapter 2 that children might find it easier to perceive one kind than the other, it might also be the case that each may play a different part in reading.

Shankweiler & Liberman, (1972) looked at the different types of mis-readings that occurred in children in the third grade (8-9yrs), and compared these with mistakes in oral repetition. They found that vowel mis-readings are about twice as frequent as consonant mis-readings in the early stages of learning to read. However, vowel mis-hearings are far fewer than consonant mis-hearings. What is more, errors in oral repetition of consonants and vowels were far fewer than reading errors, suggesting that the errors in reading were not caused by mis-hearings, but were being caused by some difficulty in de-coding the orthographic representation of the phonemes. This suggests that children genuinely have

difficulties with decoding the orthographic representations of both consonant and vowel phonemes, and that this difficulty is greatest for vowels.

However, the conclusions drawn about the vowel reading errors have to be interpreted with some caution, since the elevated number of vowels as compared to consonant reading errors might have been a consequence of the vowel position within the word (always word medial) as opposed to something specific to vowels themselves. Nevertheless, there are still conclusions to be drawn concerning the nature and the cause of vowel reading errors. Vowels tend to have much more complex orthographic representations than consonants. Also, there is much less consistency in letter-sound relationships for vowels than there is for consonants. Whereas initial consonants in words are consistent in spelling-sound correspondences across about 96% of words, and final consonants are consistent across about 91% of words, vowels are consistent across only 51% of words: they do not systematically represent the same sounds (for example, the letter 'a' makes a different sound in *cake*, *call*, *cat*, *car*; the digraph 'ou' in *soup*, *loud*, *four* ...;Goswami, 1999). This might also explain why they are more frequently misread. Furthermore, since the complexity of the orthographic rules varies for different vowels, we would expect different error rates among them. This is precisely what Shankweiler and Liberman found. The more alternative orthographic representations of the same vowel phoneme, the more likely a child was to make an error reading it. For example, the phoneme /I/ is typically represented with an 'i' in the English orthography. The phoneme /u/ , on the other hand, can be represented orthographically as 'oo', 'u', ''ou', 'oe', 'ew', 'o', and 'ui'! Children were much more likely to misread a representation of the /u/ phoneme than they were the representation of the /I/ phoneme. Hence it might be the number of alternative orthographic representations of a phoneme that determine the ease with which it is read.

3.1.v Rimes or phonemes?

A review of the research also indicates that many recent research questions have focussed on which phonological unit is important in reading (Duncan *et al.*, 1997; Muter *et al.*, 1997). Is it the rime or is it the phoneme? It strikes us that this query reflects a fundamentally mis-guided approach to the study of literacy acquisition. It should not be a question of 'which unit', but of how and when the children use their awareness of each of the units in reading. We know that the awareness of rimes and of phonemes are intimately linked: Bryant *et al.*, (1990) have shown that rhyme awareness is a powerful predictor of phoneme awareness suggesting that phonological development is a continuum[7]. From the research reviewed it would appear that both onset/rime and phoneme awareness are powerful predictors of reading ability. Rime appears to play a larger role at first, but this is possibly because phonemic awareness has yet to develop. Once children become aware of phonemes, then these units too play a critical role in reading. Hence, knowledge of both the rime unit and of phonemes is important; their contribution to reading ability may differ as a function of time and phonological insight.

This point is a particularly important one. It emphasises the fact that, although all phonological units might be implicated in reading, how and when they interact with reading ability might be specific to both the phonological and the orthographic structures of each language. Hence, if differences in literacy acquisition exist across languages, it may not just be a case of the involvement of different levels of phonology. Rather, the differences may manifest themselves in when and how each level of phonology is involved at different stages of reading acquisition. It is important to bear this in mind when we review the literature on Spanish and bilingual reading acquisition. We will return to this point in Section 3.3.

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[7] note that this is a particularly interesting point because the question arises of whether this continuum develops at the same rate depending on the phonology(ies) and orthography(ies) to which you are exposed.

3.1.vi "Epilinguistic" or "metalinguistic" awareness?

Another preoccupation in recent literature, and a factor that has cropped up in our discussion of this literature, has been the uncertainty of whether it is "epilinguistic" or "metalinguistic" awareness that is relevant in reading. "Epilinguistic" awareness refers to "implicit" or "non/sub-conscious" awareness of sounds. "Metalinguistic" awareness refers to "explicit" or "conscious" awareness of sounds. It is argued that phonological tasks simply requiring discrimination of sounds are measures of "epilinguistic" awareness; tasks that require the direct manipulation of sounds are measures of "metalinguistic" awareness. From a review of the research we can see that the question of epi- versus meta-linguistic awareness has come about largely as a consequence of the confounding of method with phonological unit. Some researchers (e.g. Muter *et al.*, 1997; Duncan *et al.*, 1997; Gombert, 1993; Høien, Lundberg, Stanovich, and Bjaalid, 1995; Carrillo, 1994) have argued that rime and onset awareness exist primarily epilinguistically, and that metalinguistic awareness of these units does not appear until late in reading acquisition. Phonemic awareness, on the other hand, is metalinguistic from the very outset (although phonemic awareness might not develop until school age). Moreover, metalinguistic awareness is the only form of phonological awareness that is critical in reading: epilinguistic awareness is irrelevant. Since phonemic awareness is the first form of metalinguistic awareness to develop, it is this that children use in reading. The use of rime does not come about until later, when metalinguistic awareness of it develops.

However, these researchers have always tested rime awareness using one method, and phoneme awareness using a different method. Any result becomes automatically discredited simply because the performance on each of the tasks cannot be directly compared, as explained in Section 3.1.i.d.

There is another qualm concerning the very idea of meta- and epi-linguistic awareness. The implication is that 'meta'-awareness requires 'consciousness' (Chomsky,

1979; Gombert, 1992); 'epi'-awareness does not. However, no one can specify what is meant by 'consciousness' or lack thereof. It is much more probable that many levels of awareness or consciousness exist. It is not the aim of this thesis to determine whether different or unrelated forms of awareness really exist. Instead, by using the same methodology for all phonological units, which is what is done in this thesis, the significance of the question vanishes.

3.1.vii Summary

Children approach the task of learning to read with the smallest units of phonology of which they have an implicit representation being the onset and rime. These units are the linguistically salient aspects of syllables to young children (Kirtley *et al.*, 1989).

The English orthography is structured so that the rime unit is a particularly pertinent one: it is not phonemically based, but depends on onsets and rimes (Treiman *et al.*, 1995). As mentioned in Section 3.1.iv onsets are consistent in spelling sound correspondences across 96% of words; codas across 91% of words. Consistency for vowels, on the other hand, is a mere 51%. However, the consistency rises to 77% when the entire rime is considered. Hence, given that rimes are phonologically salient units, and given that this unit is where the regularity of the English orthography lies, it would make a lot of sense for children to use this convenient mapping in reading. From the evidence reviewed above, we see that children do capitalise on this correspondence in their reading via the (spontaneous) use of analogy (Goswami, 1986, 1993, 1999; Goswami and Mead, 1992; Marsh *et al.*, 1977). It appears that children begin learning to read by establishing direct recognition units for words, recognition units that have a phonological underpinning at the onset-rime level (Wimmer and Goswami, 1994). Such underpinning is thought to build directly on pre-school phonological knowledge about onsets and rimes (Goswami & Bryant, 1990).

So reading is conceptualised as a process of establishing direct recognition units from the very earliest phases of learning written words.

The emergence of phonemic representations, on the other hand, appears to depend crucially on being taught what a phoneme is, either through direct training or reading instruction (Goswami and Bryant, 1990; Byrne and Fielding-Barnsley, 1995; Bruce, 1964; Mann, 1986).

This might be because phonemes are the most variable and least distinct phonological units in the speech stream. Hence, since they are phonetically undefinable (because they alter so much according to the context in which they are found) it would appear that the only way of 'pinning them down' as representations is through learning to read an alphabetic script. Indeed, literate people's beliefs about what sounds occur in words sometimes differ from what beginning readers think (Read, 1975, 1986): it is as if they both <u>listen</u> to the same string of sounds, but they <u>hear</u> different things. This is presumably because we 're-mould' our representations of sounds in words as a consequence of learning about how these sounds are represented in the orthography. Hence, the first sound of '*truck*' might sound like a '/tʃɹ/' to beginning readers, whereas to advanced readers it sounds like a '/tɹ/'.

Once children have acquired phonemic awareness, they use this to help them read (Bradley and Bryant, 1983; Bryant *et al.*, 1990; Muter *et al.*, 1997; Duncan *et al.*, 1997; Stuart and Coltheart, 1988; Goswami, 1993). Children can build their phoneme-based approach from the approach involving the larger units. The use of analogies develops rapidly over the first year, from analogies based on large units such as the rime, to analogies based on smaller units such as the phoneme (Goswami, 1993, 1999).

Thus, when learning to read in English, children initially use their awareness of the rime and onset unit, and gradually, as they begin to become more proficient in their

reading, and as a consequence of this increased proficiency, they also apply their knowledge of phonemes.

3.2 READING IN SPANISH

Unlike English, Spanish has a very transparent orthography. The vast majority of phonemes have one single graphemic representation, and likewise, the majority of graphemes may only be pronounced in one way. It is not just this transparency at the grapheme-phoneme level that might make Spanish an easier language to read than English. Other factors, such as the low incidence of consonant clusters, the small number of vowel sounds and the simple syllable structure also might make the acquisition of decoding skills both faster and easier than it is in English.

Since Spanish has such a transparent orthography, it is tempting to propose that Spanish readers rely solely, or at least heavily, on a grapheme-phoneme-conversion route when reading. As a consequence, the majority of research has focussed on two main areas: whether decoding is achieved at the grapheme-phoneme level or whether it occurs at the syllabic level, and, whether a lexical route is also used.

3.2.i Syllables

González (1996) conducted a study to determine the extent to which syllabic awareness is related to reading proficiency. She gave six-to-eight year olds word initial, middle and final syllable identification (which word of a pair contains a target syllable), syllable segmentation (split the word into its component syllables), syllable omission and addition tasks, and a standardised reading task.

Syllable awareness was highly correlated with reading ability (accuracy, speed and comprehension), particularly in the youngest and the oldest children. This suggests that,

since children approach the task of learning to read already in the possession of syllabic awareness, they exploit this awareness to get them started. As they become more proficient and their phonological awareness increases, they may begin to rely less on this syllable strategy. They may return to this strategy at a later age since it is a very efficient way of reading.

Unfortunately, González does not differentiate between the different syllable tasks given to the children. We do not know whether certain tasks were more highly correlated with reading ability than others. In other words, if it is true that certain tasks require "analytical" awareness, whereas others only require "holistic" awareness, then it would be desirable to investigate what kind of awareness is (most) necessary for reading in Spanish.

3.2.ii Phonemes

There is a plethora of evidence that suggests that phonemic awareness is crucial for successful reading in Spanish, and that this type of awareness develops very early in Spanish-speaking children. As mentioned in Section 3.2, reading purely via grapheme-phoneme correspondences works for the majority of words in Spanish. There are a few exceptions to this rule, but children are formally taught these at a very young age, and consequently, they do not pose a major problem in reading or spelling. Indeed, Cuetos (1989) has shown that pre-school five-year-old children can correctly read and spell 90% of disyllabic pseudo-words, that contain context-dependent letters. This evidence alone indicates that Spanish children learn to read much faster than English children, suggesting that the processes involved must be much simpler.

3.2.ii.a The manipulation of length and frequency

Some researchers suggest that phonemic awareness is the only phonological awareness necessary for reading in Spanish; awareness of other phonological units such as rimes or syllables is unnecessary. Valle Arroyo (1989) tested this theory by asking eight-to-thirteen-year-old children to read words that were manipulated for frequency or length. If children read using GPC rules, then long words should be harder to read than shorter words, since there are more opportunities for errors to occur. If, on the other hand, children read using some other strategy (e.g. visual, analogical), then they should find more frequent words easier to read than less frequent words. He found that frequency had no affect on the accuracy of reading, whereas length did. This finding suggests, according to Valle-Arroyo, that children do not use a visual or an analogical strategy when reading, rather, they use GPC rules.

However, there is an alternative explanation. It is equally possible that children chunk letters to form units and that they read using these larger units. For example, they might read syllable by syllable. This type of reading could involve the drawing of analogies. If this strategy is used, then you would still expect to find an effect of length but not of frequency. Valle Arroyo also failed to control for word frequency in his 'length' task, and for word length on his 'frequency' task. Since the most frequent words also tend to be the shortest he could have been confounding the effects of frequency and length. Children might have been reading the short words more accurately, not because they were short, but because they were frequent. Equally, they could have been misreading the infrequent words, not because they were long, but because they were infrequent. What he should have done was have words of equal length but of differing frequencies for the frequency task, and words of differing lengths but of equal frequencies for the length task. So we have no conclusive evidence that phonemic awareness is the only kind of phonological awareness that counts.

Domínguez Martínez and Cuetos Vega (1992) conducted a similar study in which they manipulated word frequency and length for real words, and word length for pseudo-words. Their task involved showing good and poor readers from second-to-eighth-grade (6-13yrs) the stimulus words on a computer screen, and asking them to press a key if they thought the word was real or not. They measured the children's reaction times to determine the effect frequency and length were having on word recognition. Unlike Valle Arroyo they found that word frequency did have an affect on reaction time; the children responded faster to the higher frequency words, suggesting that a lexical (non-phonological route) is being used. Interestingly, word length only had an effect on pseudo-words, once more indicating that a lexical route must be in use when children are reading real words.

Furthermore, the effect of word length was greatest for children in the lower school years, suggesting that at the early stages of learning to read, children rely more on a phonological (possibly a phonemic) code for reading, but that a lexical route must still be available to them from a very early age. Possibly, as they get older and become more fluent readers a lexical route might become even more dominant.

Domínguez Martínez and Cuetos Vega's study seems to indicate that, although a phonological route is available to the children, it is the lexical route that they primarily rely on when reading real words. Hence, the importance of the phoneme in Spanish reading might not be as great as one would intuit. However, we should bear in mind that the study was conducted using only 10 children of each age group, and these 10 children were in turn split into two groups: good readers and poor readers. Hence, given both the tiny numbers of children being tested in this study, and the contradiction between these findings and those of Valle Arroyo, it is difficult to draw any strong conclusions concerning the nature of the processes involved in Spanish reading.

3.2.ii.b Predictive studies

González (1996) wanted to determine the relative contribution of phonemic awareness to reading in Spanish first-third graders (6-9yrs). She gave them phoneme identification, segmentation, omission and addition tasks, the latter two tasks involving word-initial phonemes only. She also gave them a standardised reading test. She found that all of the tasks were related to reading ability (accuracy, speed and comprehension) and made an independent contribution to reading variance after syllable awareness (see Section 3.2.i) had been taken into account. What is more, the influence of phonemic awareness on reading was greater for the older children. Although this suggests that phonemic awareness is more important the more proficient you become at reading, it may have been that the younger children, who had only just started to learn to read, scored relatively poorly on the phonemic awareness tasks, and hence fewer correlations would be expected.

Jiménez (1996) was also interested in the relationship between phonemic awareness and reading in Spanish. He gave first-, second- and third-grade children (6-9 yrs) three different types of phonemic awareness tasks; an oddity task testing for the awareness of word-initial phonemes; a phoneme segmentation task in which the children had to segment words into their individual phonemes (e.g. '*gato*' → /g/, /a/, /t/, /o/); and a phoneme reversal task, in which children had to 'say a word backwards' (e.g. '*gato*' → /o/, /t/, /a/, /g/).

He found that the children's performance on the tasks was highly correlated with their reading ability; the better they were at reading, the easier they found the tasks. This suggests that phonemic analysis is an important contributor to Spanish reading. Interestingly, there was no difference in performance on the oddity task between the poor readers and younger reading age match controls, but the control group performed better on the segmentation and reversal tasks. This suggests that it is the ability to manipulate

phonemes, rather than just being able to distinguish them, that is necessary for proficient reading.

Carrillo (1994) (see Chapter 2.2.1.a for a full explanation of her experiment) also found that those kindergarteners who had started reading were those that had reached some sort of segmental awareness. However, the extent to which you must be capable of segmenting words to read is debatable. She found that at the initial stages of reading, it was sufficient that the children could segment words by deleting a particular phoneme or pair of phonemes. Total segmentation, or the even more sophisticated ability to reverse phonemes in words was not necessary, although these abilities had developed by the first year when children were reading more fluently.

She also found that first grader's reading ability was unrelated to their "holistic" awareness, but was highly correlated with their "analytical" or "segmentation" capacities. From this she concluded that the two types of awareness were unrelated and that it was "analytical" awareness alone that is related to reading ability.

This conclusion is not the only one that can be drawn. The first grade children in her study scored at almost ceiling level on the "holistic" awareness tasks, so this data should not be included in the analysis to determine the relationship between this type of awareness and reading skill. So we have no evidence that the two types of awareness are independent from one another. Indeed, given that the kindergarten children had some form of segmental awareness it would appear more likely that the more "holistic" versions of awareness fed into the more "analytical" type. This in turn, on exposure to, and experience with, the alphabet might have further enhanced their segmental abilities.

The role the more advanced forms of segmentation ability, such as total segmentation or reversal, play in reading is also debatable. Carrillo found that many kindergarteners and some first-graders who were good readers were poor segmenters. However, it is unclear whether this was because they truly did not know how to segment,

or whether it was simply because they had not understood the tasks properly, since most of them performed well on some of the segmentation tasks, but very poorly on others. However, all those children who performed well on the segmental tasks were good readers. The combination of these findings suggests that if you can segment, then you will use this knowledge to help you read, but, reading can be achieved via strategies that do not involve segmentation.

One problem with all of these predictive studies is that they tell us little about actual reading strategies. If phonemic awareness and reading ability are causally related, as the above studies indicate, it may be that good reading causes phonemic awareness rather than phonemic awareness causing good reading.

3.2.ii.c A causal link between phonological awareness and reading

One way of determining the way in which phonemic awareness is causally related to reading ability is to train children in this type of awareness and see whether reading skill improves. Borzone de Manrique and Signorini (1994) trained first-grade (6-7yrs) Spanish children to segment words into their constituent phonemes. After the training they gave them standardised reading and spelling tasks. They found that not all of the children who did well on the segmentation task did well in reading. However, no child performed badly on the segmentation task and well on the reading task. Hence, the ability to segment might be a necessary, but not a sufficient condition for good reading. This finding is in accordance with Carrillo's study, described in Section 3.2.ii.b above. Interestingly, all the good readers scored at ceiling level on the segmentation and the spelling task. The poor readers, on the other hand, only reached criterion on the segmentation task, but their spelling was in fact better than their reading.

Defior and Tudela (1994) conducted a similar training study to that of Borzone de Manrique and Signorini. They trained first-grade children who had not yet learned to read (or spell), and who had relatively low phonological awareness, under five different conditions. The first group was trained to categorise words according to initial, middle and end sounds. The second group received the same training, but was also taught how the sounds corresponded to plastic letters. The third group was trained to categorise words according to semantic categories (e.g. colours, animals). The fourth group was trained as the third, only they were also given written words as aids to this learning. Finally, the fifth group, who acted as a control, was not trained at all. The training lasted six months in total.

Defior and Tudela found that the only group who improved in their reading (and spelling) ability were the group who had been taught to categorise words according to initial, middle and final phonemes whilst also being taught about the relationship between these sounds and the letters of the alphabet. This is a particularly interesting finding since the children had only been trained for 20 weeks when the advantage began to appear, a much shorter training period than in equivalent training studies in English (see Section 3.1.ii). What is more, this advantage not only continued, it actually increased over the two months following the training. No other group improved significantly.

This provides strong evidence that phonemic awareness has a positive causal influence on reading (and spelling) acquisition for Spanish-speaking children. More specifically, it points to the need to be able to distinguish phonemes from one another and to have an explicit understanding of the connection between phonemes and their written symbols.

Nevertheless, we must treat the conclusions drawn with caution since there were only 12 children in each of the training groups, and these children were chosen on the basis of their poor phonological skills and poor reading and spelling abilities (according to their

teacher's judgements). If these children really were poor readers we cannot be sure that the training given to them would have had the same effect on normal readers. A study needs to be conducted with greater numbers of children, and including children who are normal readers.

Domínguez (1992) conducted a training study in which first-grade children were taught to omit or detect phonemes with, or without, the use of plastic letters. A control group was taught about rimes, once more, with or without the use of plastic letters. She found that it was only those children who had been trained in phonemic awareness and the relationship between phonemes and graphemes that improved in their reading ability. Those children taught about rimes, or who had been taught without the use of plastic letters did not improve significantly. Furthermore, this effect lasted at least until the third school year, even though the children had only been trained in their first school year (Domínguez, 1996). One interesting finding of this study was that the harder the children found the training session, the more likely their reading skill was to improve. This suggests that certain training procedures (for example, teaching children about rime) might be too easy. If the child is learning very little in the training sessions she or he will not extrapolate from what she or he has learned to apply it to her or his reading. It also suggests that teaching children the hardest phonological skills (i.e. phonemic awareness) allows them to work out the easier ones for themselves. If this is the case, then by training children in GPCs you are actually giving them a whole knew range of knowledge that they can then use when they try to read.

However, only 10 children were trained in each of the groups in the Domínguez study, making it unjustifiable to draw strong conclusions about the effects of grapheme-phoneme training on future reading ability.

All of these training studies fall under the same criticism as the training studies conducted in English (see Section 3.1.ii). None of them had a control group that was

trained only on GPCs. Hence, we cannot be sure whether knowledge of GPCs is in itself enough to improve reading skill, or whether the ability to categorise words according to sounds is also necessary. However, none of these studies, with the exception of Domínguez's study, trained children to explicitly manipulate phonemes. Instead, they used tasks that are believed to require 'implicit' phonemic awareness, yet reading skills improved. This suggests that 'implicit' forms of awareness may be sufficient for reading, and that explicit forms may initially be a consequence rather than a cause of reading.

3.2.iii The use of analogy

In learning to read do Spanish children simply have to learn the sounds of each of the letters? Given the evidence described so far, it would appear that in reading a shallow orthography it is possible to rely solely on the pre-lexical phonological route.

Sebastian Gallés and Parreño Vacchiano (1995) believe that children use other strategies to help them learn to read. They conducted an experiment to test whether children use analogies, just as English children appear to. They reasoned that if you take words that contain context dependent letters, and then change the context of that letter such that it should now be pronounced differently, then mistakes should be made if children are drawing analogies to the familiar words. If, on the other hand, children are simply applying GPC rules, then they should make no more mistakes on these words than on words that have no context dependent letters in them. Sebastian Gallés and Parreño Vacchiano tested this hypothesis.

There is a rule in Spanish that says that the letter 'g' is pronounced /x/ if followed by an 'i' or an 'e', but pronounced /g/ if followed by an 'a', an 'o' or a 'u'. Pseudo-words were created by changing one letter from real words. This change either did, or did not, change the pronunciation of the 'g' (*change* condition and *no-change* condition,

respectively). For example, a *change*-condition pseudo-word might be '*arrugedo*' (/arruxedo/), created from the word '*arrugado*' (/arrugado/); note the change in pronunciation of the 'g'. A *no-change*-condition pseudo-word might be '*encogedo*' (/encoxedo/), created from the word '*encogido*' (/encoxido/); note that the 'g' is pronounced in the same way in both examples.

Sebastian Gallés and Parreño Vacchiano gave six-, eight- and ten-year-old children *no-change* and *change* pseudo-words to read. They found that all of the children were far more likely to make errors on the *change* pseudo-words than they were on the *no-change* pseudo-words. They took this as evidence that children do use an analogical strategy when reading. The reason more mistakes were being made on the *change* pseudo-words is because the children were reading them by drawing analogies with the real words, and hence mispronouncing the context-dependent graphemes.

However, the majority of errors made were lexicalisations rather than simple incorrect pronunciations of the letter 'g'. This suggests that children were reading using some sort of a global method (rather than an analogical method). Indeed, the older the children were, the more likely they were to make lexicalisation errors. This is indicative of a more global or visual strategy being used as the child becomes a more proficient reader. The children may also have been unwilling to produce a word that they had not heard of before and hence gave a word which they knew. Nevertheless, more lexicalisations occurred for the *change* than for the *no-change* words. If children were unwilling to produce a nonsense-word then this should have been equally true for the two conditions, yet this was clearly not the case. Similarly, if they were using a global reading strategy then they should have lexicalised both types of pseudo-words equally. This does suggest, then, that some sort of an analogical strategy was being used. However, on giving adult subjects the same materials they claimed that it was far easier for them to work out which real words the *change*-pseudo-words had been created from than for the *no-change*-pseudo-

words. This might have been because the *change* pseudo-words had a higher density of real word neighbours than did the *no-change* pseudo-words. This factor might explain why more lexicalisations occurred for the *change* than for the *no-change* pseudo-words.

Nevertheless, the fact that there were not only more lexicalisations, but also more incorrect readings of the letter 'g' in the *change* condition than there were in the *no-change* condition[8] does suggest that some analogical reading takes place in Spanish. It would be interesting to see whether it was the same children that made all of the mistakes or whether the number of mistakes were evenly spread across the subjects. If the former were true it would suggest that some children, but not others, adopt an analogical method when learning to read. If the latter were true, then it would suggest that drawing analogies is a strategy that all Spanish children apply, but that it is not the only one that they exploit.

One last criticism of Sebastian Gallés and Parreño Vacchiano's experiment is that there were only 10 children in each of the age groups. This makes it impossible to draw any strong conclusions concerning reading strategies that Spanish children as a whole might implement. Furthermore, Sebastian Gallés and Parreño Vacchiano made no attempt at identifying the phonological unit across which Spanish children might draw analogies.

To our knowledge, no one has conducted an experiment in Spanish to determine whether children spontaneously draw analogies, or across which units this is done. It would be interesting to see whether Spanish children are likely to draw analogies across the rime unit, just as English children appear to, or whether there is a different more salient unit for them, or whether analogy is a strategy that is simply inappropriate in Spanish literacy. There are various reasons for believing this latter scenario might be true. The Spanish orthography is unlike the English orthography in two ways that are relevant here. Firstly, as mentioned earlier, it is far more transparent: on the whole, using GPCs works.

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[8] i.e. reading 'encogedo' as /encogedo/ rather than /encoxedo/ more often than reading 'arrugedo' incorrectly.

Secondly, the way in which words are broken into phonological units might not be the same across the languages, simply because of the way in which the words are created. The majority of English syllables have a CVC structure. This allows you to break the word up into an onset and a rime. The majority of Spanish syllables, on the other hand, are open. They either have a CV or a VC structure. This means that breaking them into onset and rime is actually breaking them down into their constituent phonemes in the case of CV syllables, or leaving them as intact syllables, as is the case in VC syllables. Hence, drawing analogies across the rime unit is the equivalent of drawing analogies across individual phonemes (i.e. using GPCs) in the case of CV syllables, and is the equivalent of drawing analogies across syllables in the case of VC syllables.

Given the evidence discussed in Chapter 2.2.i.b that a more salient unit for the Spanish speakers might be the body or syllable, we might hypothesise that if analogies are drawn by Spanish children, this is the unit they would choose.

3.2.iv Reading errors

Another way of examining the processes involved in reading is to look at reading errors. The kind of mistakes children make can give us clues as to the strategies they are employing in reading. Defior, Justicia and Martos (1998) looked at the sort of reading errors made by Spanish children of different ages and reading abilities. They compared errors made by first- to sixth-grade (seven-to-twelve-year-old) normal and poor readers on real-, pseudo-, and non-words (e.g. *playa, blaya, mlaya*, respectively)[9].

[9] The pseudo-words were orthographically and phonologically legal strings; the non-words contained illegal strings.

They found that normal readers read real words better than pseudo-words, and pseudo-words better than non-words, and this was true from the very earliest stages of reading. The poor readers, on the other hand, read all of the words equally well until the third grade when they started demonstrating the pattern shown by the normal readers. Defior *et al.* argued that this was because it was not until the third-grade that poor readers developed enough phonological skills to use a phonological route. However, the opposite may be true. If there are no differences between the reading performance on real- and pseudo-words, this is presumably because the children are relying too heavily on a phonological (or a phonemic) route, rather than using lexical knowledge to help them learn to read.

One problem with the comparisons drawn between the normal and poor readers in this study is that there were 10 normal readers in each year grade, whereas there were only four poor readers. Hence, the numbers of poor readers was too low for any definitive comparisons to be made.

The results do suggest that Spanish-speaking children rely on both GPCs and on a more 'global' strategy from the very beginning of their reading. However, it still remains unclear as to how the 'global' route works. Is it a purely visual route, or are we really referring to the use of analogies being drawn across units larger than individual phonemes? If this is the case, then what units might these be?

3.2.v Summary

It appears that at the beginning stages of reading, Spanish children rely on their pre-reading knowledge of syllables to help them read. As they learn to read, they learn more about the relationship between individual phonemes and graphemes, which then allows them to read more fluently via the application of GPCs. So, both syllable and phoneme

awareness are important for reading in Spanish from the earliest stages. However, little research has been conducted to indicate the role that rime awareness may play. Furthermore, much of the research confounds syllable and body, leaving it unclear as to which of these units is the truly relevant one in reading.

We have also seen evidence that some analogical reading takes place, since frequency effects are found from a very early age, and children are more likely to lexicalise or mispronounce words with context-dependent letters that are similar, but pronounced differently, to known words. Further research also needs to be conducted to examine more closely the phonological level at which analogies in reading are drawn.

However, a lack of replicated or clear-cut results and the low numbers of children participating in the studies makes any strong conclusions as to which units are most important for reading in Spanish and how phonological awareness and reading interact over time impossible.

3.3 CONCLUSIONS AND QUESTIONS

So far we have reviewed the literature concerning English and Spanish reading development independently. In this section we compare the processes involved in reading in English and Spanish to see how they differ from one another, and ask what gaps have been left in the research in each language.

English-speakers appear to rely on an analogy strategy to help them read. Firstly, they draw these analogies across the rime unit, and later, as their phonological awareness increases, smaller units that become phonemically underpinned start to be represented orthographically. Because of the complex nature of the relationship between phonology and orthography in English, various forms of phonological awareness are important. The crucial insight is working out when each type is applicable. It is not possible to rely

heavily on any one single correspondence or mapping between a phonological unit and an orthographic representation. Rather, it is important to understand the context dependency of when to choose which phonological unit for mapping onto the orthography.

Due to the much more transparent orthography, reading in Spanish could, theoretically, be a much simpler process. There is evidence that children rely on a phonological route with syllables and phonemes being the phonological units whose orthographic representations children learn. However, one area that has been neglected in the Spanish literature is the role that rime awareness may play in learning to read in Spanish. There is evidence that an analogical strategy is applied in Spanish reading. Using syllable awareness is one example of how analogies may be drawn, another unit might be the rime.

From a review of the literature, therefore, we may conclude that although similar reading strategies may be employed in both languages, they are used to different extents, and with different phonological-to-orthographic unit mappings. However, the lack of evidence directly comparing English- and Spanish-speakers use of phonological knowledge in reading makes any conclusions as to how the relationships differ across languages little more than speculation. In order to determine how reading differs in English and Spanish it is necessary to compare the two groups directly.

There is at least one experiment that confirms that the processes involved in learning to read in English and Spanish are different from one another. As we have mentioned, Spanish has a very transparent orthography: letter-sound correspondences are, on the whole, highly consistent. The English orthography, on the other hand, is relatively consistent at the onset-rime level. We have seen how young learners of Spanish may benefit from focussing on individual GPCs, and on syllable-to-grapheme-sequence correspondences. Young learners of English gain more from concentrating on the orthographic units that correspond to onsets and rimes.

These findings suggest that regularity and consistency are likely to affect children's reading. A word like *light* is irregular but consistent, because it has irregular GPCs, but all other words that end in the orthographic rime 'ight' (termed 'orthographic neighbours') are pronounced in the same way. A word like *bear* is regular but inconsistent because not all words that end in 'ear' are pronounced to rhyme with *bear* (e.g. *hear*). A word like *cat* is both regular and consistent, because it has regular GPCs and all of its 'orthographic neighbours' rhyme. Regularity and consistency can be systematically varied to determine the role that each plays in reading.

Goswami, Gombert and de Barrera (1998) looked at how these two factors affect reading in English and Spanish. The theory was that if children are paying attention to the way in which the orthography that they are learning to read represents the phonology of their language, then a difference in reading speed and accuracy would be found between words that were manipulated for consistency and regularity. Words that are regular and consistent should be read faster than words that are irregular and inconsistent.

Goswami *et al.* created nonsense-words, like '*dake*', in English, and '*nas*', in Spanish, that had analogous real word neighbours in the mental lexicon (*cake* and *gas*, respectively) and could be read via the use of GPCs or via the use of rime analogy. These were the O+P+ words, because they have both orthographic and phonological neighbours. Another type of nonsense word had no orthographic and no phonological neighbours (e.g. '*faish*' in English, and '*saf*' in Spanish). These were termed the O-P- words. It was predicted that, irrespective of the transparency of the orthography, the O+P+ words should be read faster and more accurately than the O-P-, but the magnitude of the effect might be smaller in Spanish because Spanish children should rely on GPCs to a greater extent than English children.

This theory was tested on seven-to-nine-year-old English and Venezuelan (Spanish-speaking) children. They found that, although all of the children found the O-P- words

harder to read than the O+P+ words, the differences in speed and accuracy between the two different types of word were much smaller for the Spanish-speaking children than for the English-speaking children. Furthermore, the Spanish-speaking children were both faster and more accurate than the English-speaking children on both types of word. However, the differences between the English-speaking and Spanish-speaking children diminished in the older age groups.

This suggests that at the early stages of reading, Spanish children rely more heavily on GPC rules than do English children because they were more accurate and faster at reading both types of word. However, the findings also suggest that both groups are relying on some orthographic knowledge when reading because both groups found O+P+ words easier than O-P- words. However, the reliance on this strategy is probably not as great for the Spanish-speakers as for the English children because the differences in performance on O-P- and O+P+ words were smaller for the Spanish group. In other words, both groups use similar strategies, but the extent to which these are employed differs across the groups.

The above experiment focuses on GPCs in reading. There are many questions left unanswered concerning the specific relationship between phoneme awareness and reading for the groups under study here. Although there is plenty of research looking at phonemes and reading ability in both English and Spanish (although not with bilingual children), the majority of the tasks used in experiments have concentrated on consonant phonemes. However, it is not clear whether different types of phonemes play different roles in the acquisition of literacy.

This can be split into two questions. Firstly, do the two general types of phoneme, vowels and consonants, play different roles? Few people have looked at the relationship between vowel awareness and reading. There are reasons to believe that vowel phonemes might be more salient to Spanish-speakers than are consonant phonemes. This is because

they are phonetically more stable; they change less than consonants do as a consequence of the context in which they are found and there are fewer of them. Hence, for Spanish speakers, at least, it might be that vowel awareness plays an important role in reading.

Secondly, do the different types of consonants (stops, fricatives, nasals and liquids) each differ in their relationship to reading? It is possible that certain consonant types are more salient than others. Increased salience may, in turn, aid the mapping of the sound onto its orthographic representation. If this is the case, it could have important implications for which GPCs children should start off being taught about.

Research into specific reading errors is also scant. Most studies look at reading ability in general, without ever asking where and what type of reading errors occur. In our review of the literature we have seen that work on reading errors by Shankweiler and Liberman (1992) and by Defior *et al.* (1998) tells us something about how children try and work out the mapping between their phonological and orthographic systems. Their difficulties might lie in their lack of accurate phonological representations. Phonological representations may be less accurate for certain units (e.g. vowels in English, consonant clusters in both English and Spanish) than others. This lack of accurate representation might reflect itself in an inability to accurately read these sounds.

One way of looking at this is to examine whether a direct relationship exists between phonological awareness and reading. By asking children to read words containing orthographic sequences corresponding to phonological units for which you have already tested awareness, you can determine the direct relationship between awareness and literacy. If a correlation is found between the awareness of a unit and the ability to read it there is strong evidence that the two are directly related.

For example, we saw in Chapter 2.3.iii.c that children are more aware of the first consonant of a consonant cluster onset than they are of the second consonant. How does this affect their ability to read words that begin with consonant clusters? Treiman (1985a)

asked first- and second-grade children to read words that either begin with singleton onsets or consonant cluster onsets. She found that they often misread words with initial consonant clusters as if they started with initial singletons. For example, they might read '*swing*' as '*sing*'. Another common reading error is to turn initial consonant clusters into consonant-vowel-consonants (CVC's). For example they might read '*smoo*' as '*somo*'. The mistakes made in reading are very similar to those made in phonological awareness tasks. Where word initial consonant clusters are concerned, it is the second consonant that loses out to the first.

Domínguez (1996) found that Spanish children also have difficulties with reading consonant clusters in word-initial positions, where they tend to omit the second, liquid consonant.

We have already seen (Chapter 2.3.iii.c) that the way in which a word is syllabified might influence perception of the constituent phonemes of a double-consonant, by determining the type of phonological unit that is being perceived. We wanted to determine whether the trouble children have in decoding printed double-consonants is due to their difficulty in analysing clusters in spoken words, and if so, whether syllabification determines the difficulty of analysing double-consonants found in the middle of words.

3.4 THE TRANSFER OF READING STRATEGIES IN BILINGUALS

The final question concerning reading is whether bilingual children approach its acquisition in the same way as monolingual children. We have seen that the processes involved in reading in English and Spanish are different. Not only are the phonological structures of the languages different, but the level at which the phonological and orthographic systems map onto one another is also different. The interesting question that arises for bilingual children is, do they act as two monolinguals, or, do they use their

awareness of each of their languages' phonologies to help them read in the other language? Or, do they rely on different strategies from either of their monolingual counterparts?

Since the majority of the bilingual children in this study were Spanish-dominant, it is possible that phonological representations, auditory discrimination, memory for phonemes and for verbal information, and speed of lexical access will be more developed in Spanish than in English. Since all of these factors are involved in reading and spelling, it might be easier to learn to read and spell in Spanish for these children. On the other hand, the majority of formal literacy instruction took place in English. Hence we could equally argue that it should be easier to read and spell in English. We need to ascertain the extent to which the above mentioned factors have evolved in the English of the bilingual children under study, and the extent to which they are affected or influenced by the levels of proficiency in Spanish.

From the English and Spanish literature it is possible to speculate as to how bilingual children might approach reading in each language. There are two principle issues that need to be considered. Firstly, how the exposure to two phonological systems might affect literacy, and secondly, how exposure to two orthographic systems might affect literacy.

We will begin by considering the possible relation between phonological awareness and reading for this group of children. If the exposure to two differing phonological systems means bilingual children are 'phonologically advantaged', this might also put them at an advantage when it comes to learning to read. The theory is that close analysis of your language can only help, (not hinder), when it comes to reading and spelling. If they can transfer their phonological awareness across languages, or if they are better at analysing the linguistic structure of their languages, they have a much larger repertoire with which to attempt phonological-to-orthographic mappings.

The exposure to two differing orthographic systems may also influence the ease with

which bilingual children learn to read and spell. There is some evidence that the exposure to different orthographies makes children realise the symbolic nature of orthographic systems to a greater extent than children who are only exposed to one orthographic system. Bialystok (1997) examined four-five year old English-French bilingual and English monolingual children's emerging concepts of how print refers to language. None of the children in the study could read by themselves although they could recognise written forms. The children were presented with two pictures (e.g. cat and mouse). The experimenter then produced a card and told the child what it said (e.g. '*mouse*'). She then placed it underneath the picture that it named (e.g. picture of mouse). The child was asked to read the word (introductory question). Then a 'naughty bunny' would come along and accidentally kick the card so that it was underneath the other picture (e.g. picture of cat). The children were then asked to read the word again (inconsistent question). Finally, the children were told that the mess the bunny had made needed to be cleared up, and the card was placed in its original position, underneath the object to which it corresponded (consistent question, e.g. picture of mouse).

Bialystok found that the bilingual children were more likely to keep their response the same in the inconsistent question trials than were the monolingual children. The monolingual children were more likely to incorrectly claim that the written word said the name of the object that it was now underneath (e.g. they would read '*cat*' instead of '*mouse*'). She took this as evidence that bilingual children who have had similar amounts of literacy experience in English as the monolinguals show a better understanding of the general symbolic properties of written English. They understood that "written form carried meaning and that the picture was irrelevant" (p.437). However, understanding that print represents words is just the first step in learning to read. Children need to further understand the specific representational properties of print, how different written strings represent different sounds.

In other words, learning to read and spell involves the process of working out how a phonological system maps onto an orthographic system. A bilingual child has to do this

twice, once in each language. This may put them at an advantage if they can transfer reading strategies across languages. If a particular strategy works in Language A, they may try it in Language B. If it works in Language B, then they may be employing a strategy that would have otherwise gone unperceived. Alternatively, if that particular strategy does not work in Language B the child may not advance in his or her reading ability. However, an unsuccessful reading strategy could help them focus on the structure of each of their orthographic systems and hence more readily work out how each corresponds to, or represents (differently) phonology.

Research into bilingual reading is scant to say the least. da Fantoura and Siegel (1995) found that Portuguese-Canadian English fourth-to sixth-graders, when tested in English, were just as good as their monolingual counterparts at reading. However, those that were poor readers were better at reading (and spelling) pseudo-words than their poor-reading English-speaking counterparts. Portuguese (like Spanish) has a far more transparent orthography than English. This suggests that knowledge of the more regular conversion rules of Portuguese may transfer positively to the reading (and spelling) of English pseudo-words. The children tested obviously possessed a reading skill used in Portuguese that their English-speaking counterparts lacked. If these bilingual children could learn how this skill might be applicable to benefit their English reading then we would have an example of how reading strategies (based on phonological awareness) may be transferred across languages to the advantage of reading skill.

Koda (1988) looked at English and Spanish adults' reading strategies for English words (the Spanish adults were proficient in English, although they had not learned it during childhood). He found that when the visual information was distorted the English participants' lexical decision making was affected, but that of the Spanish participants was not. This suggests that the same reading strategy is employed in both Spanish and English for the Spanish-speakers: they still rely heavily on a phonological code rather than visual

information when reading in English. However, it could be that they were not proficient enough in English reading for a visual or automated strategy to be employed. Moreover, these Spanish-English-speakers were not brought up as bilinguals. Consequently, we cannot be sure that the processes they employ in reading would be the same as those of children brought up to be biliterate.

Durgunoğlu, Nagy and Hancin-Bhatt (1993) were interested in whether phonemic awareness that develops through experience at home and school in a child's first language (Spanish) is related to word recognition in a second language (English). They gave first-grade (4-5yrs) Spanish dominant bilingual children a battery of phonological tasks:

Task:	**Unit:**	**Example:**
Blending	phoneme	/l/ /a/ → '/la/'
	syllable	/fo/ /to/ → '/foto/'
	onset/rime	/f/ /in/ → '/fin/'
Segmentation	phoneme	/la/ → '/l/' '/a/'
	syllable	/foto/ → '/fo/' '/to/'
	onset/rime	/fin/ → '/f/' '/in/'
Matching	onset	which of three alternatives begins with the same sound as a target word: target = '/ganas/', alternatives = /gota/, /luna/, /bota/
	syllable	target word = '/capa/', alternatives = /leche/, /caro/, /agua/
	body	target word = '/bota/', alternatives = /curva/, /parte/, /bolsa/

They were also given reading and language tests:

1. language assessment
2. letter identification. Children had to give either the name or the sound of the letter
3. word recognition. Children had to read a list of 15 common words in each language
4. pseudo-word reading. Half of the words contained graphemes pronounced the same in English and Spanish, half contained graphemes that are pronounced differently. The

experimenter pronounced the pseudo-word and then asked the children to break it into the onset and rime. They then gave them a teach-test procedure to determine how easily they could learn to read these pseudo-words..

5. word reading tasks. The words contained the same onsets and rimes as the pseudo-words. The experimenter sounded out and blended the words to the children and then gave them to the children to read.

All of the tasks were conducted in both languages, apart from the phonological awareness tasks, which were conducted solely in Spanish.

The amalgamated phonological awareness scores were significantly correlated with English word and pseudo-word reading. So was Spanish word reading ability. Language proficiency did not affect reading for either language. These results indicate that the best predictor of performance on English pseudo-word and word recognition tests are Spanish phonological awareness and Spanish word reading. Moreover, we know that the children were not just using their Spanish reading strategies to read in English, because their performance on those test items that are pronounced differently in each language was just as good as for those words pronounced similarly in both languages.

This is a very interesting finding. However, one limitation is that Durgunoğlu *et al.* did not look at English phonological awareness to see how this is related both to Spanish phonological awareness and to English and Spanish reading abilities. Another limitation is that they amalgamated the phonological awareness scores. It would have been fascinating to see whether awareness of different units in Spanish was differentially related to reading ability in English. Which unit was most correlated with English word-reading? Furthermore, the fact that the words were sounded out and blended for the children before they were asked to read them might have influenced the way in which they chose to read them: some of the children might simply have remembered what the words were from these pre-reading blendings.

Importantly, however, the study does suggest that bilingual children can transfer phonological knowledge across languages, although we do not know at what phonological level this occurs. The experiment also shows us that developing phonological awareness and word recognition in the first language can help reading in the second language.

Cisero and Royer (1995) (described in Chapter 2.4) found that performance in phonological awareness in L1 at Time 1 predicted reading performance in L2 at Time 2. The pattern of correlations they found suggests that evidence for cross-language transfer could have been found for any of the phonological awareness skills if one had looked at the right skill at the right point in the development process of skill acquisition.

These results jointly indicate that it is possible to build on the strengths that children already have in their first language in order to help them acquire literacy in their second language.

Having reviewed the literature on reading acquisition for English and Spanish monolingual children, we can make some predictions about how differences in reading strategies across these languages might affect bilingual children. In particular, we are interested in those aspects of reading in English and Spanish that could be transferred across languages.

One possibility is that bilingual children use an analogy strategy in Spanish to a greater extent than monolingual Spanish-children do. Analogy is a popular strategy in English and one that is not necessary in Spanish (see Sections 3.1.iii and 3.2.iii, respectively). Bilingual children may draw analogies across units larger than individual phonemes, such as the rime, as a direct consequence of learning this strategy from English reading. Another possibility is that bilingual children will employ the use of phonemes in English reading at an earlier stage than English monolingual children. This could occur if Spanish children are aware of phonemes sooner than English children, as the evidence discussed in Chapter 2.3 suggests. Knowledge of vowel phonemes may be particularly

helpful since English children have difficulties both in becoming aware of them, and in acquiring orthographic representations of them (Goswami, 1993). Furthermore, phoneme awareness is a powerful predictor of reading ability at the later stages of reading acquisition for English children. This could entail that bilingual children will be good at reading in English, if they transfer Spanish phonemic awareness across languages, or if they can use their Spanish phoneme awareness in English reading.

One of the ways in which we can verify whether bilingual children are transferring their use of strategies and their phonological knowledge from one language to another in reading is by looking at the correlations between reading and phonological awareness for this group. If we find correlations between English reading and phonological units that are typically correlated with Spanish reading ability, then we have evidence that Spanish reading strategies are affecting English reading. Similarly, if we find correlations between Spanish reading and phonological units that are typically correlated with English reading ability, then we have evidence that English reading strategies are affecting Spanish reading.

CHAPTER 4

SPELLING

In Chapter 3 we discussed reading. In this chapter we look at the development of spelling. We begin by looking at spelling in English and then look at spelling in Spanish. We then discuss how the processes involved in each language differ from one another. Finally, we discuss the gaps in the research and how the differences between English and Spanish spelling might affect spelling development in bilingual children.

4.1 SPELLING IN ENGLISH

In English, children rarely begin to spell until they have first learned to read, and this is certainly the sequence in which literacy is taught at school. This might be because in order to learn to spell, you need access to phonemes, and most importantly, you need to understand the relationship between phonemes and their orthographic representations. Since access to this level of knowledge is not acquired until you have learned to read, it is hardly surprising that reading precedes writing.

4.1.i The importance of phonology

4.1.i.a Phonemes

The mistakes children make when they first start to spell indicate that they are quite obviously paying attention to the relationship between the individual sounds of the spoken words and the individual letters of the words they write. In fact, many of their mistakes show that they make phonetic distinctions that adults have long forgotten about, presumably as a consequence of learning to spell (Read, 1986)! For example, they might

spell the word 'truck' as 'chruk', or 'judge' as 'juj' which is actually an accurate phonetic transcription of the sounds being heard. Nevertheless, they use a phonological code too literally. It would appear that they are trying to represent each phoneme that they hear as a grapheme on the page. Children who have some pre-reading letter-sound knowledge will make these kinds of spellings even before they have learned to read. So at the earliest stages of spelling, children employ their phonemic awareness. Do they continue to do this when they start to use conventional spellings?

One way of ascertaining whether or not children use their knowledge of GPCs when they spell is to compare them with a population that would be expected to make little use of this strategy, namely, deaf children. Dodd (1980) conducted such an experiment. She gave 14-year-old hearing and deaf children words that were either regular (e.g. dish), or irregular (e.g. receipt). She found that the deaf children made similar numbers of mistakes on both types of words. The hearing children, on the other hand, made fewer errors on the regular words than they did on the irregular words. Since regular words can be spelled by applying GPCs, whereas irregular words cannot, the evidence would suggest that hearing children do rely primarily on their phonemic awareness when it comes to spelling.

However, we should not be too hasty in drawing this conclusion. For regular words there is only one possible spelling. For irregular or ambiguous words, on the other hand, there are various phonologically plausible alternatives. Hence the child has to decide between these, something that does not need to be done for the regular words. For example, the word *receipt* could be spelled '*reseat*', '*reseit*', '*reseet*' etc. Do these extra alternatives confuse children? Waters, Bruck and Seidenberg (1985) conducted an experiment to find out. They asked eight-to-twelve-year-old children to spell words that were either regular, ambiguous (had various alternative spellings, e.g. *beef*, where the /i/ could be spelled 'ea, ei'), or exceptions (e.g *yacht*: cannot be spelled via GPCs or analogy). They found that the words most often correctly spelled were the regular words, followed by

the ambiguous words, with the exception words being the most often misspelled. It is also interesting that the ambiguous words were often spelled using a sequence of letters that would be a legitimate representation of that sound. For example, they spelled 'beef' as 'beaf'. Hence, it would appear that these children are linking sounds to spelling sequences; they just have not yet learned in which scenarios the different spelling sequences are appropriate. Indeed, many adults are not explicitly aware of the factors determining how phonemes should be spelled in different circumstances. Through increased experience with the orthographic system we must implicitly learn something about its structure[1] that enables us to correctly spell, on the majority of occasions, unfamiliar words that have various possible alternative spellings.

The initial evidence would suggest that at the early stages of learning to spell children rely heavily on their phonemic awareness. However, the English orthography is misleading: relying on grapheme-phoneme correspondences in order to spell will not get you very far. It is also necessary to bear in mind larger phonological units. Do children do this?

4.1.i.b Rimes

Read (1986) looked at children's 'invented' spellings. He found that children would often use single letter names to represent rimes of words. For example, they might spell 'car' as 'cr', 'baby' as 'bab', 'lady' as 'lad', and 'bell' as 'bl'. In these instances, children are using single letters to represent rimes. However, we must be careful about the conclusions we draw from this since the children could either genuinely be confusing letter names and letter sounds, or they could just be missing out the essential letters for an

[1] E.g. the constraints on which graphemes may go together in different word positions, the frequency of certain orthographic representations of phonology etc., etc..

accurate spelling of the word. In the former case, they would be attempting to represent a phonological unit; in the latter case, they would be ignoring parts of phonology.

Bradley and Bryant's (1983) study, described in Chapter 3.1.i.b, showed that pre-readers' awareness of rimes was a good predictor of spelling ability three-to-four years later. However, this does not tell us anything about the actual processes involved in spelling.

4.1.i.c Onsets

Children try to represent the onsets of words from the earliest stages of learning to spell. We can see this because they often make mistakes when trying to represent onsets that consist of more than just one phoneme, such as the 'str' of '*string*' or the 'bl' of '*blow*'. Rather than writing all of the consonants they will usually only write the first of them (e.g. '*b*ow' for '*bl*ow'). Bruck and Treiman (unpublished; in Goswami and Bryant, 1990) performed an experiment to examine whether children's ability to represent both phonemes of a consonant cluster onset was related to their ability to perceive both of the phonemes. They gave six- and seven-year-olds some words to spell, and also asked them whether or not certain phonemes were contained in words. The phonemes would either be part of a consonant cluster onset, or a singleton onset (e.g. is there a /l/ in '*blow*'?; is there a /l/ in '*laugh*'?). The words the children were asked to spell either had consonant cluster onsets, or singleton onsets.

They found a strong relationship between the inability to 'hear' the second consonant of the consonant cluster, and the representation of this cluster with a single grapheme. They concluded that this was evidence that young children perceive the onset as a single unit (as opposed to two phoneme units) and hence represent it as such. If they do not perceive the second consonant, then they will not represent it in their writing.

However, it is possible that children have difficulties with spelling consonant clusters simply because double-consonants are particularly hard and not because they constitute the onset. Indeed, children also have difficulties in perceiving and also representing both of the consonants of word-final consonant clusters: these clusters are not speech units in the same way that the onset is (Treiman, 1983)[2]. This suggests that the difficulty might be more with breaking up double-consonants (see Chapter 2.3.iii.c) than with breaking up the onset unit.

It is also possible that it is the types of consonant that make up the cluster that causes difficulties in spelling. Various researchers (see for example Read, 1975; Snowling, 1982 - non-words; Marcel, 1980 - liquids and nasals; Treiman, 1993 - liquids and nasals) have found that children often fail to symbolise nasals when they precede obstruents (e.g. sink). This might be because nasals are acoustically shorter before voiceless than voiced stops (Malécot, 1960). Hence consonant cluster mis-spellings do not necessarily reflect a bias to spell all consonant clusters as singletons. Rather it seems that the child when spelling is trying to represent the phonemic level of the language. However, children's phonemic representations sometimes differ from those embodied in the conventional writing system. Treiman, Mullennix, Bijeljac-Babic, and Richmond-Welty (1995) found that those words that were mis-spelled were also represented with one less token than necessary in a phoneme counting task. Hence, children really do seem to be representing each phoneme in the spoken form of the word with a grapheme. The only problem is that the child's phonemic representations do not always match those assumed by the conventional orthography.

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[2] However, Treiman's (1983) experiment (see Chapter 2.1.i.a) is not conclusive about codas being encoded as phonological units that pertain to the hierarchical structure of the syllable. If they are perceived as cohesive units then this could explain why they are represented by single consonants in spelling.

4.1.ii Analogies and spelling

So far, we have seen that children at the early stages of learning to spell make use of their phonemic awareness. However, despite the creativity of their spellings, their 'over-reliance' on GPCs results in many mistakes. Given that the English orthography is not regular at this level, this is hardly surprising. Yet children do eventually learn to spell correctly. How do they do this? One explanation is that they eventually abandon using a phonological strategy in favour of a purely visual one. The theory has it that they simply memorise the spelling sequence of each word. However, if this were the case, then they would not be able to spell words that they have never seen before. Yet they can do this. So what strategy are they using?

One possibility is that they use the same strategy as for reading, namely, analogy. Goswami (1986, 1988b) conducted an experiment to investigate whether children could spell unfamiliar words after they had been taught to spell analogous words. Just as in her experiment on reading (see Chapter 3.1.iii), she taught six-year-old children (with a spelling age of 7yrs) to spell a list of 'clue' words and then looked at whether they were capable of spelling 'target' words by drawing analogies either across the rime unit or the onset-plus-vowel unit. She also included in this target list control words that shared individual graphemes with the 'clue' words but that could not be spelled via analogies with clue words.

She found that teaching them to spell the clue words (such as '*beak*') did not help them to spell the control words (such as '*<u>ba</u>s<u>k</u>*' [shared graphemes]), but did help them spell the analogous words (such as '*<u>bea</u>n*' [shared body] and '*<u>pea</u>k*' [shared rime]). What is more, the children were more likely to correctly spell the analogous words that shared the rime segment with the clue word, than the body.

Thus her experiment shows that, just as in reading, children can spontaneously draw analogies across words to help them spell. Rime seems to be the unit with which they are happiest, but they can still draw analogies across other units such as the body.

4.1.iii Summary

We have seen that children might start to learn to spell using grapheme-phoneme correspondences. This means that spelling in English cannot really begin until the child has learned to read, since it is usually through reading that the child becomes aware of phonemes. However, once this awareness has developed, it can predict future spelling ability (Bryant and Bradley, 1983; Muter *et al.*, 1997). However, even though in the initial stages of spelling children attempt to represent each phoneme they hear as a grapheme on the page, this approach needs to be replaced. English is not regular at the phoneme-to-grapheme level, and hence using PGCs cannot be a successful strategy. Therefore, despite the strong correlations between phoneme awareness and spelling ability, children cannot be directly employing their knowledge of phonemes in spelling. Rather, the strong correlation is probably due to phoneme awareness being a reflection of a sophisticated level of understanding of the English phonological system. This sophisticated understanding probably allows children to choose the appropriate level of phonology to map onto an orthographic sequence for any given word. We have seen how one such mapping occurs at the rime level. As with reading, the use of analogies, drawn primarily across the rime, but also across other units, is one strategy skilled spellers apply in order to spell conventionally.

4.2 SPELLING IN SPANISH

Unlike spelling in English, which typically does not develop until the child has started to read, spelling in Spanish develops simultaneously with, or often precedes, reading. In Chapter 3 we saw how the Spanish orthography is highly regular at the GPC level. This means that generally, it is possible to spell in Spanish by using GPCs. The main question of interest, then, is whether children employ this method exclusively, or whether they also have alternative strategies available to them.

4.2.i The stages of spelling

Vernon (unpublished) looked at children's initial spellings and found a developmental pattern consisting of four phases through which all children seem to pass. In the first stage children represent each syllable with one grapheme, although the letter chosen is random; in the second stage children again represent each syllable with a letter, but this time the letter is a pertinent one (often the vowel of the syllable); in the third stage, some syllables are still represented syllabically while others are represented alphabetically; in the fourth stage, syllables are represented in a complete way, although not always conventionally.

These stages differ from those through which English-speaking children pass. As discussed in Sections 4.1.i.b and 4.1.i.c, English children may represent rimes and onsets with individual graphemes in the early stages of spelling, but there is little evidence to suggest that they are attempting to represent syllables. This difference might be a reflection of the use which children from these different linguistic backgrounds make of their phonological awareness when it comes to spelling. Although both groups use GPCs to represent units larger than individual phonemes, each group appears to choose those units that are phonologically salient to them: English children focus on orthographic

representations at the level of the rime, whereas Spanish children focus on the syllable unit. Furthermore, whereas English children tend to use consonant graphemes to represent phonological units, Spanish children choose vowel graphemes. Again, this may be a reflection of the phonemes that each group finds most salient.

4.2.ii Phoneme awareness and causal connections with spelling

Manrique and Signorini (1988) were interested in whether training children in phoneme awareness could improve their spelling capacities. They examined the spelling skills of first-grade children at the beginning of the school year. Children in the Experimental Group then received training in phoneme segmentation. At the end of the year, children were asked to write (and read) known and unknown words. The children in the experimental group wrote conventionally the words they knew, and they represented the letter-sound correspondences by conventional or invented letters for those that they did not know. Of the Control Group children (who had received no training), 20% performed similarly to the trained group, 50% only wrote those words that they knew, and the remaining 30% did not write anything at all!

Manrique and Signorini fail to tell us why this last 30% failed to write anything at all, and it is possible that these children had perhaps interpreted the instructions as 'only write those words that you know you will get right'. If they were uncertain about how to spell any of them, then they might have not bothered. The trained group, on the other hand, might have gained confidence as a consequence of the training and might have been more willing to try out new spelling patterns.

Nevertheless, the results do seem to indicate that training in phonemic segmentation does improve spelling ability.

Manrique (1993) implemented an instructional literacy program in a kindergarten classroom during the school year. The program included training with rhymes, initial and final sounds, and segmentation of words into sounds, as well as other language activities such as general vocabulary development, listening to stories, word and text writing and a systematic exposure to print. Children were evaluated at the beginning and the end of the term in phonological awareness by the "tapping task". This task involves counting phonological units by tapping them out either with a stick or your hand on the table. Spelling (and reading) skills were also assessed. By the end of the year, 65% of the children could write words and texts in a conventional form. These children also reached the segmentation criterion, though they could only read a few words. An interesting result was that from a total of 157 words written by the children, only seven presented omissions of phonemes. Omissions are usually quite common in spelling errors. According to Manrique, these data point to a consistent association between phonological segmentation ability and spelling skills, (whereas the former does not seem to be related to reading ability in this group of kindergarten children).

However, we should bear in mind that the children had received training in other things besides phoneme segmentation in the course of the literacy program implemented. Hence, it should not be assumed that it was purely a result of the segmentation instruction that the children's spelling ability developed. No doubt, the other training involving phonological awareness and the more general training in vocabulary and text awareness that took place during the year also had an influence.

Interestingly, this training study, along with that conducted by Manrique and Signorini (1988) showed an improvement in spelling ability as a consequence of phoneme segmentation training alone. In contrast to the English studies, it was apparently not necessary for the children to be taught the relationship between graphemes and phonemes for the improvement in spelling to occur.

Defior and Tudela (1994) also conducted a training study to determine whether teaching children about phonemes would improve their spelling (and reading). The methodology employed was described in Chapter 3.2.ii.c. They found that children who were taught to categorise words according to shared phonemes and were also taught letter-to-sound correspondences were the only group whose spelling ability improved. Teaching children sound categorisation alone did not significantly improve spelling skill. However, we do not know whether teaching GPCs alone would have been sufficient for spelling improvement, since a GPC group was not included in the study.

Domínguez's (1992, 1996) training study described in Chapter 3.2.ii.c also looked at whether teaching children about phonology and about GPCs improved their ability to spell. She found that the only group whose spelling ability significantly improved was that which had been taught how to omit or add phonemes to words whilst also being taught how these phonemes corresponded to graphemes. The children who had been taught to delete or add phonemes with no GPC training, or to classify words according to common rimes or common semantic themes did not improve. Once again, this indicates that phonemic and GPC knowledge are both important for spelling in Spanish.

The findings of Defior & Tudela (1994) and Domínguez (1992, 1996) are in contradiction to those of Manrique and co-workers. Is it necessary to be able both to segment words into their phonemes and to understand the relationship that holds between these phonemes and their corresponding graphemes in order for spelling ability to improve? One difference between the studies conducted by Defior & Tudela and Domínguez and those of Manrique and colleagues is that in the former studies nearly all of the children improved in their spelling ability, whereas in the work carried out by Manrique and colleagues, the improvement was either specific to certain children or was not as great overall. It is possible that the children who improved in Manrique's experiments extrapolated from the segmentation knowledge to deduce GPCs, or that they were already

aware of these correspondences. Those who were either unaware of GPCs or unable to work them out might have been precisely those children whose spelling skill failed to improve. If this explanation is correct, it suggests that both phonological segmentation ability and knowledge of GPCs are necessary for spelling in Spanish. However, no study has been conducted that looks at whether GPC training alone is enough to improve spelling ability. Further research is needed to clarify this issue.

4.2.iii The use of grapheme-phoneme-correspondences

Studies that train children in phoneme awareness and then look at whether reading improves tell us that the awareness of phonemes must be involved in reading. However, we are no closer to knowing anything about the mechanisms used by children. It is not clear that children are directly employing the knowledge they have gained through training to help them read, or whether the relationship between training and the improvement in reading is mediated by a third factor. In English, we saw in Chapter 3.1.ii that it is unlikely that training improves reading ability directly through the use of GPCs, because using GPCs does not often work in English. In Spanish, however, using GPCs does work. Hence it is possible that children rely solely on this knowledge when spelling.

Valle Arroyo (1990) conducted a study with the aim of determining whether children rely on GPCs alone in order to spell. He gave second-, fourth- and eighth-graders (7, 9, and 13yrs, respectively) real- and non-words to spell. The words were controlled for frequency, length and regularity. Valle Arroyo argued that if children rely on a GPC strategy in order to spell then: (i) there should be fewer errors made on pseudo- as compared with real-words; (ii) there should be more errors made on longer words, since length should affect accuracy; and (iii) regular words should be spelled significantly better than irregular words.

He did indeed find this pattern of results for the second-grade children. This suggests that they rely primarily on a phoneme-grapheme route for spelling. Eighth-graders, on the other hand, showed the opposite pattern of results. They found real words easier than non-words, long words as easy as short words, and irregular words as easy as regular words. There was also a frequency effect, with the more frequent words being easier to spell. This suggests that these children were relying more on a 'lexical' strategy. Exactly what this lexical strategy might involve, however, is left unspecified by Valle Arroyo. We do not know whether this route is meant to be entirely visual, or whether it encompasses the use of a level of phonological awareness different from the phonemic level. For example, if the children were spelling words via analogies then we would expect to find the results that were actually obtained. Across which unit(s) the analogies might have been drawn is still open to question.

There is one finding that does not fit with Valle Arroyo's conclusion that the younger children rely on a GPC route. The younger children's spelling was also subject to frequency effects. This finding indicates the use of some sort of lexical route even by the younger children. Both types of spelling strategy were be used from the very outset of spelling and experience with the alphabetic script simply influenced the relative extent to each was relied on.

4.2.iv Double-consonants

Do double-consonants cause the same problems with spelling for Spanish-speaking children as they do for English children? Carbonell de Grompone (1974) looked at Uruguayan (Spanish-speaking) third-graders who were better spellers than readers. He found that the errors which were authentic auditory misperceptions were caused by the difficulty of hearing two phonemes when they were adjacent consonants in the same

syllable (i.e. double-consonants), as well as by the expectations that arose from the high frequency of open syllables in Spanish, and by the intellectual difficulty of maintaining the scanning of syllables and phonemes in long words. Hence, phonological awareness of double-consonants does seem to have an effect on your ability to spell these double-consonants.

Furthermore, Domínguez (1996) also found that Spanish children have difficulties with spelling double-consonants, both in word-initial positions, where they tend to omit the liquid consonant (the second consonant), and word-medial position, where they also tend to omit the second consonant. This might be because liquids are generally considered to be more vowel like than obstruent consonants and therefore tend to 'bind' more tightly to the preceding vowel (Hooper, 1976). However, it could also be argued that the second liquid consonant of a double-consonant is more likely to be omitted precisely because it is the second consonant of a consonant cluster word onset.

In order to determine which of these hypotheses is correct, an experiment needs to be conducted that requires children to spell double-consonants that consist of two obstruent consonants. If these are easier to spell than obstruent+liquid double-consonants then the first explanation would be correct. If they are equally hard to spell then the second explanation would be endorsed.

4.3 CONCLUSIONS AND QUESTIONS

We have seen that the processes involved in learning to spell in English and Spanish are different. Children from these different linguistic backgrounds appear to focus on those units that are most phonologically salient to them when attempting to represent words orthographically. Whereas in English, beginner spellers rely on their knowledge of GPCs, and in particular their knowledge of how consonant sounds are represented

graphemically in an endeavour to represent rime or onset units, Spanish children begin by trying to represent syllable units, usually through the use of individual vowel graphemes.

As children become more proficient spellers, the differences in the phonological structure of the two languages influence their approaches to spelling acquisition. English children begin to rely more on analogical methods of spelling, drawing analogies first across the rime unit, and later across other phonological units such as the onset and the body. Spanish children, on the other hand, increasingly rely on GPCs, although they too use analogy as a strategy. However, the units across which analogies are drawn may not be the same as those units that English children choose. Instead of concentrating on rimes and onsets, it may tentatively be suggested that Spanish children use syllables and bodies as the analogical units.

One area that has been neglected in both English and Spanish is that concerning the specific role that phoneme awareness plays in learning to spell in each language. Firstly, although we have evidence from both the Spanish and the English literature that phoneme awareness is important in spelling, we know little about whether children directly map between their phonological representations of phonemes and their orthographic representations. One way of looking at whether children do this is to test their awareness of sounds and then make them spell the same sounds. If the two abilities are correlated, it is likely that the children are directly mapping between the sounds and their spelling sequences.

We would predict that the more aware you are of a sound, the more likely you are to represent it in spelling. One factor that might determine whether or not you are aware of a sound is its phonological status. For example, we have already seen that in English, children sometimes represent rimes and onsets with individual graphemes, and in Spanish they represent syllables with individual graphemes. However, we also saw that although these phonological units were represented, they were usually represented unconventionally

with single graphemes. Hence a further factor that might determine whether or not a sound is represented orthographically in spelling is how complex the orthographic representation of that sound is. In English, for example, an onset is more likely to be correctly spelled if it is a singleton than if it is a cluster.

We saw in Chapters 2.3.iii.c and 3.3 that the way in which a child syllabifies a word might affect their ability to hear and read word-medial double-consonants because the phonological unit status of each consonant will be different depending on where the syllable boundary lies. The same might be true for spelling. Carbonell de Grompone's (see Section 4.2.iv), and Treiman and colleague's (see Section 4.1.i.c) results suggest that syllable structure does play a role in spelling in Spanish and English. Although Domínguez's (see Section 4.2.iv) result does not necessarily indicate the same, an experiment has not been conducted in which the type of middle double-consonant has been manipulated, so that each of the consonants in the double-consonant either belongs to the same, or belongs to different syllables.

In theory we might expect the Spanish-speaking child would find it easier to spell a word if the double-consonant is made up of two consonants each belonging to a different syllable (e.g. '*manta*' = '*man*' + '*ta*') than two consonants that belong to the same syllable (e.g. '*micro*' = '*mi*' + '*cro*'). This is because in the first instance each consonant is a singleton, whereas in the second instance the consonants form a cluster. Note that this is, in effect, what Domínguez found. She argues that the reason the second consonant of the cluster is omitted is because it is a liquid and hence it binds closely to the following vowel. However, in Spanish, if the second consonant of a double-consonant is a liquid, then the double-consonant will always be a consonant cluster onset of the second syllable[3]. Hence, rather than Domínguez's results being a consequence of the liquid consonant being closely

[3] unless the first consonant is also a liquid, in which case the consonants will be split between the syllables.

bound to the vowel sound, it could be that it is often omitted because it is always the second consonant of an onset consonant cluster. The result might not have been so if the second consonant of the word-medial double-consonant had also been the first (singleton onset) consonant of the second syllable.

A second, related, area that has been ignored is the possibility that the relationship between phoneme awareness and spelling may differ for the different types of phoneme. The majority of research has concentrated on consonant phonemes, to the exclusion of vowel phonemes. This distinction might be an important one to make, because different predictions can be made about whether grapheme-to-phoneme mapping is likely to occur for consonants and vowels for English- and Spanish-speakers.

Within languages, PGCs can be drawn for both consonants and vowels in Spanish, since the majority of consonants and all vowels have one and only one graphemic representation. In English, on the other hand, we would predict that PGCs would be easier for consonants than for vowels. PGCs are generally reliable and consistent for consonants. The same is not true for vowels, for which the mapping between phonological and orthographic representations is quite complex. The same vowel sound may be represented in various alternative ways (e.g. /i/ = *s<u>ea</u>t*, *f<u>ee</u>t*, *P<u>e</u>te*, *p<u>ie</u>ce*, *c<u>ei</u>ling*), and the same orthographic sequence may be pronounced in various alternative ways (e.g. '*u*' = /flut/, /bʌt/). Sometimes vowel sounds are represented by single graphemes (e.g. /lok/ = '*l<u>o</u>ck*'), but sometimes they are represented with digraphs (two graphemes) (e.g. /lʊk/ = '*l<u>oo</u>k*').

Looking at cross-language differences, one would expect there to be little difference in Spanish and English children's ability to spell consonant sounds, but for Spanish children to find vowel spelling considerably easier than English children.

Hence, it is predicted that both phonological complexity (how salient a sound is) and orthographic complexity (how consistent the sound-to-letter correspondences are) will both affect a child's ability to spell.

4.4 BILINGUAL CHILDREN

To our knowledge, very little research has been carried out to examine the approach bilingual children take to learning to spell. We wanted to know whether they behave like two monolinguals in the two languages, or whether their approach differs from those of monolingual children in each of their languages. If it is the case that their phonological awareness in L1/L2 is influenced by the phonology of L2/L1, they may be able to apply this 'extra' knowledge when it comes to spelling. Furthermore, the exposure to two different orthographic systems may also entail that their views concerning the relationship between phonology and orthography differ from those of their monolingual counterparts in each language. It is possible that they employ strategies that are valuable in L1/L2 to help them spell in L2/L1. Whether this benefits their spelling acquisition, or whether it merely serves to confuse them through the use of inappropriate spelling strategies is a question we investigate.

4.5 OVERALL SUMMARY AND AIMS OF THE THESIS

4.5.i The three questions

This thesis asks three main questions:

1) Do differences in language structure affect phonological awareness?
2) Do bilingual children transfer phonological awareness across languages?
3) How is phonological awareness related to literacy for each of the groups?
    a) What is the relationship between phonological awareness and reading at a general level for each group?

b) Is there direct mapping between phonemic awareness and phoneme literacy for each group?

c) Do bilingual children approach literacy acquisition differently from monolinguals?

4.5.ii Phonological awareness

It will be recalled that the sequence of phonological development from large to small units appears to be universal, at least for implicit forms of awareness. Nevertheless, the evidence available suggests that speakers of English and Spanish may process their languages differently. This is to be expected because of the different structures of each phonological system. Bilingual-speakers, in turn, show qualitative differences in awareness from monolinguals. This suggests that they do not process language in the same way as monolingual children.

However, the research has failed to compare phonological awareness across English and Spanish children directly. Furthermore, research on bilinguals has focused on qualitative rather than quantitative differences from monolinguals. Hence no conclusions can be drawn about the relative awareness of each phonological unit for each group.

In this thesis phonological awareness in the three groups of children will be examined by directly comparing their awareness of the three different levels of phonology: syllables, intra-syllabic units and phonemes. It was predicted that the same pattern of phonological development will occur for children from each of the three groups. It can further be argued that English and Spanish children should show relative differences in their awareness to each phonological unit. It was also predicted that bilingual children will not behave as no more than the sum of two monolinguals. Instead, they were expected to transfer awareness across languages of those units made relatively salient in one, but not in the other, language.

We will concentrate, principally, on phonemes. We shall distinguish between consonants and vowels, to see if they are differentially salient in each language. Cross-linguistically this distinction might be important because the vowel systems of English and Spanish are quite dissimilar whereas the consonant systems are more alike. Hence, greater English-Spanish differences were expected for the vowels than the consonants. We shall also examine awareness of word-medial consonants since this is an area that has largely been neglected by researchers. It is predicted that syllable boundaries may have an effect on the awareness of these consonants, and cross-linguistic differences in syllabification strategy might result in cross-linguistic differences in awareness of them.

4.5.iii Literacy

The available evidence suggests that English and Spanish children do not approach literacy acquisition in the same way. Although phonological awareness is related to literacy in both languages, the level of phonology that is most important at different stages of development seems to vary across groups. Furthermore, bilingual children do not appear to acquire literacy in the same manner as monolinguals. Their exposure to two phonologies enables them to make use of both in reading in each language.

However, investigators have failed to compare English and Spanish children's reading and spelling strategies systematically. Furthermore, since research into Spanish literacy acquisition began relatively recently, it is far from conclusive. Similarly, little is understood about bilingual children's reading in each of their languages or how their exposure to two orthographies may affect their approach to literacy.

We predict that the relationship between phonological awareness and literacy will differ for monolingual speakers of English and Spanish. It also seems likely that bilingual

children, having access to two phonological systems and having to face two orthographic systems, will not acquire literacy in the same way as monolingual children.

The relationship between each of the levels of phonology tested and reading will be examined. A similar pattern of results is expected as found by previous research for the monolingual children. Awareness of rimes is expected to play an important role in early English reading, with phoneme awareness becoming increasingly important as reading improves. The awareness of syllables and phonemes are expected to be related to Spanish reading. The relationship between phonological awareness and reading for the bilingual children is of particular interest. The study examines both the relationships between L1/2 phonology and L1/2 reading and at whether L1/2 awareness is related to L2/1 literacy.

The study concentrates particularly on the relationship between phoneme awareness and literacy. It investigates not only whether phonemic awareness is a good predictor of reading ability for each of the groups, but also whether it is directly related to the ability to read and spell phonemes accurately. Since both English and Spanish-speakers are supposed to use GPCs in reading and spelling, a direct relationship for all of the groups is expected. However, it is predicted that this relationship will be strongest for Spanish-speakers for whom the use of GPCs is a more effective strategy.

Evidence that children from the three linguistic backgrounds are dissimilar in their processing of language and their approach to literacy acquisition will be presented in Chapters 5-10.

CHAPTER 5

EXPERIMENT 1: PHONOLOGICAL AWARENESS AND READING

5.1 INTRODUCTION

5.1.i Phonological awareness

Studies examining the development of phonological awareness in pre-literate speakers of languages other than English have shown that the sequence of development of phonological awareness follows much the same pattern as it does for English children. Awareness of rhyme is greatest, followed by awareness of syllables; followed by awareness of the intra-syllabic units of rime and then onset; and lastly, and usually not before some experience with the alphabet, phonemic awareness appears (Cossu, Shankweiler, Liberman, Tola & Katz, 1988 in Italian; Caravolas & Buck, 1993 in Czech; Morais, Bertelson, Cary & Alegria, 1986 in Portuguese; Domínguez, 1996 in Spanish; see Chapter 2). However, these findings do not necessarily entail that phonological awareness develops in exactly the same manner for all languages. After all, the developmental pattern may simply be a reflection of the (decreasing) size of the phonological unit. In other words, the larger the unit, the sooner you will become sensitive to it. We might find, however, that speakers of certain languages find certain units relatively more salient than speakers of other languages do. In other words, it is crucial to look, not just at the sequence of development, but at the amount of awareness of each of the different phonological units, to see if there are any quantitative differences in phonological sensitivity between children of different languages.

This investigation's first two aims were to discover:

a) Whether the sequence of development of phonological awareness is the same in Spanish and English; and,

b) Whether the degree of awareness of each of the phonological units is the same in English and Spanish at the same points in time in development.

The third main aim of this study was to investigate phonological awareness in Spanish-English bilingual children. In Chapter 2.4 we proposed alternative possible accounts of how bilingual children's phonological awareness might develop. In essence, these alternatives distinguished between two different approaches they may take. Do they behave as two monolingual children, developing phonological awareness of each language in parallel? Or, do they compare the two phonological systems to which they are exposed in order to gain a greater insight into how each is composed? If this latter theory is correct, we may expect bilingual children to be more aware than their monolingual counterparts of those units that are particularly salient in one language, but not the other. In other words, they may transfer phonological knowledge across languages.

The third aim of this investigation was thus to determine both the pattern of development of phonological awareness in each language for Spanish-English bilingual children, and, how their awareness of each phonological unit compared to that of the Spanish and English monolingual children.

5.1.ii Phonological awareness and reading

Phonological awareness is known to be important for reading in English (Chapter 3.1). However, the relationship between phonological awareness and reading in Spanish is not as fully understood (Chapter 3.2). Furthermore, virtually nothing is known about reading in

Spanish-English bilingual children (Chapter 3.4). It is possible that the bilingual child employs strategies that are not traditionally relied upon to read in each of her or his languages. Rather than being the sum of two monolinguals, reading for the bilingual child might, instead, involve a unique process that makes use of all the knowledge and skills available to him or her.

The fourth and fifth aims of this investigation, were to discover which phonological units are most correlated with reading ability in English and in Spanish (for all three groups), and whether these units coincide with those that the spoken language makes most salient.

Lastly, to our knowledge, no one has done research into how L1 and L2 reading abilities are related. This was the sixth aim of the experiment. For example, does being a good reader in L1 automatically mean that you will be a good reader in L2? What sorts of strategies, if any, are being transferred? Is it transfer of phonological knowledge that is most useful? Or, is it the need to discriminate between two different orthographies that leads to the child paying closer attention to certain noticeable or pertinent features of each, hence promoting good use of beneficial reading strategies?

To address these questions, a study was designed to test English monolingual, Spanish monolingual and Spanish-English bilingual five- and six- year olds' sensitivity to four different kinds of phonological unit: rhyme, syllable, rime and phoneme (in this instance, the vowel[1]). All of the words used were disyllabic[2], with stress in the first syllable. This allowed us to examine the role of stress in phonological awareness. It further allowed us to determine whether the salience of rime in English is linked to its position within the word.

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[1] It was decided that vowels should be used since, not only are there marked differences between the vowels of the two languages (see Chapter 2.3.iii.a), but to our knowledge no study has ever been conducted that investigates English children's awareness of vowels. Instead, consonants have always been chosen. We might find that phonemic awareness in terms of vowels might produce quite different results to those that have used consonants.

[2] The English language consists primarily of mono- and disyllabic words. The Spanish language consists primarily of di- and tri-syllabic words. This means that any investigation aiming to compare the two groups must use words that are equally common in both languages. Disyllables were the chosen kind here.

By employing these different conditions we aimed to discover how the knowledge gained through simple exposure to language differs depending on the language(s) to which children are exposed, be this English, Spanish, or both.

A series of other tasks were also administered. Firstly a memory task, in order to make sure that poor performance by any of the children could not be attributed to a lack of memory of the test materials. A vocabulary test was also given to see whether phonological awareness was at all correlated with vocabulary ability. Finally, a reading test was administered to see which phonological units were most highly correlated with reading ability.

5.2 PREDICTIONS

It was predicted that the sequence of development of phonological awareness would be the same for all three groups. However, we expected there to be differences in the degree to which each group was aware of the various phonological units. In particular, we expected Spanish-speakers to be more aware of syllables and vowels than English-speakers. This was because of the clear syllable boundaries and the low number of high-contrast vowels found in this language. We also expected the English-speaking children to be more aware of rhymes and rimes than the Spanish-speakers. This was because of the exposure to nursery rhymes that English children have. It was also because of the relatively low number of rimes that are not single phonemes found in the Spanish language, and the belief that the syllable is underpinned at the body/coda, rather than the onset/rime level in Spanish (see Chapter 2.2.i.b). We expected the bilingual children to gain from being exposed to two languages by transferring awareness of those units made particularly salient by the phonological structure of one language across to the other language.

We also expected children to be more aware of the units found in stressed syllables than the units found in unstressed syllables. We predicted this to be the case for all three groups, but particularly so for the English-speakers, since stress plays a greater role in the linguistic structure of this language than it does in Spanish.

Finally it was predicted that the relationship between phonological awareness and reading would differ across languages. Rhyme and rime awareness were expected to correlate with English-speakers' reading ability, while syllable and phoneme awareness were expected to play a greater role in Spanish-speakers' reading. We were particularly interested in looking at which units correlated with reading in bilingual children, and whether they used their awareness of phonology in L1 to help them read in L2.

5.3 METHOD

5.3.i Participants

Forty-two monolingual English first-grade children (14 boys, 28 girls; age range 5yrs, 2 mnths – 6yrs, 5mnths, mean age 5yrs, 10mnths), 42 monolingual Spanish first-grade children (20 boys, 22 girls; age range 5yrs 4mnths – 6yrs, 3mnths, mean age 5yrs, 10mnths) and 42 Spanish-English bilingual first-grade children (24 boys, 18 girls; age range 5yrs, 2 mnths – 6yrs, 4mnths, mean age 5yrs, 10mnths) took part in the study.

All of the children in the study came from middle to upper-middle socio-economic backgrounds. The English monolingual children were all pupils at the same state school in Oxford, and the Spanish monolingual children all attended the same private school in Madrid. The bilingual children were pupils from three different bilingual schools, also in Madrid. All of the bilingual schools' lessons were conducted purely in English, apart from two of the schools that had one-and-a-half hours of Spanish lessons each day[3]. None of the monolingual children had been instructed in, or were able to speak any language other than their mother-tongue.

5.3.ii Tasks and procedure

All of the tests were individually administered to the subjects by a single experimenter fluent in both English and Spanish. For the monolingual children, each child was tested on three occasions, each separated by approximately 24 hours, and each lasting between 15 and 25 minutes, depending on the speed of the child.

[3] The school days at these schools were also one-and-a-half hours longer than in the other schools in the study.

The bilingual children were tested in both English and Spanish and hence each child was seen on six separate occasions. The first three sessions occurred on consecutive days. One week later, the final three sessions took place, again on consecutive days. For half of the children, the first three sessions were conducted in English and the second three sessions were conducted in Spanish; the other half of the children were tested in Spanish for the first three sessions and in English for the second three sessions.

All of the instructions were given in the language of the test, except for some of the bilingual children whose English was not good enough to understand the English instructions fully. These children received the instructions in both English and Spanish for the English tasks, although the tasks themselves were (obviously) conducted in English.

For all three groups (English monolingual, Spanish monolingual and Spanish-English bilingual) half of the children were administered the memory, vocabulary and reading tests in the first session, with the phonological awareness tests taking place in the second and third sessions. The other half of the children did the phonological awareness tests in the first two sessions and all of the other tests in the third session. Given that there were seven different phonological awareness tests, the order of the tests, and the number of tests done in each session was also counterbalanced. For each of the seven phonological tests, two examples were given followed by eight trials. The order in which the trials were administered was randomised for each child.

5.3.ii.a Memory task

In the memory task the experimenter read out the first three examples of each of the seven phonological awareness tests that the child had either undergone in a previous session or

would undergo in a future session. The child simply had to repeat back the sets of three words to the experimenter. One point was given for each correctly remembered word, giving a possible total score of 63 points.

5.3.ii.b Vocabulary task

The English-speaking children (both monolingual and bilingual), were given the 'British Picture Vocabulary Scale – Long Form' (BPVS - Dunn, Dunn, Whetton & Pintilie, 1982). The BPVS is a standardized test of receptive vocabulary.

The Spanish-speaking children (both monolingual and bilingual) were given a translated and adapted version of the American standardised vocabulary test - the 'Peabody Picture Vocabulary test - revised', called the 'Test de Vocabulario en Imágenes Peabody - Adaptación Española' (Dunn, 1985).

5.3.ii.c Reading task

The 'Schonell Graded Word Reading Test' (Schonell and Goodacre, 1974) was used for the English-speaking children. The children were shown a list of simple and familiar words which they were asked to read one by one, starting at the top of the page and working their way a long the row, just as you do when you read a book. Only one row was shown at a time to the child. Testing continued through increasingly difficult words until the child reads ten consecutive words incorrectly when the test is ended and the child is congratulated and thanked for their participation. The number of correctly read words was added up and a reading age is given to the child, according to their reading ability as compared to the rest of the population.

The Spanish-speaking children were given the 'Test de Análisis de Lectoescritura' (T.A.L.E.; Toro and Cervera, 1995). This is a standardised test of reading (and spelling) ability. Only a part of the entire test was given. This involved the children reading a list of familiar and simple words that increased in difficulty the further through the test you reached, in exactly the same way as the English-speaking children had done. A child was stopped after she or he had made a total of 30 errors, although these did not have to be consecutive. The rest of the children carried on until they reached the end of the test. As a consequence of the nature of the Spanish orthography and its high regularity concerning GPCs, it is possible for a child with knowledge of the sounds of alphabetic letters to get to the end of the reading list. For this reason, the test is marked not only quantitatively (i.e. how many words the child has read)[4], but also qualitatively. The score given to the child depends upon the speed and the accuracy of reading. Errors were split into nine categories[5]. These are listed in footnote 5. Different sorts of mistakes are expected to occur at different frequencies in different age groups. For example, more 'substitutions' are expected to occur than 'additions' (see footnote 5), and this is true for all reading levels. This makes it very difficult to give the child one single reading score, because she or he might perform at the correct level in terms of her or his age for one particular type of mistake, while performing below or above average for another type of mistake. Hence, the child will fall into different reading ability categories for different aspects of reading. In

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[4] as it is for the English test.

[5] The different categories were: 1) Hesitation - the child hesitates longer than usual before reading a word; 2) Repetition - the child repeats either a letter, a syllable or the whole word, e.g. *me-mesa*; 3) Rectification - the child reads a letter or syllable incorrectly, but then realizes the mistake and rectifies it, e.g. *capé-café*; 4) Substitution - the child substitutes one phoneme for another. This usually occurs with consonants, e.g. *rota-sota*. It does not apply to those letters that are described in the rotation category; 5) Rotation - the child substitutes one letter for another, but only if the letters are those designated 'mobile'. Mobile letters refers to those pairs of letters that are the mirror images of one another. They are usually: *p* and *q*, *d* and *b*, *p* and *d*, *q* and *b*, *m* and *w*, *n* and *u*, e.g. *bata - data*; 6) Word substitution - the child reads one word for another, e.g. *balcón - blanco*; 7) Additions - the child adds a phoneme to the word, e.g. *patata - patatas*; 8) Omission - the child omits a phoneme from a word, e.g. *espuela → espela*; 9) Inversions - the child reads the word as if certain of its letters were in a different order, e.g. *peine → piene*.

order to give each child a single score, the average of the reading scores for each different category of mistake, along with the speed of their reading were used. However, this reading score was fairly crude since it was in terms of school grade-level, as opposed to reading age in years and months.

5.3.ii.d Phonological awareness tasks

All of the words used in the experiment were disyllabic, with stress in the first syllable. Only high frequency words that children would understand were used. There were a total of seven different tests that tested for awareness of: rhyme, syllables (2 tests), rimes (2 tests) and vowels (2 tests). The reason there were two syllable, rime and vowel tests was because awareness of these units was tested in both first, stressed syllables and second, unstressed syllable positions (see Table 5.1).

The oddity task was used for all phonological units. This test involves the experimenter reading out three words to the child. Two of the words share a phonological unit, whereas the third word has no sounds in common with the 'matching' pair. The child is then asked which word they think is the odd-one-out. For each of the seven tests the child was given two examples followed by eight trial sessions. The child scored one point for each correct answer, so there was a possible total score of eight for each test.

The tests took place in a quite room in the school. It was ensured that there would be as little noise as possible during the testing sessions so that the child could hear all that was being said clearly. At the beginning of the session the child was told that she or he and the experimenter were going to play a little game involving sounds and words, so the child must listen very carefully to the words the experimenter says and the sounds in them. She or he was

then given the following instructions on how the game is played: "I am going to give you three words. Two of those words will share a sound, they will have a sound in common, they will sound quite similar. But, the other word will sound different. It won't share any sounds with the other two words. OK? What you have to do is tell me which word is the different one, which is the odd-one-out. I will give you an example so that you know which sounds you are looking for."

Then depending on the test that came first for that particular child, an example would be given. If, say, the rhyme test was the first test, then the child would be given the following instructions: "If I say to you '*mummy*', '*tummy*', and '*children*', then you would have to say '*children*' to me, because children is the odd-one-out. Do you know why '*children*' is the odd-one-out? [Without giving the child a chance to reply, the experimenter would continue to say...] '*Children*' is the odd one out because *mummy* and *tummy* sound quite similar, don't they? They both share the '*ummy*' sound. *M-**uummyy***, *t-**uummyy***. Can you hear that they both share the '*ummy*' sound? [If the child looked very confused, then the experimenter would segment the word once more, again stressing the phonological unit that was shared by the two similar words]. But '*children*' is different. '*Children*' doesn't have that '*ummy*' sound. Instead, '*children*' has an '***ildren***' sound - *ch-**illlddrreen***. Can you hear the '*ildren*' sound? [Again, if the child looked confused then the experimenter would segment the word for him or her again]. Do you think you have understood?"

If the child disagreed or looked bewildered then they would be asked if they would like to go through the instructions again. If the child agreed then the experimenter would go on to give the second example: "Let me give you another example then. Which one do you think is the odd-one-out out of '*lorry*', '*jumper*' and '*sorry*'?" If the child answered correctly she or he was congratulated, if she or he answered incorrectly the experimenter would say "Oh no,

_____ isn't the odd-one-out. In this case you should have said '*jumper*' to me." Regardless of a correct or incorrect answer, the experimenter would go on to explain why the two similar words were similar, and why the odd-one-out was different in exactly the same manner as was used for the first example.

Once the experimenter had finished explaining and was satisfied that the child had understood what she or he was supposed to be doing (to the best of her or his ability), the test trials would begin. After each response no feedback was given concerning whether or not the child was answering correctly, but children were encouraged as much as possible by the enthusiasm of the experimenter.

When the last trial for that particular phonological unit had been given, the experimenter would say "Well done, that was very good. Now we are going to listen for a different sound, OK? Let me give you an example so you know what sound you are looking for. If I say to you...". The two examples would be given in the same way as they had been for the first phonological unit tested, and then the trials would proceed. This pattern was continued for the three or four phonological units being tested in that session.

At the end of the session the child was thanked for their participation and asked to go back to their classroom and send in the next child on the experimenter's list. At the beginning of the second phonological awareness session the child would be reminded of what they had been doing the day before, and she or he was told that they had done it so well that the experimenter wanted to see them again. The rest of the session continued exactly as it had done the previous day, the only difference being the phonological units being tested.

The Tasks

Table 5.1 gives an explanation of each of the tasks with an example from each language. A complete list of the materials is given in Appendix 1.

Table 5. 1: The phonological tasks with examples

Task	Measures sensitivity to:	English example	Spanish example
Rhyme (RH)	rhyme that crosses over syllabic border	***toffee***, ***coffee***, <u>*hamster*</u>	***planta***, ***manta***, <u>*dulce*</u>
Syllable 1 (S1)	first stressed syllable	***win****ter*, ***win****dow*, <u>*martian*</u>	***cin****ta*, ***cin****co*, <u>*meses*</u>
Syllable 2 (S2)	second unstressed syllable	*dent****ist***, *art****ist***, <u>*flower*</u>	*o****so***, *ver****so***, <u>*Pati*</u>
Rime 1 (R1)	rime in the first stressed syllable	*clum****sy***, *jum****per***, <u>*hedgehog*</u>	*dul****ce***, *cul****pa***, <u>*frío*</u>
Rime 2 (R2)	rime in the second unstressed syllable	*neck****lace***, *tort****oise***, <u>*farmyard*</u>	*poz****os***, *cul****os***, <u>*mandan*</u>
Vowel 1 (V1)	stressed vowel	***pa****ncake*, ***ha****mster*, <u>*elbow*</u>	***to****rno*, ***bo****sque*, <u>*lucha*</u>
Vowel 2 (V2)	unstressed vowel	*panc****a****ke*, *birthd****a****ys*, <u>*tiger*</u>	*mes****e****s*, *cog****e****n*, <u>*fácil*</u>

5.4 RESULTS

5.4.i Vocabulary

Table 5. 2 below shows the percentile rank scores of each of the groups on the vocabulary test.

Table 5. 2: Mean percentile rank vocabulary scores for each group

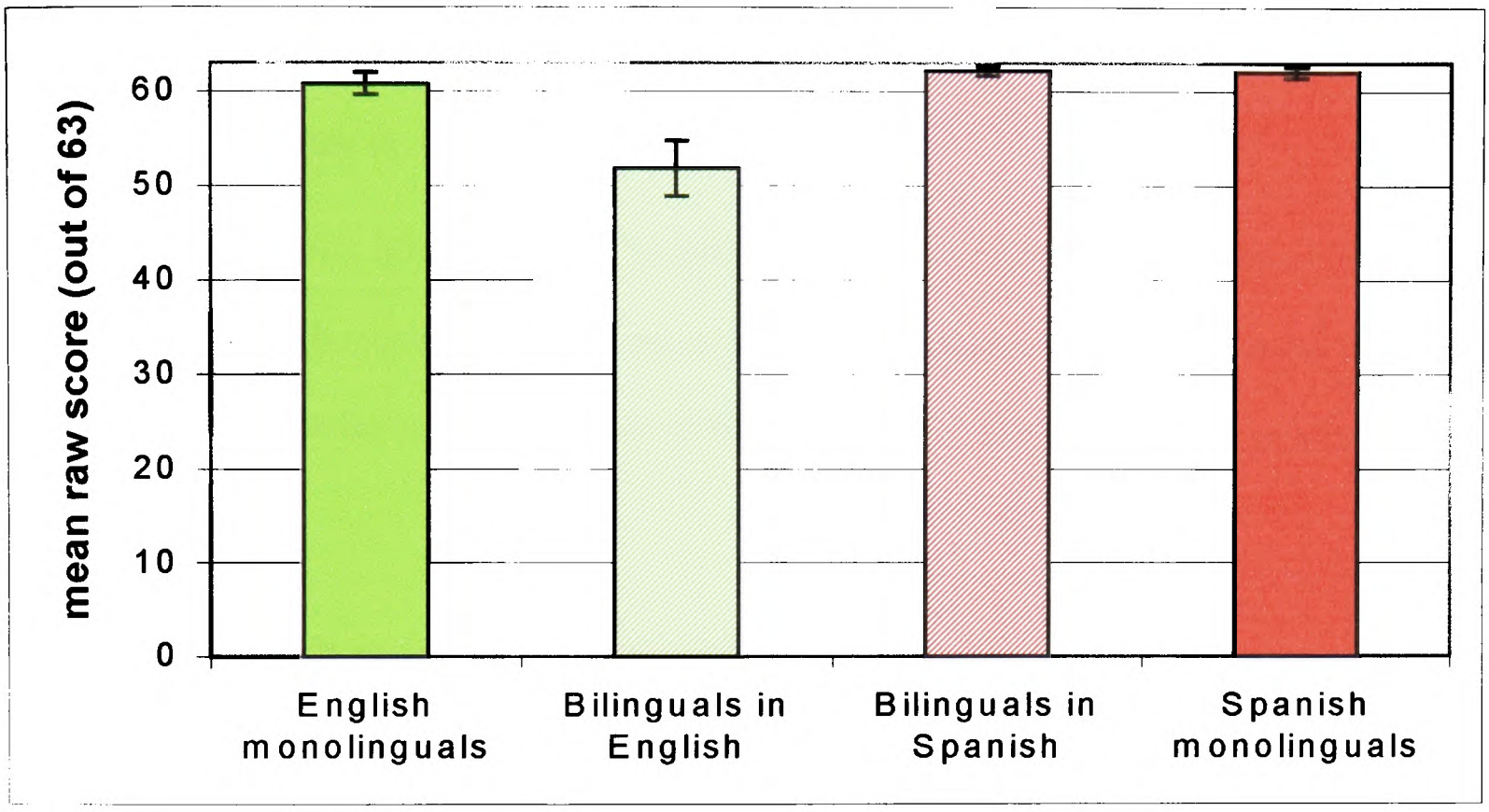
	English monolinguals	Bilinguals in English	Bilinguals in Spanish	Spanish monolinguals
Mean	66.69	10.71	62.45	68.83
s.d.	28.11	16.78	28.85	25.90

Vocabulary is highly correlated with intellectual ability. Hence, any differences in vocabulary between the groups could be indicative of differences in their intellectual capacities, which could in turn, affect their performance on the phonological and reading tasks. In order to see whether or not this was happening, we compared the groups' receptive vocabulary scores in a series of one-way Analyses of Variance (ANOVA's). We found no difference in receptive vocabulary between the English and Spanish monolinguals ($F[1,83] = 0.132$, $p < 0.718$) or the Spanish monolinguals and the bilinguals in Spanish ($F[1,83] = 1.193$, $p < 0.278$). However, the bilinguals performed worse in English than in Spanish ($F[1,41] = 72.808$, $p < 0.000$) and they performed worse in English than the English monolinguals ($F[1,83] = 114.415$, $p < 0.000$). It is possible that the bilingual children's limited exposure to English is the cause of their poor English vocabulary score. However, the most important comparisons to make are between the English monolinguals, the Spanish monolinguals and the bilinguals in Spanish. From the finding that they all have similar receptive vocabularies, it can be implied that all of the children were of a similar intellectual ability.

5.4.ii Memory

For the memory task, children's scores were left as raw scores. This allowed us to compare the children across, as well as within, languages. A series of one-way ANOVA's were conducted to compare the groups' performance on the memory task.

Figure 5. 1: Mean memory raw scores for each group



English monolinguals vs. bilinguals in English

The mean raw scores for the test in English were 60.79 (s.d. = 0.29) for the monolingual children, and 51.83 (s.d. = 0.75) for the bilingual children, as can be seen from Figure 5.1. A one-way ANOVA showed that this difference was significant ($F[1,83] = 30.91$, $p < 0.000$). The bilingual children were significantly worse than the monolingual children on the memory task.

Spanish monolinguals vs. bilinguals in Spanish

The mean scores for the test in Spanish were 62.02 (s.d. = 0.15), for the monolingual children and 62.14 (s.d. = 0.14) for the bilingual children, as can be seen in Figure 5.1. A one-way ANOVA showed that there were no significant differences between these scores ($F[1,83] = 0.089$; $p < 0.766$). The monolingual and bilingual children's Spanish memory scores were similar.

English monolinguals vs. Spanish monolinguals

The mean score for the English monolinguals was 60.79 (s.d. = 0.29), and 62.02 (s.d. = 0.15), for the Spanish monolinguals. A one-way ANOVA showed that there was no significant difference between these scores ($F[1,83] = 3.596$; $p < 0.061$). Both groups had similar memory scores.

Bilinguals in English vs. bilinguals in Spanish

The mean scores were 51.83 (s.d. = 0.75) for the English test, and 62.14 (s.d. = 0.14) for the Spanish. A one-way ANOVA showed that there was a significant difference between these scores ($F[1,41] = 45.677$; $p < 0.000$); the children performed much better on the Spanish test.

In summary, all of the children showed similar memory scores, apart from the bilinguals in English whose scores were particularly poor.

5.4.iii Standardised reading

For the reading task, the English-speakers were scored in terms of age in years and months and the Spanish-speakers were scored in terms of grade-level. As a consequence of

these different scoring systems we were unable to compare the English and Spanish reading tests.

Figure 5.2 shows the mean reading age scores for the English-speaking groups. The mean reading age for the monolinguals was 6yrs 1mnth[6] (s.d. = 13.5), and for the bilinguals the mean reading age was 6yrs 5mnths (s.d. = 11.86). A one-way ANOVA showed that there were no significant difference between the two groups' mean reading ages ($F[1,83] = 1.592$; $p < 0.211$).

Figure 5. 2: Mean English reading age for the monolinguals and bilinguals

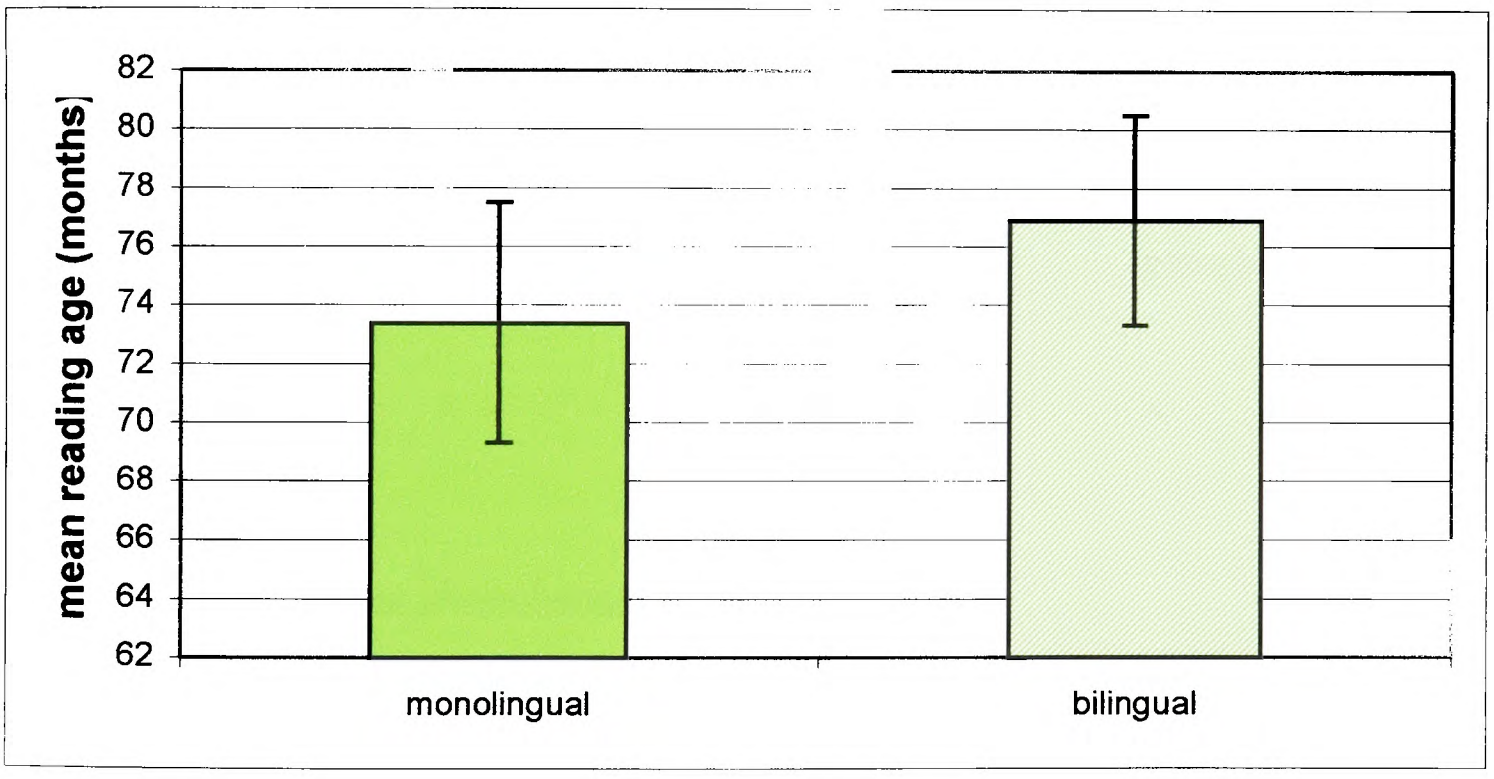
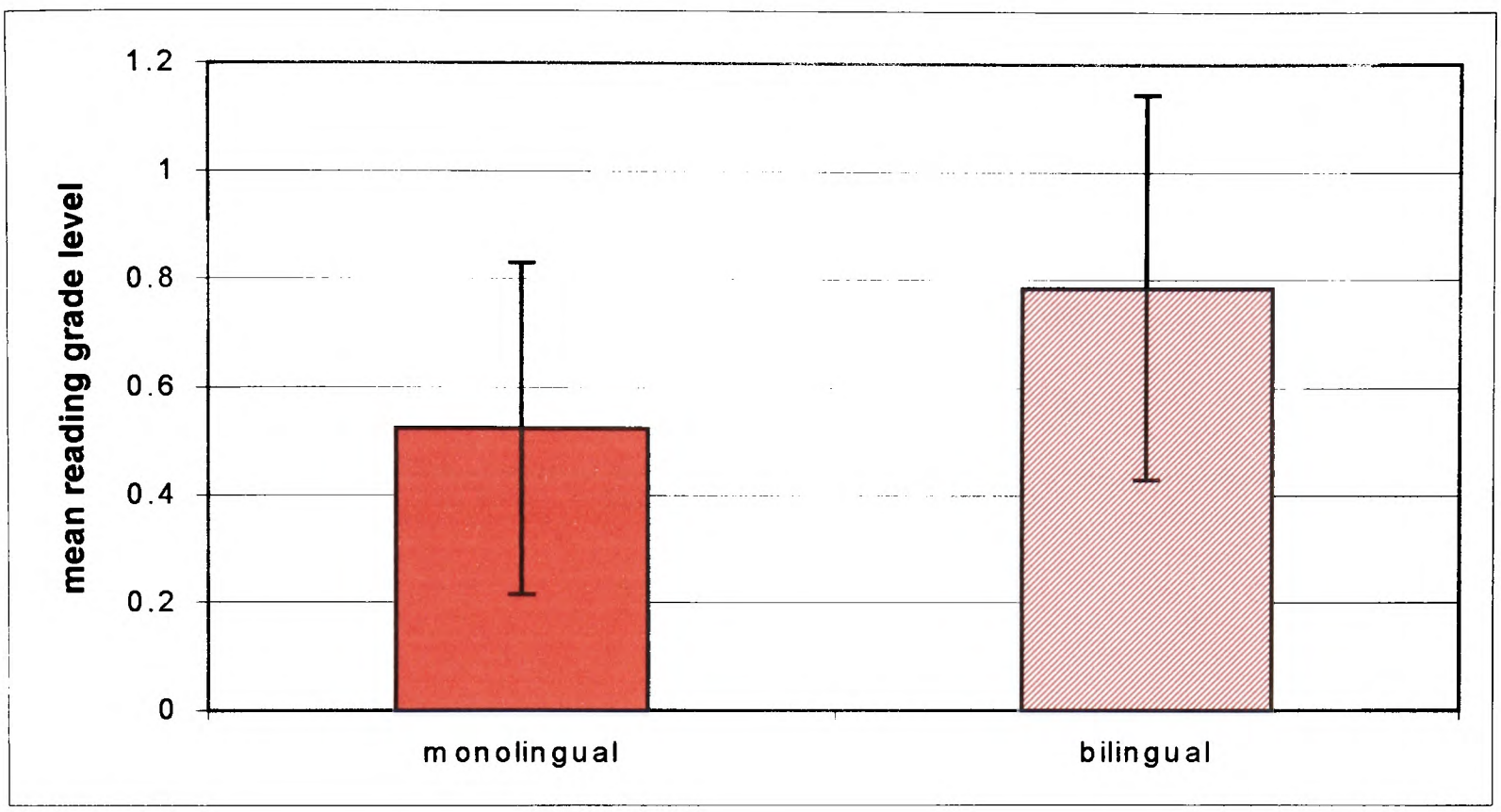


Figure 5.3 shows the mean grade-level reading score for the Spanish-speaking groups. The mean grade-level was 0.52 (s.d. = 1.02) for the monolinguals, and 0.79 (s.d. = 1.18) for the bilinguals. A one-way ANOVA showed that this difference was not significant (F[1,83] =

[6] It should also be noted that those children who could not read a single word on the reading task administered were scored as having a reading age of 5yrs 0mnths.

1.187; $p < 0.279$). The bilingual children were at a similar level of reading ability to the monolingual children.

Figure 5. 3: Mean Spanish reading grade-level for the monolinguals and bilinguals



5.4.iv Reliability of the phonological tasks

We wanted to know whether the phonological task scores were correlated with one another. This would allow us to determine the extent to which the tasks were tapping into the same underlying skill. Tables 5.3, 5.4, 5.5 and 5.6 show the correlations for each of the groups individually. Table 5.7 shows the correlations for the bilingual children across their languages.

English monolinguals

Table 5. 3: Spearman's rank correlations for the phonological tasks

	Rhyme	Syllable 1	Syllable 2	Rime 1	Rime 2	Vowel 1
Syllable 1	.540**	1				
Syllable 2	.461**	.454**	1			
Rime 1	.113	.145	.256	1		
Rime 2	.331*	.452**	.319*	.171	1	
Vowel 1	-.025	.053	.017	.405**	.009	
Vowel 2	.057	.176	-.08	.270	.236	.207

Key: * means significant at the 0.05 level; ** means significant at the 0.01 level

Spanish monolinguals

Table 5. 4: Spearman's rank correlations for the phonological tasks

	Rhyme	Syllable 1	Syllable 2	Rime 1	Rime 2	Vowel 1
Syllable 1	.194	1				
Syllable 2	.470**	.192	1			
Rime 1	.22	.003	.237	1		
Rime 2	.166	.152	.372*	.116	1	
Vowel 1	.171	.273	.283	.139	.436*	1
Vowel 2	.08	.181	.225	.469**	.083	.166

Key: * means significant at the 0.05 level; ** means significant at the 0.01 level

Bilinguals in English

Table 5. 5: Spearman's rank correlations for the phonological tasks

	Rhyme	Syllable 1	Syllable 2	Rime 1	Rime 2	Vowel 1
Syllable 1	.358*	1				
Syllable 2	.546**	.343*	1			
Rime 1	.152	.027	.039	1		
Rime 2	.143	-.171	.16	.145	1	
Vowel 1	-.017	-.058	-.069	.012	.091	1
Vowel 2	.115	.227	.021	-.034	-.013	.105

Key: * means significant at the 0.05 level; ** means significant at the 0.01 level

Bilinguals in Spanish

Table 5. 6: Spearman's rank correlations for the phonological tasks

	Rhyme	Syllable 1	Syllable 2	Rime 1	Rime 2	Vowel 1
Syllable 1	.351*	1				
Syllable 2	.137	.413*	1			
Rime 1	.131	.313*	.352*	1		
Rime 2	.288	.306*	.350*	.507*	1	
Vowel 1	.352*	.283	.354*	.350*	.328*	1
Vowel 2	.076	.019	.046	.165	.038	.362*

Key: * means significant at the 0.05 level; ** means significant at the 0.01 level

Table 5. 7: Spearman's rank correlations for the phonological tasks across languages

English	Rhyme	Syllable 1	Syllable 2	Rime 1	Rime 2	Vowel 1	Vowel 2
Spanish							
Rhyme	.333*	.179	.425**	.127	.131	-.132	-.113
Syllable 1	.184	.307*	.246	.097	-.075	-.103	.143
Syllable 2	.246	.195	.096	-.013	-.041	-.034	.187
Rime 1	.253	.232	.300	.142	.080	.020	.329*
Rime 2	.197	.089	.324*	.272	.090	.019	.135
Vowel 1	.407**	.296	.476**	.227	.339*	.124	.124
Vowel 2	.007	-.038	.235	-.070	.224	.085	.032

Key: * means significant at the 0.05 level; ** means significant at the 0.01 level

The phonological tasks did not correlate highly with one another for the Spanish monolingual children, or for the bilingual children in English. This could have been for two reasons. It may be that the awareness of certain units is unrelated to the awareness of other units. Alternatively, ceiling, or near ceiling levels of awareness on some of the tasks may have masked any potential correlations.

The English monolingual children and the bilingual children in Spanish, on the other hand, show good correlations between the various phonological tasks. This suggests that for these groups of children, the tasks are tapping into the same underlying construct of phonological awareness.

The bilingual children do not show many cross-language correlations. This suggests that their phonological awareness for each language may be independent.

5.4.v Phonological awareness

It was predicted that each group should show a similar pattern of development of awareness from large to small units, but that the extent of the awareness of each unit would differ according to linguistic background. Hence, we compared the groups both across-languages (English vs. Spanish) and within-languages (monolinguals vs. bilinguals).

Table 5.8 shows the mean scores on each of the phonological awareness tasks for each group individually.

Table 5. 8: Mean phonological awareness scores for each group

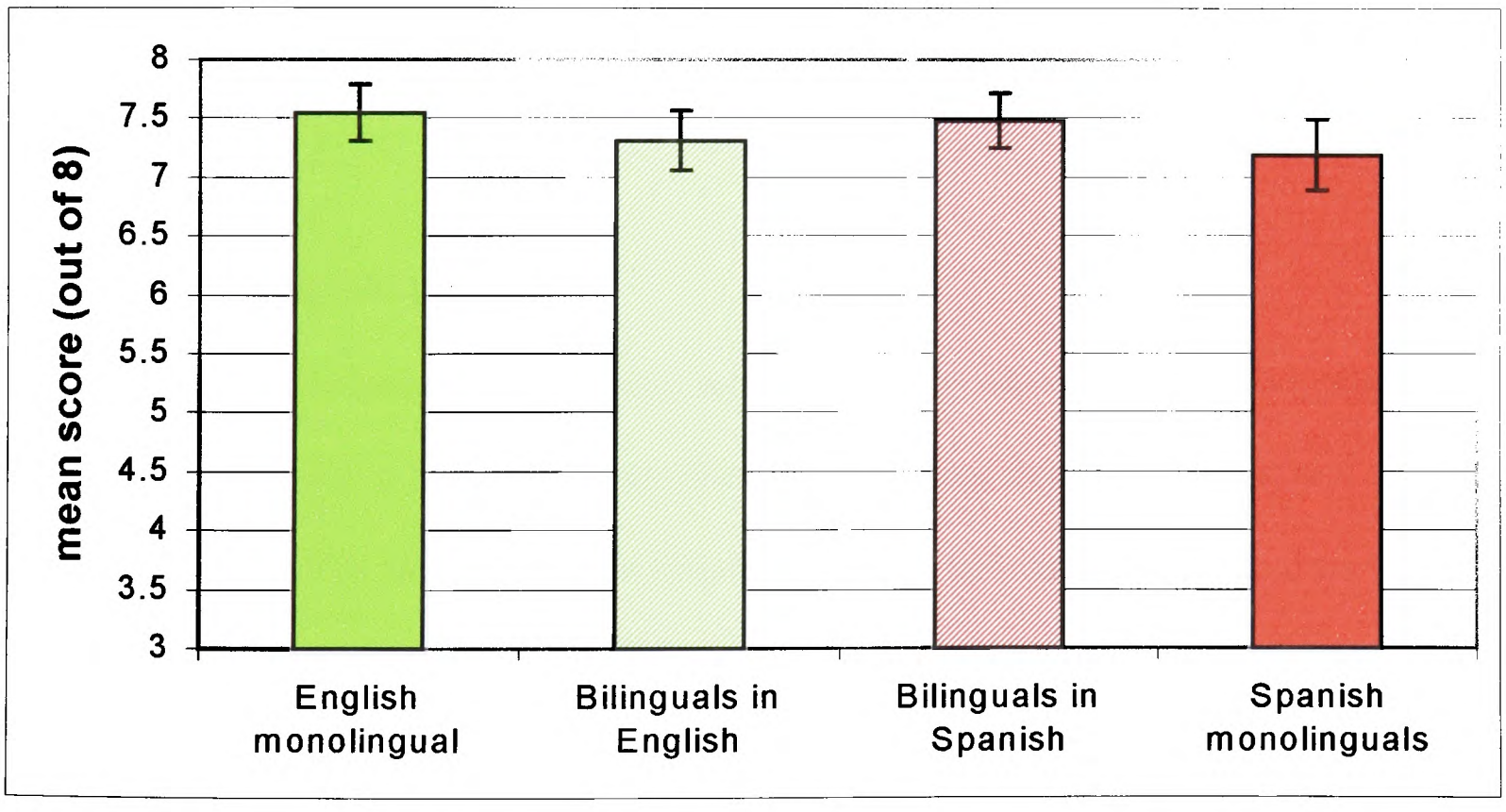
Phonological unit		English tasks		Spanish tasks	
		Monolinguals	**Bilinguals**	**Monolinguals**	**Bilinguals**
Rhyme	**mean**	7.55	7.31	7.19	7.48
	s.d.	0.80	0.84	0.99	0.77
First syllable	**mean**	7.45	7.48	6.90	7.38
	s.d.	0.86	0.71	0.85	0.85
Second syllable	**mean**	6.95	6.38	6.26	6.69
	s.d.	1.08	1.08	0.99	0.95
Rime in first syllable	**mean**	5.38	5.14	5.81	6.40
	s.d.	1.15	1.51	1.13	1.38
Rime in second syllable	**mean**	5.69	5.33	5.81	6.52
	s.d.	1.32	1.39	1.37	1.13
Vowel in first syllable	**mean**	4.36	4.69	5.36	5.48
	s.d.	1.41	1.26	1.21	1.35
Vowel in second syllable	**mean**	3.88	4.14	4.74	4.64
	s.d.	1.27	1.05	1.33	1.34

5.4.v.a Rhyme awareness

The results from the rhyme task will be looked at separately because there was only one rhyme task and hence an effect of Position need not be considered here.

Figure 5. 4 shows the mean scores for each of the phonological awareness tasks, for each of the groups of children. The performance on the rhyme task was best for the English monolinguals, followed by the bilinguals on the Spanish task, followed by those same children but on the English task, with the Spanish monolinguals performing worst of all. A series of one-way ANOVA's were carried out to see if there was a difference between the groups' performances on the rhyme task.

Figure 5. 4: Mean rhyme awareness scores for each group



There was no difference between the English monolinguals and the bilinguals in English ($F[1,83] = 1.763$; $p < 0.188$), or between the Spanish monolinguals and the bilinguals in Spanish ($F[1,83] = 2.164$; $p < 0.145$). Nor were there any differences between the English and Spanish monolinguals ($F[1,83] = 3.284$; $p < 0.074$), or the bilinguals in each of their languages ($F[1,41] = 1.414$; $p < 0.241$). Hence, all groups showed similar levels of rhyme awareness.

This was not as predicted. We had expected English-speakers to show relatively more awareness of rhymes. However, our finding suggests that rhymes are universally salient units. Nevertheless, the rhymes used in the present study spanned across two syllables. Therefore, the finding that they were particularly salient may have been a consequence of their size rather than their status as psychologically underpinned linguistic units. A third alternative explanation of why no differences were found is that all of the groups were almost at ceiling level performance on the rhyme task.

5.4.v.b Across-language comparisons

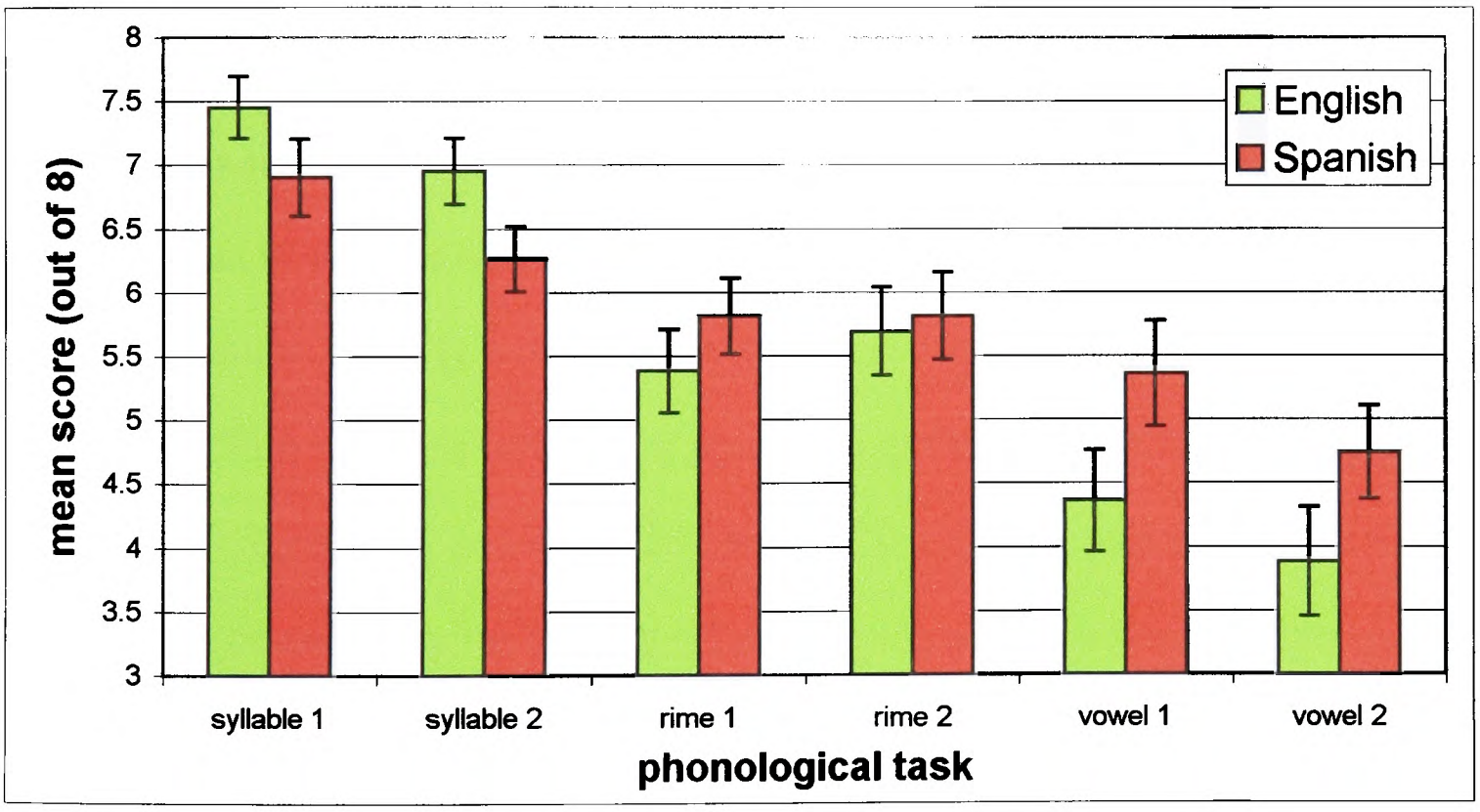
The across language comparisons serve to tell us whether certain languages make certain units more salient than other languages. We predicted that Spanish-speakers would be more aware of syllables and vowels than English-speakers, and that English-speakers would be more aware of rimes than Spanish-speakers.

English monolinguals vs. Spanish monolinguals

Figure 5. 5 shows that the Spanish monolinguals performed worse on both of the syllable tasks than did the English monolinguals, but performed better on both of the rime tasks and on

both of the vowel tasks. A three-way ANOVA was carried out to determine whether these differences were significant, with Phonological Unit (syllable, rime, vowel) and Position (first syllable, second syllable) as the within subjects variables and Group (English monolingual, Spanish monolingual) as the between subjects variable. There were main effects of Phonological Unit ($F[2,164] = 198.33$; $p < 0.000$) and Position ($F[1,82] = 14.062$; $p < 0.000$), but not of Group ($F[1,82] = 1.702$; $p < 0.196$). There were also interactions of Phonological Unit by Position ($F[2,164] = 6.143$; $p < 0.003$) and Phonological Unit by Group ($F[2,164] = 22.416$; $p < 0.000$).

Figure 5. 5: Mean scores on the phonological awareness tasks for the English and Spanish monolinguals



The main effect of Position was caused by the children performing better on the first than on the second syllable tasks overall. A post-hoc Newman Keul's test showed the main effect of Phonological Unit was caused by the syllable tasks being easier than the rime tasks and the

rime tasks being easier than the vowel tasks (both $p < 0.05$). Hence, both groups showed the same pattern of development from large to small units, as predicted.

A post-hoc Newman Keul's test showed that the Phonological Unit by Group interaction occurred because the Spanish monolinguals were significantly better than the English monolinguals on the rime and vowel tasks, but they were significantly worse on the syllable tasks (all $p < 0.05$). The Phonological Unit by Position interaction was a consequence of first syllable tasks being easier than second syllable tasks for syllable and vowel ($p < 0.05$), but not for rime, where there was no significant difference between the performance on the two tasks.

It is possible that differences in memory between the groups could affect the results of the phonological tasks. Hence further analysis was carried out using Memory as a co-variate. This was to check that the differences in phonological awareness found between the groups were not a by-product of differences in memory between the groups. When Memory (raw scores) was put in as the co-variate the main effects of Phonological Unit ($F[2,162] = 0.926$; $p < 0.398$), Position ($F[1,81] = 0.161$; $p < 0.689$) and Group ($F[1,81] = 0.806$; $p< 0.372$) disappeared. However there was still an interaction of Phonological Unit by Group ($F[2,162] = 23.017$; $p < 0.000$). A post-hoc Newman Keul's test using adjusted means showed this interaction to be caused by the Spanish children performing significantly better on the vowel task, but significantly worse on the syllable task than the English children (both $p < 0.05$). There was no difference in their performance on the rime task.

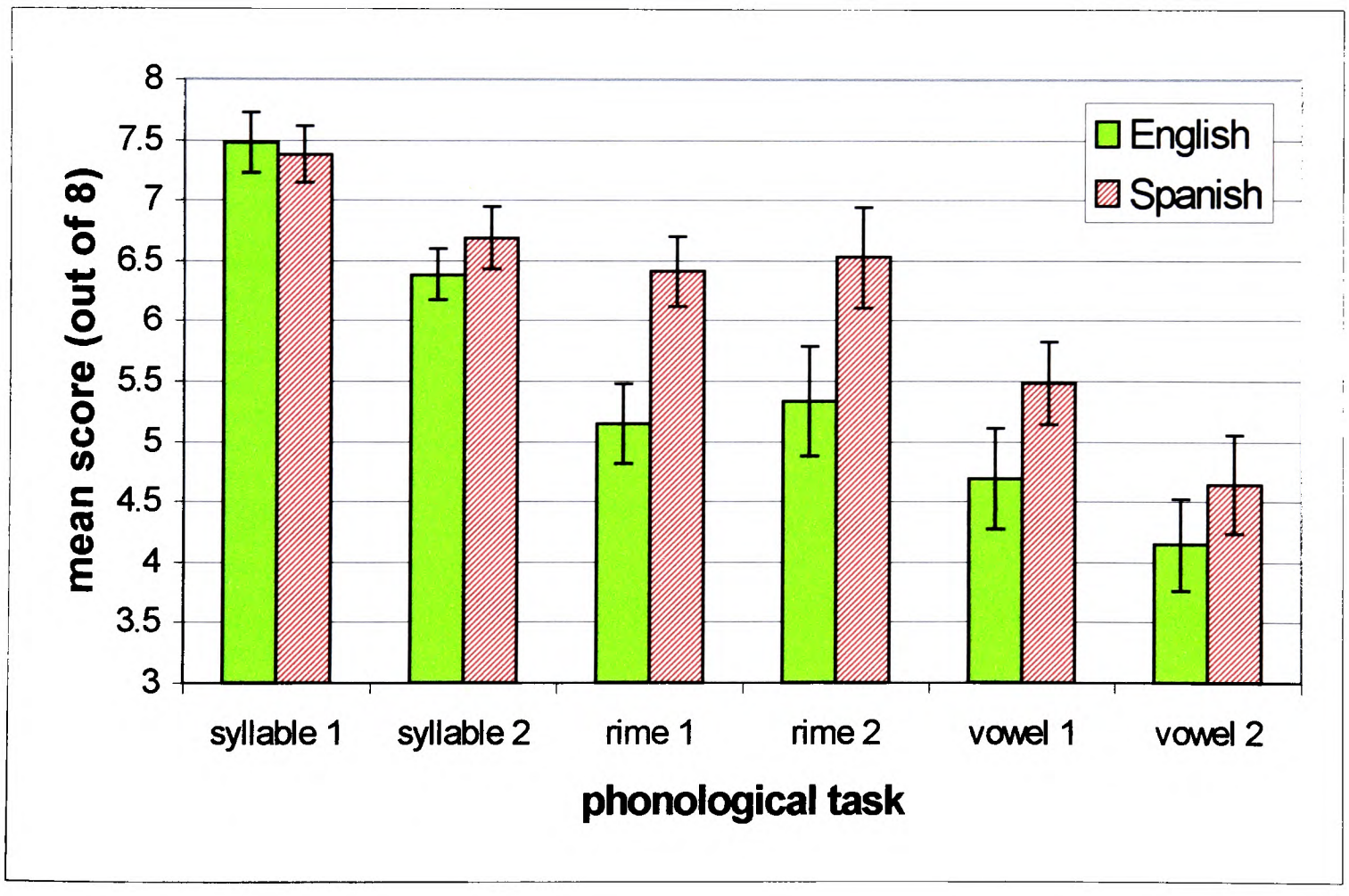
Bilinguals in English vs. Bilinguals in Spanish

As can be seen in Figure 5. 6, the bilingual children's performances on the English tasks were better than their performances on the Spanish tasks for the first syllable task only,

and this difference was very small. The bilingual children performed better on the Spanish tests for all of the other units. A repeated measures three-way ANOVA with Phonological Unit, Position and Language (English, Spanish) as the within subjects variables was carried out to determine whether any of these differences were significant.

There were main effects of all three variables: Language ($F[1,41] = 39.45$, $p < 0.000$); Phonological Unit ($F[2,82] = 146.58$, $p < 0.000$); and Position ($F[1,41] = 30.35$, $p < 0.000$). There were also interactions between Phonological Unit and Language ($F[2,82] = 9.01$, $p < 0.000$) and Phonological Unit and Position ($F[2,82] = 12.91$, $p < 0.000$).

Figure 5. 6: Mean scores on the phonological awareness tasks for the bilinguals in English and Spanish



The main effect of Language was caused by the children performing better overall on the Spanish than on the English tasks. The main effect of Position was caused by the children

performing better overall on the first than on the second syllable tasks. A post-hoc Newman Keul's test showed the main effect of Phonological Unit was caused by the syllable tasks being easier than the rime tasks and the rime tasks being easier than the vowel tasks (both $p < 0.05$). Hence, both groups showed the same pattern of development from large to small units, as predicted.

A post-hoc Newman Keul's test showed that the Phonological Unit by Language interaction was caused by the better performance of the bilinguals on the Spanish vowel and rime tasks than on the English versions of these tasks (both $p < 0.05$). There were no significant differences between their performance in the English syllable and Spanish syllable tasks. These findings were as predicted for the vowel tasks, but not for the rime tasks. We had predicted that the children would perform better on the English version of the rime task.

A post-hoc Newman Keul's test showed that the Phonological Unit by Position interaction was caused by the children performing better on the syllable and vowel first syllable tasks than on the syllable and vowel second syllable tasks, respectively (both $p < 0.05$). Performance on the first and second syllable rime tasks, however, did not differ significantly.

When Memory was put in as a co-variate the main effects of Phonological Unit ($F[2,78] = 2.247$; $P < 0.113$), Position ($F[1,39] = 0.492$; $p < 0.487$) and Language ($F[1,39] = 0.271$; $p < 0.605$) disappeared. Hence, it may have been differences in memory that caused the results, rather than real differences in phonological awareness.

In the analyses that did not have memory as a co-variate the findings of the cross-language comparisons were the same for the monolinguals and the bilinguals in terms of both

degrees of phonological awareness in the two languages, and the role of stress[1]. Furthermore, the results are in keeping with our prediction that being exposed to two languages that differ in structure will result in differing levels of awareness of different types of phonological unit. Note in particular that, just as anticipated, the linguistic or phonological make-up of the Spanish language makes the vowel unit a particularly accessible one from an early age. The unexpected finding that rime is in fact more salient in Spanish than it is in English, the lack of difference in saliency of rhyme in the two languages, and the greater saliency of the syllable unit in the English language are points that we will return to in Section 5.5.

5.4.v.c Within-language comparisons

The almost identical pattern of results found for the two different comparisons across languages, led to the question of whether there were any significant differences between the monolingual and the bilingual speakers of each language. An answer to this question could provide an indication of whether being exposed to two different languages from an early age allows you to transfer your awareness of one language's phonology to the other language. We predicted that if transfer occurred, the bilingual children should perform better than their monolingual counterparts on those units in L1/2 that are made particularly salient by L2/1.

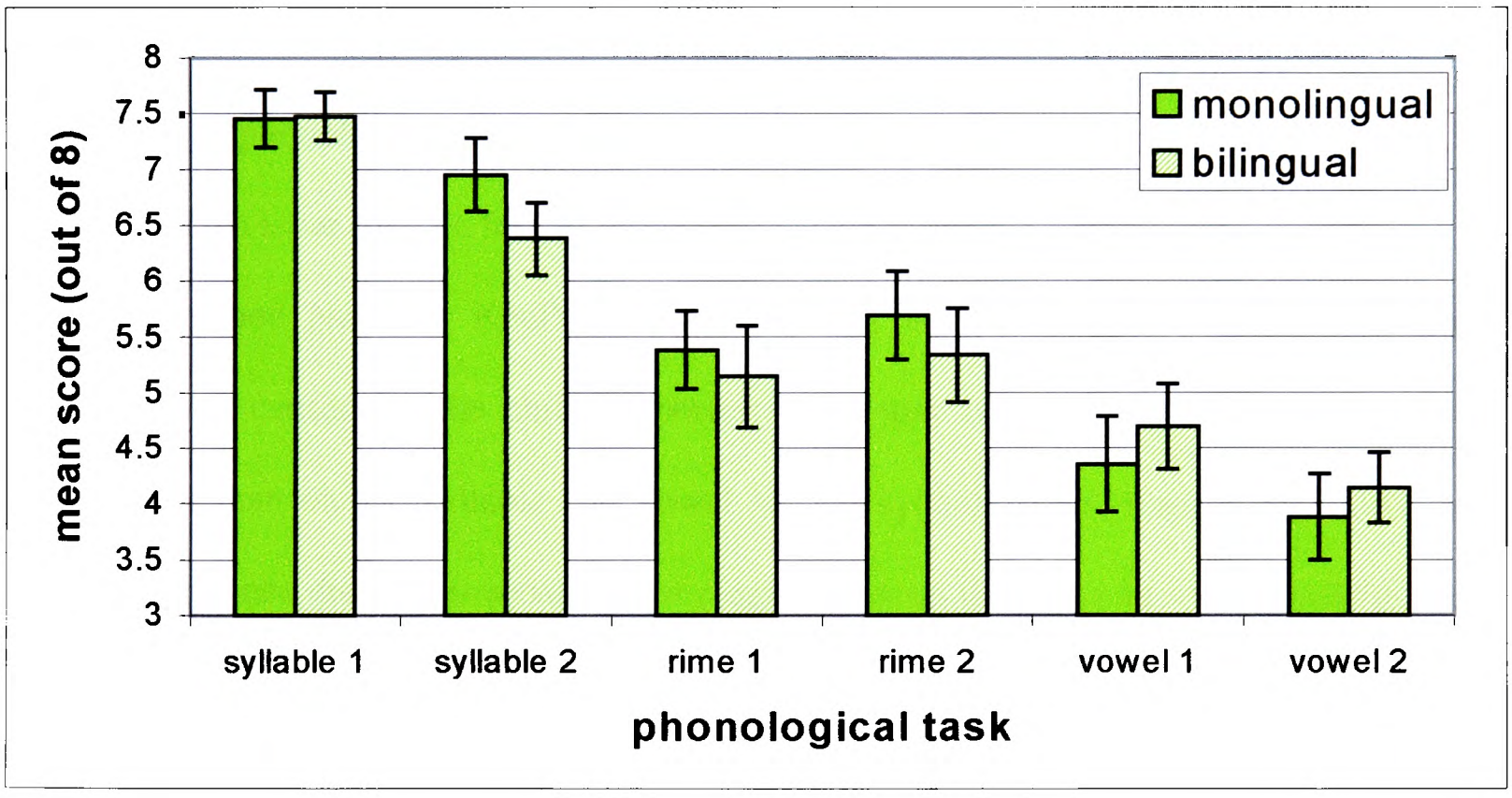
English Monolinguals vs. Bilinguals in English

Figure 5.7 shows the mean scores for the English monolinguals and for the bilinguals in English. The bilingual children's performance was worse than that of the monolinguals' on the

[1] with the exception of the results for the syllable tasks, where we found monolingual English-speakers were significantly more aware of the syllable unit than monolingual Spanish-speakers.

second syllable and the rime tasks, but they performed better than the monolinguals on the vowel tasks. A three-way ANOVA was conducted on the data with Phonological Unit and Position as the within subjects variables, and Group (English monolingual, bilingual) as the between subjects variable. There were main effects of both Phonological Unit ($F[2,164] = 225.19$, $p < 0.000$) and Position ($F[1,82] = 13.81$, $p < 0.000$), but not of Group ($F[1,82] = 0.472$; $p < 0.494$). There were also interactions of Phonological Unit by Group ($F[2,164] = 3.22$, $p < 0.042$), and Phonological Unit by Position ($F[2,164] = 10.98$, $p < 0.000$).

Figure 5. 7: Mean scores on the English phonological awareness tasks for the monolinguals and bilinguals



The main effect of Position was caused by the children performing better on the first than on the second syllable tasks overall. A post-hoc Newman Keul's test showed the main effect of Phonological Unit was caused by the syllable tasks being easier than the rime tasks and the rime tasks being easier than the vowel tasks (both $p < 0.05$). Hence, both groups showed the same pattern of development from large to small units, as predicted.

A post-hoc Newman Keul's test showed that the Phonological Unit by Group interaction was caused by the poorer performance of the monolinguals on the vowel tasks in comparison with the bilinguals, and the poorer performance of the bilinguals on the rime tasks in comparison with the monolinguals (both $p < 0.05$). There were no significant differences between performances on the syllable tasks. This finding is particularly interesting because the bilingual children are significantly more sensitive than are their monolingual counterparts to the vowel unit, which is one of the units that the Spanish language makes particularly salient. This would suggest that there is some transfer of phonological awareness across languages of vowel awareness. However, the bilinguals were significantly less sensitive to rime than the monolinguals, even though Spanish is supposed to make this unit particularly salient. Hence, any transfer of phonological knowledge across the languages has only been in terms of the vowel unit. This issue shall be further discussed in the Section 5.5.

A post-hoc Newman Keul's test showed that the Phonological Unit by Position interaction was caused by the children performing better on the syllable and vowel first syllable tasks than on the syllable and vowel second syllable tasks, respectively (both $p < 0.05$). Performance did not, however, differ significantly on the first and second syllable rime tasks.

When Memory was added as a co-variate the main effect of Phonological Unit disappeared ($F[2,162] = 1.981$; $p < 0.141$), but that of Position remained ($F[1,81] = 4.184$; $p < 0.044$). There was also no effect of Group ($F[1,81] = 0.345$; $p < 0.558$). However, there was an interaction of Phonological Unit by Position ($F[2,162] = 3.569$; $p < 0.03$). A post-hoc Newman Keul's test using adjusted means showed that this was caused by the children performing better on the first than on the second syllable task ($p < 0.05$), whilst performing

equally well on the first and second syllable rime tasks, and on the first and second syllable vowel tasks.

Spanish monolinguals vs. bilinguals in Spanish

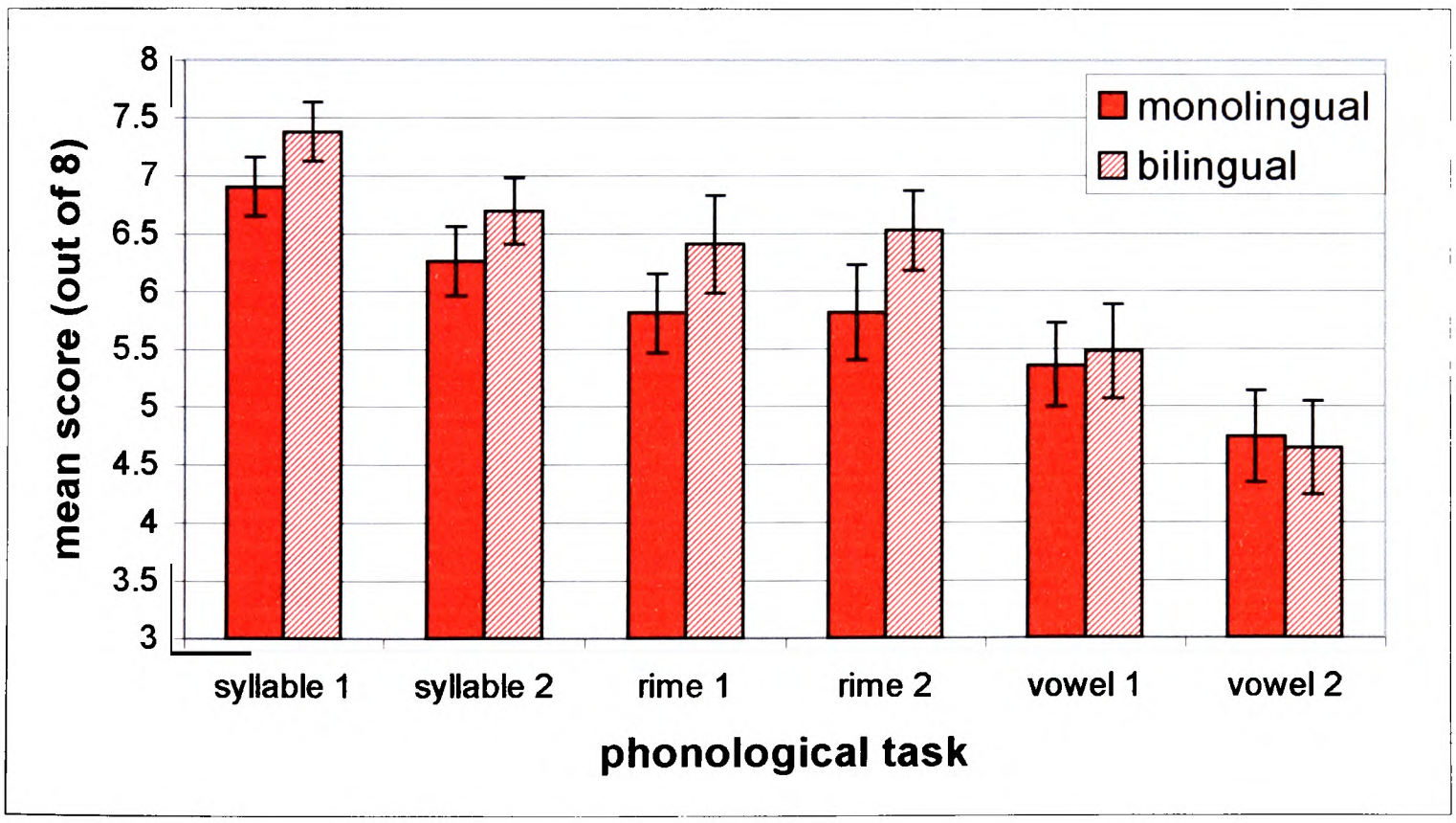
For the Spanish tasks, the mean scores for the phonological awareness tasks for the monolinguals and bilinguals can be seen in Figure 5. 8. The bilingual children performed better on the syllable and the rime tasks, and there was very little difference between the two groups on the vowel tasks. A three-way ANOVA was carried out with Phonological Unit and Position as the within subjects variable, and Group (Spanish monolingual, bilingual) as the between subjects variable. There were main effects of the three variables Phonological Unit ($F[2,164] = 119.57$, $p < 0.000$), Position ($F[1,82] = 36.64$, $p < 0.000$) and Group ($F[1,82] = 5.53$, $p < 0.021$). There were also interactions of Phonological Unit by Group ($F[2,164] = 4.11$, $p < 0.018$) and Phonological Unit by Position ($F[2,164] = 7.34$, $p < 0.001$).

The main effect of Group was caused by the bilingual children performing better overall than the monolinguals. The main effect of Position was caused by the children performing better on the first than on the second syllable tasks overall. A post-hoc Newman Keul's test showed the main effect of Phonological Unit was caused by the syllable tasks being easier than the rime tasks and the rime tasks being easier than the vowel tasks (both $p < 0.05$). Hence, both groups showed the same pattern of development from large to small units, as predicted.

A post-hoc Newman Keul's test showed that the Phonological Unit by Group interaction was a result of the bilingual children performing significantly better on the syllable and rime tasks than the monolingual children ($p < 0.05$). There were no significant differences

in performance on the vowel tasks between the two groups. English monolingual children are more aware of syllables than are Spanish monolingual children. Hence, syllables are relatively salient phonological units in English. This finding, then, is in line with the prediction that there would be transfer of phonological knowledge across languages since the bilingual children are significantly more aware of syllables than their Spanish monolingual counterparts. However, the finding that the bilingual children were more aware of rime cannot be explained in the same way since English children are less sensitive to this unit than Spanish-speakers. An alternative explanation will be proposed in Section 5.5.

Figure 5. 8: Mean scores on the Spanish phonological awareness tasks for the monolinguals and bilinguals



When Memory was put in as a co-variate the main effects of Phonological Unit ($F[2,162] = 1.285$; $p < 0.28$) and Position ($F[1,81] = 2.6$; $p < 0.111$) disappeared, but that of Group ($F[1,81] = 5.374$; $p < 0.023$) remained. The interaction between Phonological Unit and

Group also remained ($F[2,162] = 3.975$; $p < 0.021$). A post-hoc Newman Keul's using the adjusted means showed this to be caused by the bilingual children performing better on the rime tasks than their monolingual counterparts ($p < 0.05$), but there being no difference between the two groups in their performance on the vowel and syllable tasks.

5.4.vi The relationship between phonological awareness and reading ability

An important question in the study was how phonological awareness is related to reading ability in the different languages. Correlations between reading and phonological awareness were therefore investigated for each of the groups. The results of this analysis for each of the groups can be seen in Table 5. 99.

Table 5. 9: Spearman's rank correlations for the phonological awareness tasks with reading ability for each group of children

Phonological task	Rhyme	Syllable 1	Syllable 2	Rime 1	Rime 2	Vowel 1	Vowel 2
Reading							
English monolingual	.343*	.307*	.145	.080	.304	.110	-.077
Spanish monolingual	.169	.370*	.228	.011	.399**	.370*	.227
Bilinguals in English	.189	.081	-.028	-.053	.418**	-.050	.121
Bilinguals in Spanish	.054	.259	.365*	.174	.063	.184	.262

Key: * means significant at the 0.05 level; ** means significant at the 0.01 level

Rhyme and syllable 1 scores are the only ones to be significantly correlated with reading ability for the English monolingual children[7]. This is as predicted given the large number of studies that have shown the importance of rhyme in reading in English, and Brady's (unpublished; Chapter 2.1.ii) study that showed the importance of rhyme (over rime).

For the Spanish monolingual children, Syllable 1, Rime 2, and Vowel 1 were all significantly correlated with reading ability. This is as predicted by previous research which shows that both the syllable and the vowel are important phonological units for reading in Spanish. The finding that Rime 2 was also significantly correlated with reading suggests that Spanish research should not ignore this phonological unit.

English reading in bilingual children was significantly correlated with Rime 2. Spanish reading was significantly correlated with Syllable 2 for the bilingual children. Notably, phonological awareness seems to have less of an effect on the reading abilities of the bilingual children than it does for the monolingual children. The finding that bilingual children's reading was as good as that of their monolingual counterparts, yet they made less use of phonological awareness in reading will be discussed in Section 5.5.

5.4.vi.a Is phonological awareness in L1/L2 correlated with reading in L2/L1?

Our last question concerned how reading ability in one language was correlated with reading and phonological awareness in the other language for the bilingual children. Table 5.10 shows the cross-language correlations between phonological awareness and reading for these children.

[7] Note that R2 is very almost significantly correlated also ($r = 0.304$; $p < 0.051$).

Table 5. 10: Spearman's rank correlations for the phonological awareness scores with reading ability for the bilinguals in English and Spanish

	English reading	Spanish reading
English reading		0.536**
Rhyme	.160	.187
Syllable 1	.116	-.059
Syllable 2	.153	.188
Rime 1	.073	-.228
Rime 2	-.026	.212
Vowel 1	.245	.150
Vowel 2	.191	.325*

Key: * means significant at the 0.05 level; ** means significant at the 0.01 level

Reading ability in English is highly correlated with reading ability in Spanish ($r = 0.536$; $p < 0.01$). This is not a surprising finding since one would expect that if a child had grasped the basic concept of reading as a process of decoding, then they should be able to apply their decoding principles to both languages.

However, reading ability in English was not correlated with phonological awareness in Spanish, and similarly, reading ability in Spanish was only correlated with awareness of second syllable vowels in English. This finding suggests that the transfer of knowledge is occurring at the pre-reading level. In other words, rather than phonological knowledge of L1 being used to decode (and hence read) L2, it seems that phonological sensitivity to certain units in L1 transfers to L2. This increases the child's sensitivity to these units in L2, and it is this new knowledge that is applied to reading in L2. However, given the relative lack of correlations between phonological awareness and reading skill within each of the languages of the bilingual

children, it is not very surprising that very few correlations between phonological awareness and reading ability were found across languages.

The finding that reading ability in Spanish was correlated with awareness of the second vowel sound in English suggests that reading in Spanish requires a fairly sophisticated level of phonological awareness, since V2 was the hardest of all the units for both monolinguals and bilinguals in the English tasks. This is in keeping with the theory that, in order to read at all proficiently in Spanish, a certain amount of phonemic awareness is necessary.

5.5 DISCUSSION

Experiment 1 showed that the sequence of development of phonological awareness is the same for both Spanish and English. However, most interestingly we found that children's linguistic environment influences the degree of awareness of each phonological unit. So why does the language to which children are exposed affect their awareness of syllables, rimes and vowels? We shall discuss the possible reason for each phonological unit in turn.

Syllables

Spanish monolingual children are less aware of syllables than both English monolingual children and bilingual children in Spanish. This finding is the opposite to that predicted. Given that Spanish is a syllabic language, we expected children to be particularly aware of this unit when compared to English children who are exposed to a less clearly syllabified language. The reason the opposite result was actually found is, ironically, probably related to the syllabic nature of the languages. Given that Spanish children only hear clearly defined syllables and nothing but clearly defined syllables, they may have no reason to pick out this unit, because there are no alternatives to it. English children, on the other hand, are exposed to both clear syllables and to "murky" syllables (syllables with unclear boundaries). Consequently they have the possibility of comparing a clear-cut syllable against a "murky" syllable, and hence of learning what a syllable is.

This may explain why the Spanish monolinguals performed worse than the English monolinguals on the syllable tasks, but it does not explain the advantage that the bilinguals displayed on the Spanish syllable task. We shall return later to reasons why this might have occurred.

Rimes

For the rime unit we found that Spanish-speakers (both monolingual and bilingual) were more aware of rimes than English-speakers (both monolingual and bilingual).

The finding that the rime unit was more salient in Spanish than in English contradicted our prediction. However, it is a particularly interesting finding, since the majority of studies conducted on phonological awareness in English have stressed both the salience of the rime unit and its importance in reading. This does not mean that this unit cannot be more salient in Spanish, but it does highlight the need for English research to be wary of the conclusions drawn about rime, given that the experiments are confounding rhyme and rime by using mono-syllables as the experimental materials.

The result is also very interesting because studies of Spanish children's phonological awareness have generally concentrated on syllabic and phonemic awareness, ignoring that of rhyme and rime. In order for a syllable to have a rime, it is necessary for it to have a CVC structure (or at least a VC structure). However, the vast majority of syllables in Spanish have CV structures. Consequently, a CVC structure might be particularly noticeable. The child can compare the two types of rime; they can make the contrast between those syllables that end in vowels and those that end in VC units.

There is another reason why second syllable rimes may be particularly salient in Spanish. Final-syllable rimes in Spanish tend to be morphemes denoting plurals, third person plural, infinitive, or third person imperative. There are, therefore, very few alternative rime sounds that can be heard at the ends of words ('en', 'an', 'in', 'on', 'os', 'as', 'es', 'is', 'ar', 'er', 'ir', 'or' and 'ad', 'ed', 'id' are the only possible morphemes; there are very few words

that end in VC units that do not fall into any of these categories). Consequently, a child could use her or his morphemic awareness to answer these tasks.

We also found that monolingual Spanish children have less rime awareness than bilingual Spanish-speakers. One possible explanation of this finding comes from the large body of evidence suggesting that bilinguals possess more metalinguistic knowledge at an earlier age than do monolinguals (see Chapter 2.4). This is presumably because exposure to two linguistic environments throws up a lot of conflicting or contradictory information concerning the structure of language (in terms of phonology, morphology, syntax, semantics and so on). The only way to resolve this confusion is to gain a deeper understanding of how the two systems work, by making comparisons, drawing parallels and sorting out the differences. Hence, just as it was reasoned that Spanish monolingual children would be sensitive to the second rime because in the materials used the second rime usually corresponded to a morpheme, bilinguals should show the same tendency, only to a greater extent because of their higher levels of metalinguistic awareness.

It is possible that bilingual children are more apt at both focussing on structural differences within Spanish syllables (CV or CVC), and at focussing on the morphemic endings of the words. Either of these factors would have put them at an advantage over their monolingual counterparts.

Vowels

Spanish-speakers are more aware of vowels than English-speakers. It was anticipated that the low number of highly distinctive vowels in Spanish would make them a particularly salient unit. The lack of distinct boundaries and the large number of vowels in English, along

with the predominance of vowel reduction and expansion makes the relative lack of salience of the vowel unit in English understandable.

So far we have clearly seen how differences in linguistic structure between languages affects the relative salience of the various phonological units. For the bilingual children these differences in structure between languages affected their relative awareness to each unit as compared to their monolingual counterparts in each language. Firstly, they showed less awareness of the rime unit in English than the English monolingual children. This suggests negative transfer of awareness across language: where a difference exists between languages, the bilingual children will be less aware of this unit. However, we would argue that this is not necessarily the case. If the reason why second syllable rimes are particularly salient in Spanish is because of their metalinguistic status, then our finding is no longer surprising. Second syllable rimes in the English task did not correspond to morphemes and hence held no special qualities that might have caused attention to be drawn to them.

We also found that bilingual children are more aware of Spanish syllables than are Spanish children and more aware of English vowels than English children[8]. Both these findings point to a positive transfer of phonological awareness across languages. The syllable unit is particularly salient in English. Hence bilingual children could transfer this awareness across to Spanish, making them more aware of Spanish syllables than Spanish monolingual children. Similarly, the vowel unit is particularly salient in Spanish. Hence bilingual children may transfer this awareness across to English, making them more aware of vowels in English than English monolingual children. Our findings, then, suggest that bilingual children do not

[8] However, it should be pointed out that vowel awareness was still above chance level for the English children. This is an interesting finding given the quantity of literature claiming that English speaking children do not become aware of phonemes until they learn to read (e.g. Liberman, 1974; Read, 1986; Mann, 1986). This finding highlights the need of future research to avoid the present obsession of phonemes as consonant sounds, and to explore the extent and influence of vocalic knowledge in English.

process language in exactly the same way as monolingual children. Rather, they make the most of their exposure to two languages by transferring awareness from one to the other.

We also found stress to play a role in awareness of phonology. Children from all three groups were more aware of stressed syllables and stressed vowels than of the unstressed versions of these same linguistic units. As Brady (unpublished) says, "...a strong claim can be made for the impact of the stressed vowel on the salience of the phonological segments." (p.15). The same was not true, however, for the rime unit.

The rime unit might be an exception because of its physical place in the word. The second rime unit was at the very end of the word, whereas the first stressed rime unit was in the middle of the word. It has often been found that sounds in the middle of words are harder to detect than sounds at the ends of words (e.g. Bradley and Bryant 1989; Kirtley et al., 1989).

The second main aim of Experiment 1 was to examine the relationship between phonological awareness and reading for each of the groups. It was found that reading in the different languages requires the awareness of different phonological units. Reading ability was correlated with rhyme and first syllable awareness for the monolingual English children. This is in keeping with previous findings of the importance of rhyme/rime awareness in reading in English. For the Spanish monolinguals first syllables, second syllable rimes and first syllable vowels were correlated with reading ability. Once more these findings are in keeping with previous research which has also stressed the importance of syllabic and phonemic awareness in reading in Spanish[9].

[9] It is also interesting that second syllable rimes were found to be affecting reading ability. This highlights the importance for future research to not neglect the rime unit when looking at reading in Spanish.

Interestingly, the bilingual children showed similar correlations between reading and phonological awareness as their monolingual counterparts in each language. In English, reading was correlated with the awareness of second syllable rimes. In Spanish, reading was related to second syllable awareness. However, the correlations were fewer for the bilingual than for the monolingual children despite the fact that none of the children showed significant differences in reading ability. This is an interesting finding since it suggests that, even though the bilingual children are at an advantage in phonological awareness, they do not appear to be utilising this knowledge to help them read.

When comparing the bilingual children's reading ability and phonological awareness across languages, we found that reading abilities in each of the languages were highly correlated. Good (or poor) readers of English were also found to be good (or poor) readers of Spanish and vice versa, good (or poor) readers of Spanish were also good (or poor) readers of English. However, the only correlation between phonological awareness in L1 and reading ability in L2 was that between V2 awareness in English and Spanish reading ability. This result fits in with the theory that reading in Spanish requires relatively sophisticated levels of phonemic awareness, since the second vowel sound was the hardest of all of the English phonological units under test here, for both the monolingual and the bilingual children. Hence we would expect to find that children with good levels of vocalic awareness would also have good decoding skills. However, whether it is the ability to read well in Spanish that is enhancing phonological knowledge in English, or whether it is the phonological knowledge in English that is improving reading skills cannot be determined. What our findings do suggest, however, is that exposure to two phonologies and orthographies causes bilingual children both to process language and approach reading acquisition differently from monolingual children.

CHAPTER 6

EXPERIMENT 2, PART 1: VOWEL AWARENESS

6.1 INTRODUCTION

In this Chapter we will look at the first half of a study conducted on children's awareness of vowels and their ability to read and spell them. We will discuss the data concerning vowel awareness here, and in Chapter 7 we will discuss the data concerning vowel reading and spelling.

In Experiment 1 we found that Spanish-speakers are comparatively more aware of vowel sounds than are English-monolingual-speakers. Furthermore, Spanish-English bilingual children are relatively more sensitive to English vowels than are their English monolingual counterparts. This suggests that some form of transfer of vowel awareness takes place across languages.

However, we do not know whether the bilingual children performed better on the vowel task than their English monolingual counterparts because they were using their knowledge of Spanish vowel sounds in order to aid their performance, or because of a generally increased awareness of vowel sounds. Given that there are certain vowels that exist in both languages, yet others that only exist in English, it is possible to distinguish between these two hypotheses. In order to do this, we first need to understand how the English and the Spanish vowel systems differ.

There are five vowels shared by English and Spanish. These can be seen in Table 6.1. Indeed, the Spanish phonemic system only possesses these five vowels. The English system, on the other hand, contains up to 21 vowel phonemes (depending on accent) (O'Connor, 1973). It is far more complex than the Spanish system, making many more distinctions.

Table 6. 1: Vowel sounds shared by English and Spanish

Vowel phoneme	English examples	Spanish examples	Description
[i]	sea, tea	sí, tí	high-front unrounded
[e]	bet, wet mid-	té, de	front unrounded
[o]	toss, cot	loco, todo	mid-back rounded
[u]	sue, zoo	tú, sú	high-back rounded
[a]	sack	saca	low- (front-) central unrounded

(Stanley-Whitley, Ch.1, pp.12-13; Webster, 1961)

The most obvious difference between the systems is that English distinguishes tense and lax articulations. The vowels [ɑ] of *heart,* [3] of *hurt,* [I] of *bit,* [ɔ] of *caught,* and [ʊ] of *look* are, respectively, like the [a] of *saca,* the [e] of *bet,* the [i] of *beat,* and the [o] of *cot,* and the [u] of *Luke,* except the [ɑ 3 I ɔ ʊ] are laxer or pronounced with a more relaxed articulation than the tense [a e i o u][1]. These lax vowels do not exist in the Spanish system. This entails that there are certain contrasts that Spanish-speakers should be insensitive to, namely, those that have minimal contrasting pairs in English but not in Spanish. For example, a Spanish-speaker would have difficulties in distinguishing the word '/bit/' from the word '/bIt/' because they do not distinguish between /i/ and /I/.

If the bilingual children in Experiment 1 were using their knowledge of the Spanish vowel system to do the English version of the vowel task, then they should not perform better than their English monolingual counterparts on a task that involves distinguishing lax from lax, or tense from lax vowels. However, they should outperform their English monolingual counterparts on a task that involves distinguishing tense from tense vowels. If, on the other hand, the bilingual children in Experiment 1 were demonstrating an overall

[1] Some phoneticians do not agree that tenseness is the key distinction between these vowels. Many believe it is specifically the tongue root that contracts or relaxes to bring about the contrast (Stanley-Whitley, Ch.1, p.13). However, for argument's sake we will accept that the difference is one of the tenseness of the vowels. The important point is that these vowels do not exist in the Spanish system.

superiority in vowel awareness, we would expect them to be more capable of distinguishing between any of the above vowel comparisons.

The second investigation was conducted to look at this. Two different sets of vowel sounds were created. The first set included all of those vowels that exist phonemically in both English and Spanish. These were the tense vowels /a e i o u/. The second set included those vowels that exist only in English. These were the lax vowels /ɑ 3 I ɔ ʊ/. All of the subjects were given vowel oddity tasks that contrasted tense with tense vowels (the "tense-vowel" task). Only the English-speakers (monolinguals and bilinguals) were given vowel oddity tasks that contrasted lax with lax vowels (the "lax-vowel" task) and tense with lax vowels (the "tense/lax-vowel" task).

It was decided that non-words would be used for the tasks. This was for two main reasons. Firstly, it was impossible to come up with words that at the same time shared vowel sounds but no other sounds, and were not semantically related, and were easy enough for the children to understand in each language. Secondly, using non-words gave the added advantage that the same experimental materials could be used for all three groups of children. Hence, a list of disyllabic words was created. The target vowel sounds were always found in stressed syllables (either initial or final). The use of disyllables allowed us to examine the role that word position plays in vowel awareness for each group of children.

The second aim of the experiment was to look at whether phoneme awareness plays a similar role in reading and spelling for children from the different linguistic backgrounds. Hence, the children were also given standardised reading and spelling tasks to look at the relationship between phoneme awareness and literacy at this stage in literacy development.

6.2 METHOD

6.2.i Participants

Forty monolingual English first-grade children (22 boys, 18 girls; age range 7yrs, 5mnths - 9yrs, 3mnths, mean age 8yrs, 2mnths), 40 monolingual Spanish first grade-children (40 boys; age range 7yrs, 5mnths - 9yrs, 4mnths, mean age 8yrs, 1mnth) and 40 English-Spanish bilingual first-grade children (22 boys, 18 girls; age range 7yrs, 1mnth - 9yrs, 4mnths, mean age 8yrs, 2mnths) took part in the study.

All of the children in the study came from middle to upper-middle socioeconomic-status backgrounds. The English monolingual children were all pupils at the same state school in Oxford, and the Spanish monolingual children all attended the same private school in Madrid. The bilingual children were pupils from two different bilingual schools, also in Madrid. The bilingual schools' lessons were conducted purely in English, apart from one-and-a-half hours of Spanish lessons each day. None of the monolingual children had been instructed in, or were able to speak any language other than their mother-tongue.

6.2.ii Tasks and procedure

All tests were individually administered to the subjects by a single experimenter fluent in both English and Spanish. All the children were tested for vowel awareness, receptive vocabulary, memory, standardised reading, standardised spelling, non-word vowel reading, and non-word vowel spelling. The results for these latter two tasks will be discussed in Chapter 7.

For the monolingual children, each child was tested individually on three occasions, each separated by approximately 24 hours, and each lasting between 10 and 20 minutes, depending on the speed of the child. The groups also had two sessions in which spelling tests were administered to the whole group simultaneously.

The bilingual children were tested in both English and Spanish and hence each child was seen on six separate sessions (three in English, three in Spanish) and had four spelling sessions (two in English, two in Spanish). The first three sessions were separated by approximately 24 hours each. A one-week gap followed, and the last three sessions were administered, each separated by approximately 24 hours. For half of the children, the first three sessions were conducted in English and the last three sessions were conducted in Spanish; the other half of the children were tested in Spanish for the first three sessions and in English for the last three sessions. All of the instructions were given in the language of the test.

For all three groups (English monolingual, Spanish monolingual and English-Spanish bilingual) the non-word-spelling test was administered first. A 'Latin Square' design was used to counterbalance the order of administration of the rest of the tests. The order of the trials in the oddity task was randomised for each individual child.

6.2.ii.a Memory task

In the memory task the experimenter read out the first 30 non-words, in groups of three, from the phonological awareness tests. The child simply had to repeat back the sets of three words to the experimenter. One point was given for each correctly remembered word, giving a possible total score of 30 points.

6.2.ii.b Vocabulary task

For the English-speaking children (both monolingual and bilingual) the 'BPVS' was administered. For the Spanish-speaking children (both monolingual and bilingual) the 'Test de Vocabulario en Imágenes Peabody - Adaptación Española' was used.

6.2.ii.c Standardised reading task

The 'Schonell Graded Word Reading Test' was used for the English-speaking children. The Spanish-speaking children were given the 'Test de Análisis de Lectoescritura'. For an explanation of how these tests are administered refer to Chapter 5.3.ii.c.

6.2.ii.d Standardised spelling task

The 'Schonell Graded Word Spelling Test' (Schonell and Goodacre, 1971) was used for the English-speaking children. A list of simple and familiar words was read to the children. Each word was read in isolation, then placed in a sentence, and then read in isolation once more. Testing continued through increasingly difficult words until the child spells ten consecutive words incorrectly when the test is ended and the child was congratulated and thanked for her or his participation. The number of correctly spelled words was added up and a spelling age was given to the child, according to their spelling ability as compared to the rest of the population.

The Spanish-speaking children were given the 'Test de Análisis de Lectoescritura'. This is a standardised test of spelling ability. Only a part of the entire test was given. This involved giving the children two dictations appropriate for their grade-level. As a consequence of the nature of the Spanish orthography and its high regularity concerning GPCs, scoring was not only quantitative (i.e. how many words the child has read)[2], but also qualitative. The score given to the child depended upon the accuracy of spelling. Errors were split into thirteen categories[3]. These are listed in footnote 3. Different sorts of

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[2] as it is for the English test.

[3] The different categories were: 1) Accentuation - the child misses off an accent or puts one in where there should not be one, e.g. *patata-patáta, próxima-proxima*; 2) Punctuation - the child misses out or unnecessarily adds punctuation; 3) Consonant changes - the child ignored the conventional orthographic rules for those vonsonant phonemes that have alternative graphemic representations, e.g. *voz → boz, callar → cayar*; 4) Substitution - the child substitutes one phoneme for another. This usually occurs with consonants,

mistakes were expected to occur at different frequencies in different age groups. For example, more 'substitutions' were expected to occur than 'additions' (see footnote 3), at all spelling levels. This made it very difficult to give a single spelling score, because a child might perform at the correct level in terms of her or his age for one particular type of mistake, while performing below or above average for another type of mistake. Hence, a child could fall into different spelling ability categories for different aspects of spelling. In order to give each child a single score, the average of the spelling scores for each different category of mistake was used. However, this spelling score was fairly crude since it was in terms of school grade-level, as opposed to spelling age in years and months.

6.2.ii.e Phonological awareness tasks

The oddity task was used to test the children's awareness of vowel sounds. For an explanation of how the task is administered see Chapter 5.3.ii.d. All of the words used in the experiment were disyllabic. All of the words were non-words, created in the following way: The initial consonant was either /b/, /k/, /d/, /f/, /g/, /1/, /m/, /p/, /s/, /t/, or /v/. The middle consonant cluster was either /mp/, /ls/, /lt/, /ng/, /nd/, /nd/, /nt/, /ct/, or /st/. These were chosen because they are the most frequently occurring onsets and word-medial double-consonants across English and Spanish. The final consonant was either /l/, /n/, /d/, /s/, or /r/. These phonemes were chosen because they are the only permissible word-final consonant phonemes in Spanish that are pronounced in virtually the same way in English. The first and second syllable vowel phonemes were dependent on the task. The tense

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e.g. *rota-sota*. It does not apply to those letters that are described in the rotation category; 5) Rotation - the child substitutes one letter for another, but only if the letters are those designated 'mobile'. Mobile letters refers to those pairs of letters that are the mirror images of one another. They are usually: *p* and *q*, *d* and *b*, *p* and *d*, *q* and *b*, *m* and *w*, *n* and *u*, e.g. *bata - data*; 7) Additions - the child adds a phoneme to the word, e.g. *patata - patatas*; 8) Omission - the child omits a phoneme from a word, e.g. *espuela → espela*; 9) Inversions - the child spells the word as if certain of its letters were in a different order, e.g. *peine → piene*; 10) Word omission - the child omits a word; 11) Word addition - the child adds a word; 12) Union - the child unites two words, e.g. *a la → ala*; 13) Fragmentation – the child splits a word into two or more fragments, e.g. *del – de el*.

vowels used were /a e i o u/. The lax vowels used were /ɑ, 3, I, ɔ, ʊ/.

The tasks:

For each group vowel awareness was tested in the first syllable (S1), and in the second syllable (S2). The syllables containing the target vowels were always stressed. This was to control for the possible effect of stress on phoneme recognition.

For the tense-vowel task, 10 comparisons were made in the first syllable, and 10 comparisons were made in the second syllable. Each vowel sound was contrasted with every other vowel sound. For the lax-vowel task, 10 contrasts were made in the first syllable, and 10 comparisons were made in the second syllable. Once more, each vowel sound was compared with every other vowel sound. For the tense/lax vowel task, 10 contrasts were made in the first, and 10 in the second syllable. Each tense vowel was contrasted with its lax version. In five of the trials the odd-vowel-out was a lax vowel; in the other five trials the odd-vowel-out was a tense vowel. Examples of each vowel test are shown in Table 6.2. For a complete list of the experimental materials see Appendix 2.

For each test (S1, S2) the child was given two examples followed by 10 trial sessions for the Spanish-speakers (tense-vowel contrasts only), and 30 trial sessions for the English-speakers (tense-vowel, lax-vowel and tense/lax vowel contrasts). The child scored one point for each correct answer, so there was a possible total score of 10 (Spanish) or 30 (3 x 10; English) for each test. For each child the order of the tests (S1, S2) was counterbalanced and the order of the trials of each test was randomised. Hence, half of the children in each group did the S1 test first, and half did the S2 test first. No distinction was made between tense-vowel, lax-vowel and tense/lax vowel trials for the English-speaking children, and each child received the trials in a random order.

Table 6. 2: The tasks

SYLLABLE 1 task		
tense vs. tense comparisons		
p/**a**/lsud	t/**a**/nden	k/e/mpir
n/**e**/ngan	p/**e**/mpol	k/a/stir
g/**i**/lson	d/**i**/ntal	k/o/mpes
l/**o**/ndel	p/**o**/ctad	d/e/lsun
p/**u**/ndan	s/**u**/ctor	p/a/lsud
lax vs. lax comparisons		
b/*a*/ngon	n/*a*/mpus	t/ʊ/stel
g/ɜ/lsad	f/ɜ/mpon	d/I/nter
l/**I**/ndil	p/**I**/ctod	t/*a*/lsan
m/ɔ/lsar	b/ɔ/mpil	s/ɜ/nten
n/ʊ/ngan	p/ʊ/mpol	k/*a*/stir
tense vs. lax comparisons		
g/**a**/ndod	v/**a**/stir	n/*a*/mpus
f/ɜ/mpon	b/ɜ/ltad	k/e/mpes
b/**i**/mpid	p/**i**/cton	f/I/ndus
l/ɔ/mpes	k/ɔ/ngen	t/o/lsal
k/**u**/ngen	l/**u**/mpes	t/ʊ/ncad

SYLLABLE 2 task

tense vs. tense comparisons

puls/**a**/d	tend/**a**/n	kemp/i/r
nang/**e**/n	pomp/**e**/l	kist/a/s
gols/**i**/n	dant/**i**/l	komp/e/s
lend/**o**/l	pact/**o**/d	dels/u/n
pand/**u**/n	soct/**u**/s	pals/e/d

lax vs. lax comparisons

puls/**ɑ**/d	tend/**ɑ**/l	kemp/ɔ/s
kanc/**ɜ**/d	fest/**ɜ**/n	momp/I/l
lind/**I**/l	pact/**I**/d	tals/ɜ/n
keng/**ɔ**/n	dact/ɔ/s	fils/ʊ/l
nang/**ʊ**/l	pomp/ʊ/n	kist/I/s

tense vs. lax comparisons

gond/**a**/d	vist/**a**/n	nump/ɑ/s
fest/**ɜ**/l	gals/**ɜ**/d	bong/e/n
bimp/**i**/d	poct/**i**/n	fand/I/s
lemp/**ɔ**/s	king/ɔ/n	dals/o/l
kund/**u**/s	soct/**u**/n	test/ʊ/l

6.3 RESULTS

6.3.i Vocabulary

As was pointed out in Chapter 5.4.i, it is important to make sure that there are no differences in vocabulary ability between the groups, since this is an indicator of their intellectual ability. Table 6. 3 below shows the mean raw scores for each of the groups on the vocabulary test.

Table 6. 3: Mean raw vocabulary scores for each of the groups

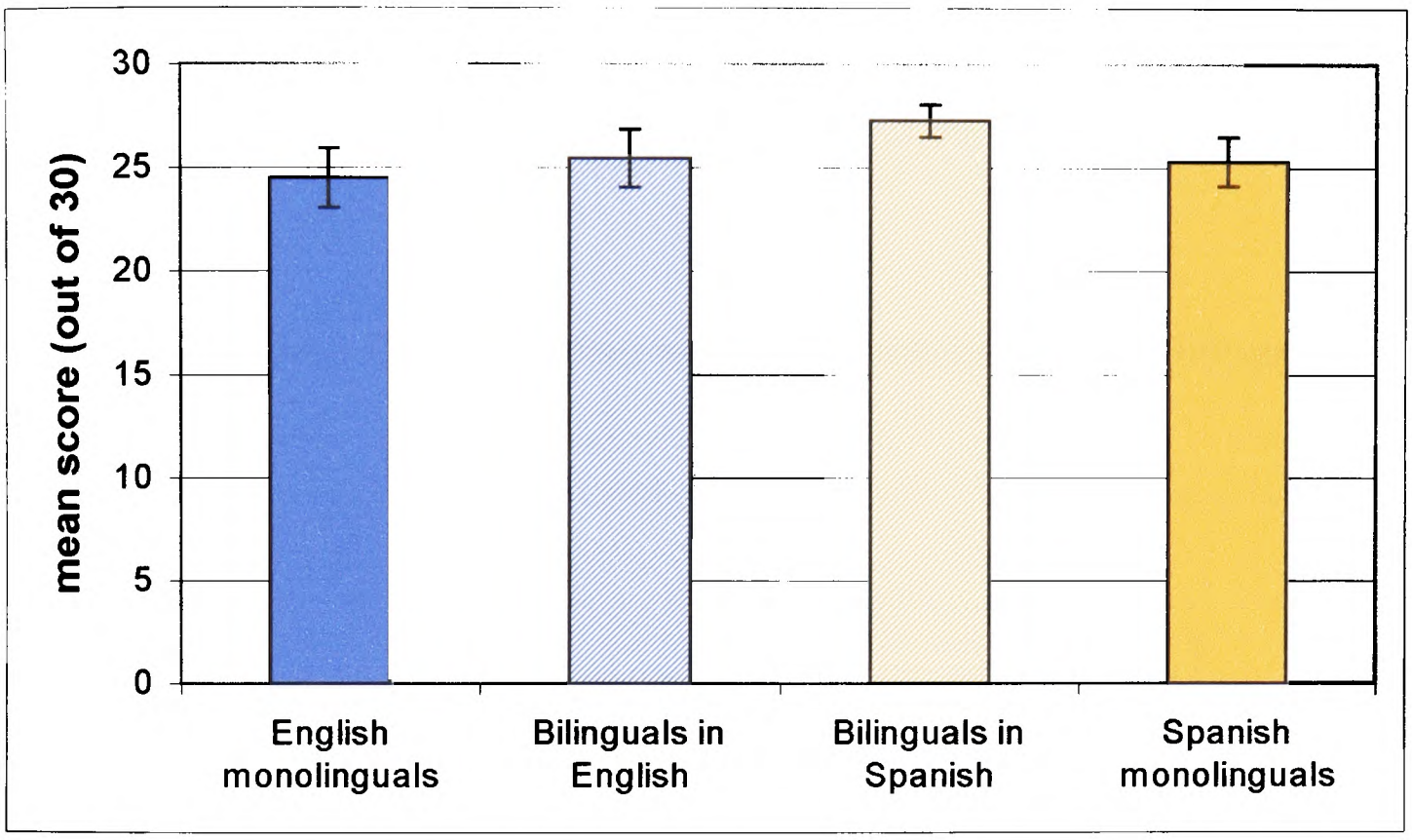
	English monolinguals	Bilinguals in English	Bilinguals in Spanish	Spanish monolinguals
Mean	80.875	53.225	80.550	83.425
s.d.	13.394	14.821	11.947	10.165

A series of one-way ANOVA's were carried out to see if the differences were significant. We found no difference in receptive vocabulary between the English and Spanish monolinguals ($F[1,79] = 0.920$, $p < 0.340$) or the Spanish monolinguals and the bilinguals in Spanish ($F[1,79] = 1.351$, $p < 0.249$). However, the bilinguals performed worse in English than in Spanish ($F[1,39] = 82.922$, $p < 0.000$) and they performed worse in English than the English monolinguals ($F[1,79] = 76.632$, $p < 0.000$). It is possible that the bilingual children's limited exposure to English is the cause of their poor English vocabulary score. However, the most important comparisons to make are between the English monolinguals, the Spanish monolinguals and the bilinguals in Spanish. From the finding that they all have similar receptive vocabularies, it can be implied that all of the children were of a similar intellectual ability.

6.3.ii Memory

The children's raw memory scores were compared in a series of one-way ANOVA to determine whether there were any significant differences between the groups. Figure 6.1 shows the raw scores for each of the groups.

Figure 6. 1: Mean memory raw scores for each group



The Spanish and the English children performed similarly on the memory task. A one-way ANOVA showed that the difference in performance was not significant ($F[1,78] = 0.738$; $p < 0.393$).

The bilingual children performed better on the Spanish memory task than on the English memory task. A one-way repeated measures ANOVA showed that this difference was significant ($F[1,39] = 8.813$;$p < 0.005$).

The bilingual children performed slightly better than the monolingual children on the English version of the memory task. A one-way ANOVA showed that this difference was not significant ($F[1,78] = 0.921$; $p < 0.34$).

The bilingual children performed better than the monolingual children on the Spanish version of the memory task. A one-way ANOVA showed that this difference was significant ($F[1,78] = 7.632$; $p < 0.007$).

In summary, all of the children showed similar memory scores, apart from the bilingual children, whose Spanish memory scores were particularly good.

6.3.iii Standardised Reading

English monolinguals vs. bilinguals in English

Figure 6. 2: Mean English reading age for the monolinguals and bilinguals

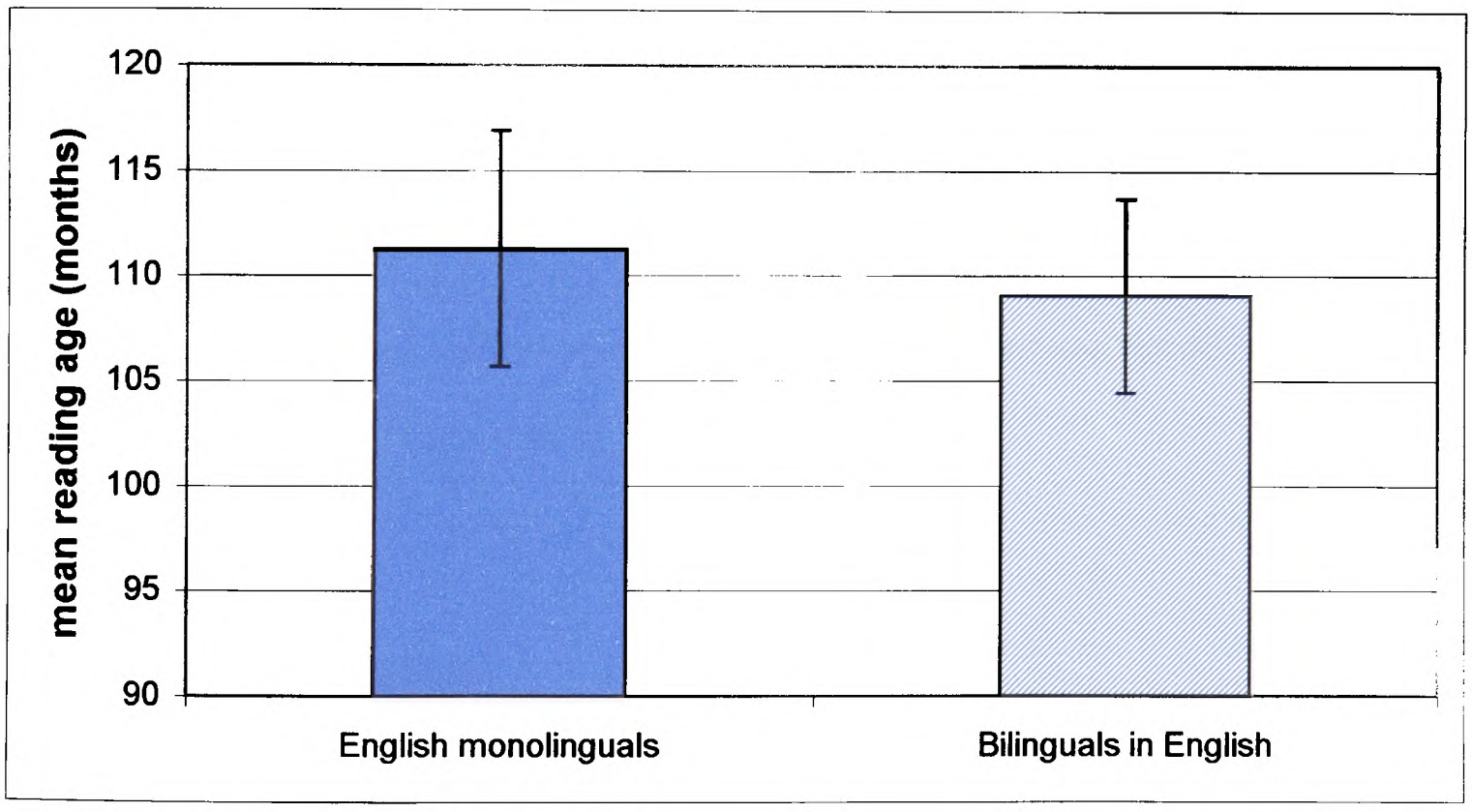


Figure 6.2 shows that there was very little difference between the bilingual and the monolingual children's ability to read in English. A one-way ANOVA showed that the difference was not significant ($F[1,77] = 0.358$; $p < 0.551$).

Spanish monolinguals vs. bilinguals in Spanish

Figure 6. 3: Mean Spanish reading grade-level for the monolinguals and bilinguals

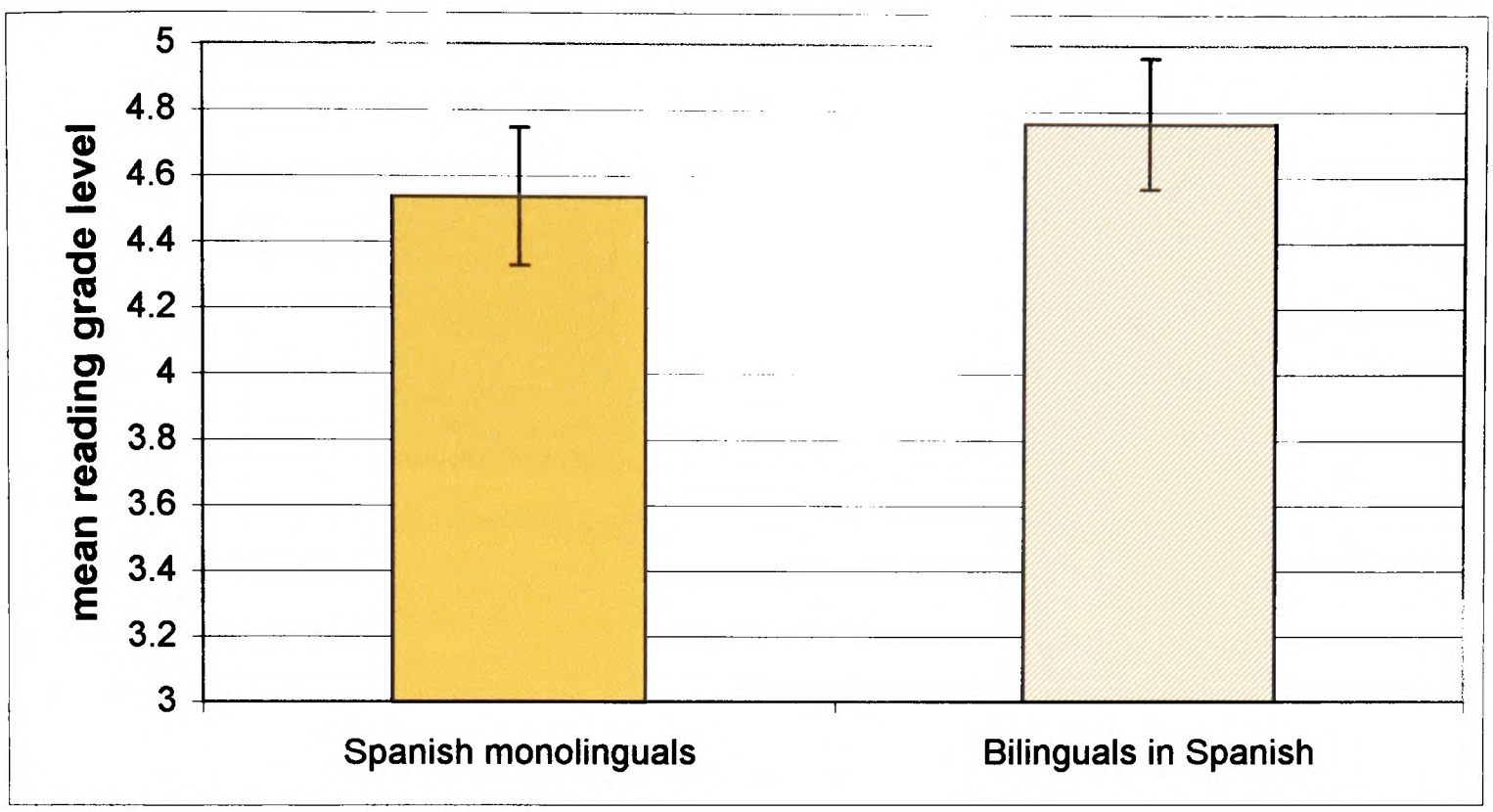


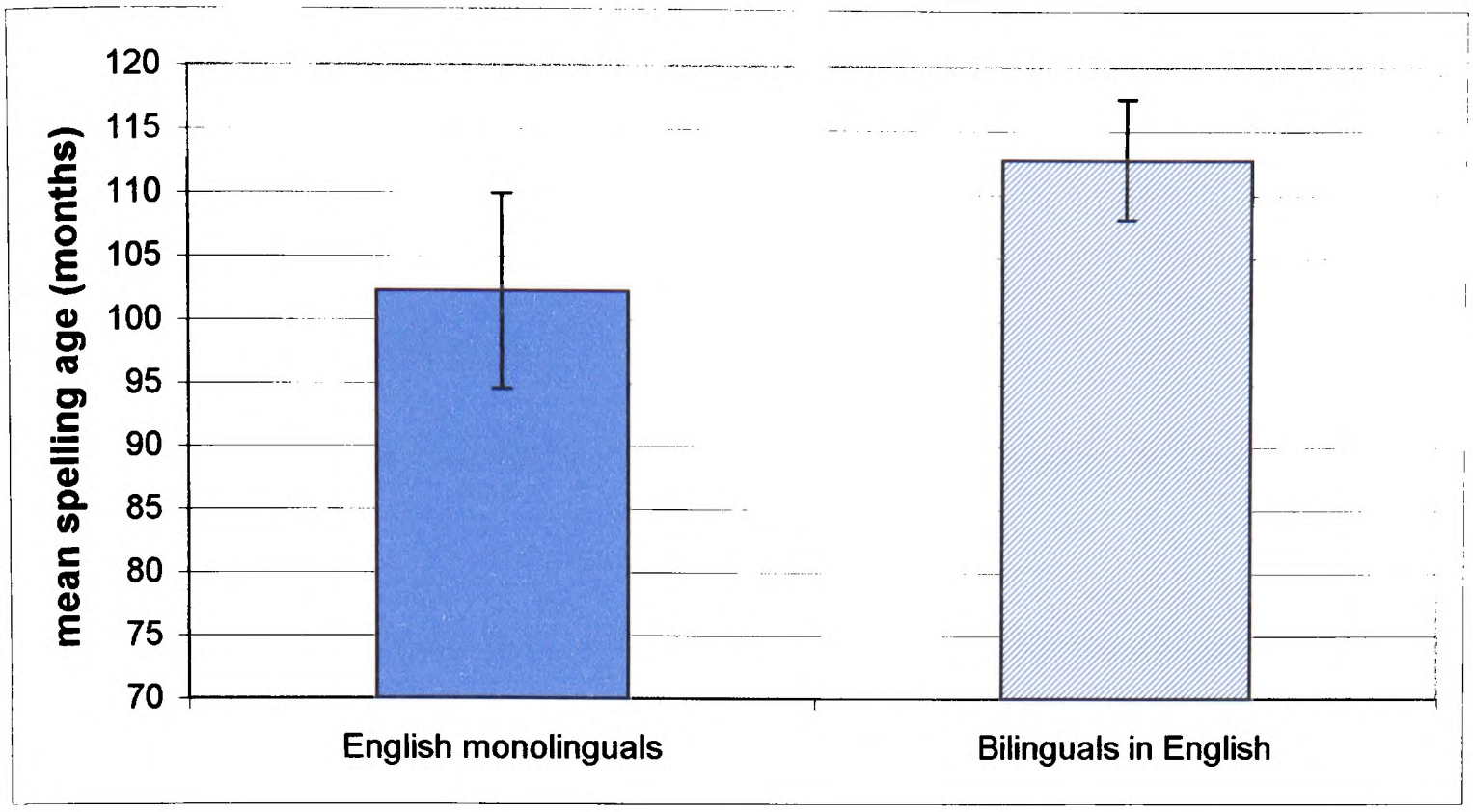
Figure 6.3 shows that there was very little difference between the monolinguals' and the bilinguals' reading ability. A one-way ANOVA showed that the difference was not significant ($F[1,78] = 2.344$; $p < 0.13$).

6.3.iv Standardised spelling

English monolinguals vs. bilinguals in English

Error! Not a valid bookmark self-reference. shows that the bilingual children were better at spelling then the monolingual children. A one-way ANOVA showed this difference to be significant ($F[1,78] = 5.198$; $p < 0.025$). The bilingual children were better at spelling in English than their English monolingual counterparts.

Figure 6. 4: Mean English spelling age for the monolinguals and bilinguals



Spanish monolingual vs. bilinguals in Spanish

Figure 6. 5: Mean Spanish spelling grade-level for the monolinguals and bilinguals

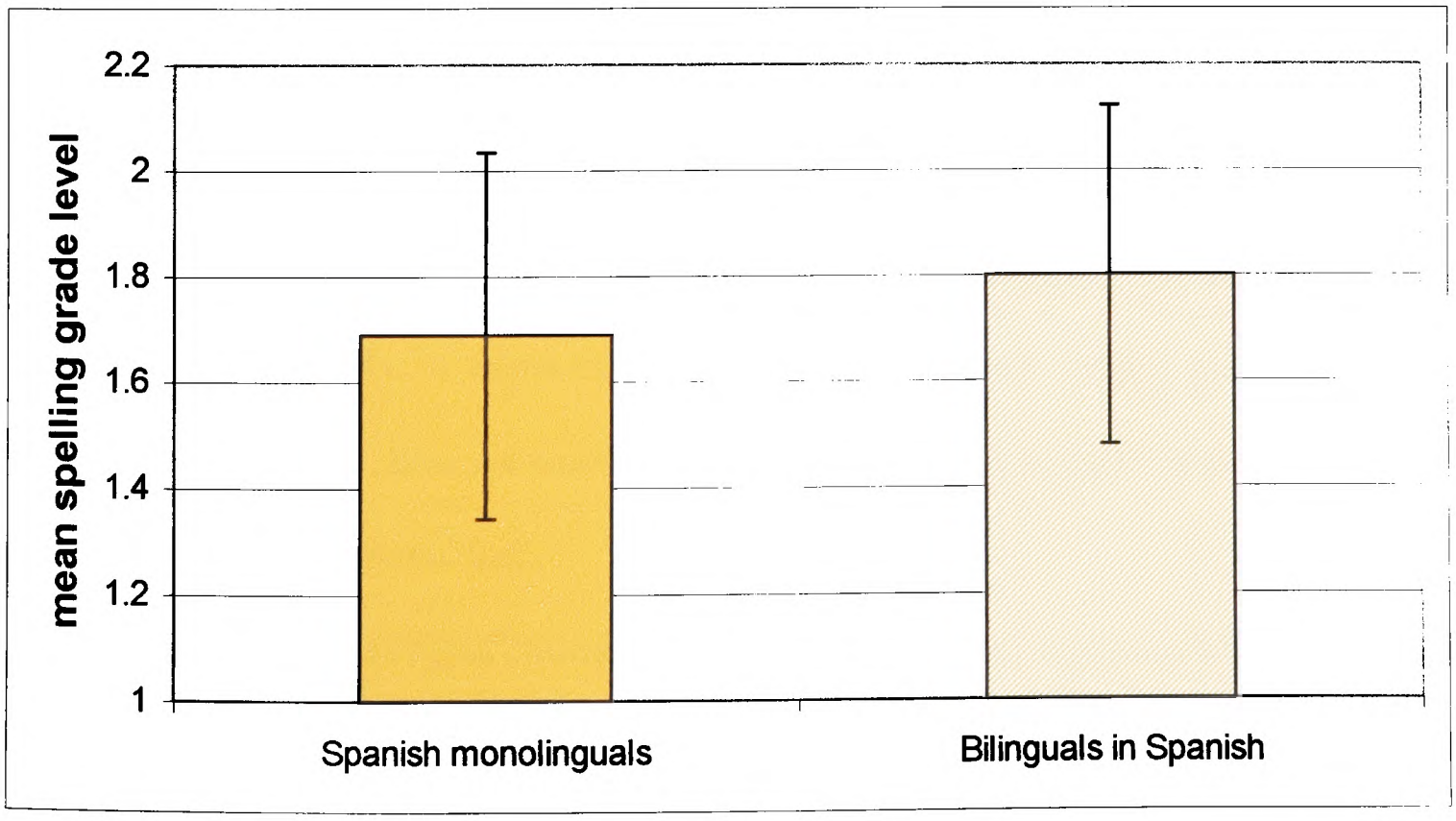


Figure 6.5 shows that there was very little difference between the bilingual children and the monolingual children's ability to spell. A one-way ANOVA showed that the difference was not significant ($F[1,78] = 0.218$; $p < 0.642$).

6.3.v Phonological awareness

We predicted that Spanish-speakers would be more aware of vowel sounds than English-speakers.

We further predicted that, if bilingual children's vowel awareness is affected by their exposure to Spanish, then their awareness of tense vowel sounds should be greater than their awareness of lax vowel sounds. We were particularly interested in how children perform on the tense/lax-vowel task. We know that Spanish children find it very difficult to distinguish tense from lax versions of the same vowel because this distinction is not phonemically relevant in Spanish. However, it is phonemically relevant for the bilingual children in English. Hence, if the bilingual children perform badly on the tense/lax-vowel task, this may be a consequence of their over-reliance on Spanish vowel phonology[4]. If, on the other hand, they perform well on this task, it could be argued that bilingual children pay particular attention to those aspects of their two phonologies which are different, namely, the tense/lax distinction that is relevant in one language (English) but not in the other (Spanish). Alternatively, if exposure to Spanish and English simply makes you more aware of vowels overall, then we would expect little difference in performance between the three different types of vowel task.

Comparing the bilingual children with the monolingual English children also allows us to determine whether a bilingual vowel advantage is due to transfer of awareness or

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[4] In other words, they treat all vowels as if they were Spanish and consequently have problems in distinguishing tense from lax versions of the same vowel.

whether it is due to an increased ability to analyse vowel sounds. If transfer of awareness occurs for bilingual children, then they should only perform better than the English monolingual children on the English tense-vowel tests. This is because lax vowels do not exist in Spanish, and hence, bilingual children could not be transferring their awareness of this type of vowel across languages. If bilingual children are better at analysing vowels than monolingual children, then they should perform better than English monolingual children on all of the English vowel tests.

Table 6. 4: Mean vowel awareness scores for each group

	Tense Vowel 1		**Tense Vowel 2**		**Lax Vowel 1**		**Lax Vowel 2**		**Tense/lax Vowel 1**		**Tense/lax Vowel 2**	
	m	**s.d.**	**m**	**s.d.**	**m**	**s.d.**	**m**	**s.d.**	**m**	**s.d.**	**m**	**s.d.**
English Monolingual	6.00	2.32	5.98	1.98	6.15	1.82	4.90	2.16	7.17	1.22	6.26	1.61
Bilinguals in English	8.30	1.22	8.38	1.43	7.68	1.37	6.90	1.58	7.00	1.28	7.73	1.36
Bilinguals in Spanish	8.33	1.23	8.35	1.29								
Spanish Monolingual	7.88	1.24	7.98	1.21								

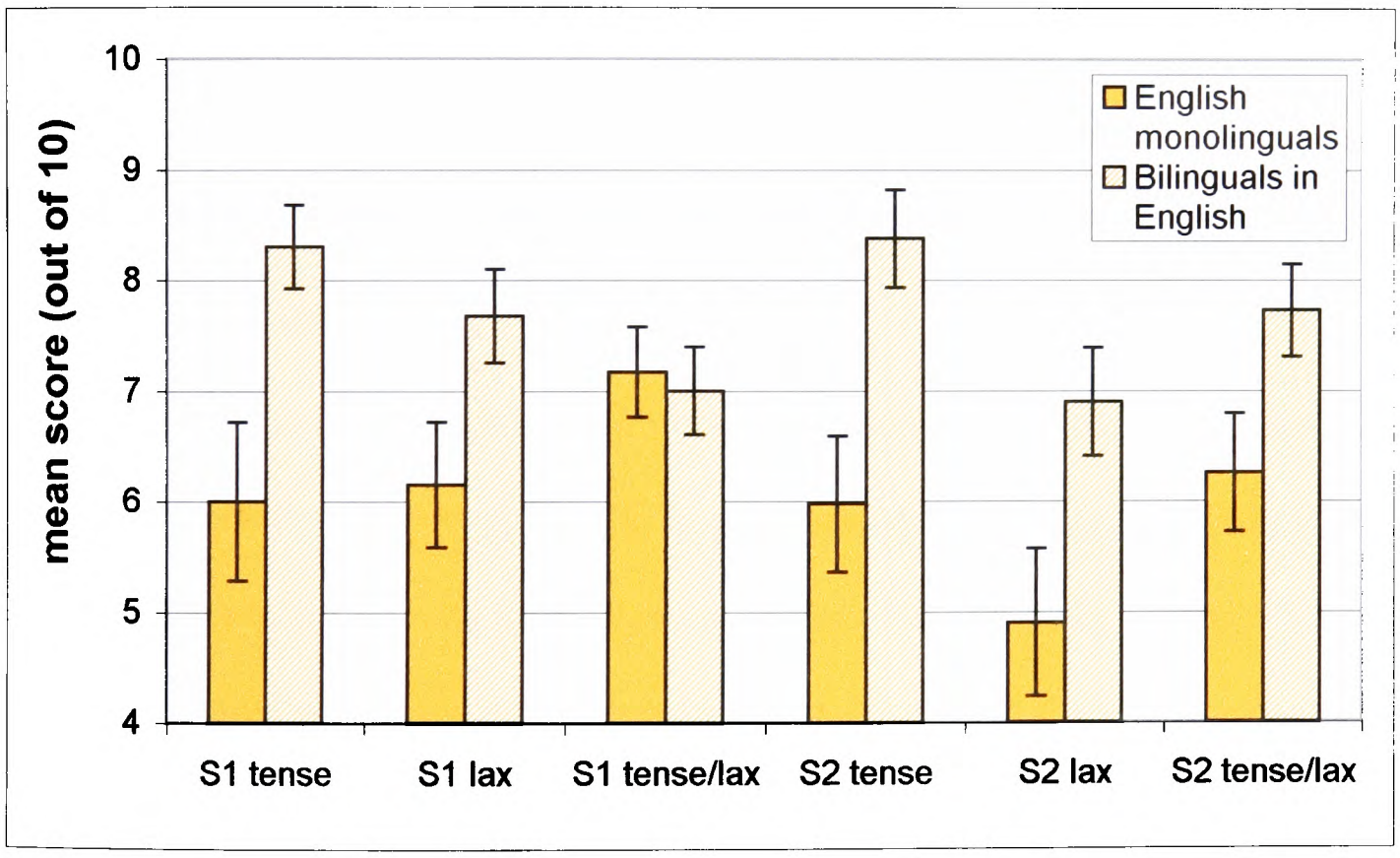
Key: m = mean; s.d. = standard deviation

Table 6. 4 shows the mean scores on each vowel task for the three groups. We begin by comparing the English monolinguals with the bilinguals in English. We then compare the English with the Spanish-speakers, and finally we compare the bilinguals against the Spanish monolinguals.

English monolinguals vs. bilinguals in English

Figure 6. 6 compares the English monolinguals' performance on the vowel tasks with that of the bilingual children in English. This figure shows that the bilingual children performed better on the tense-vowel task than the lax-vowel and the tense/lax-vowel tasks. The performance on the lax- and tense/lax-vowel tasks was similar. The monolingual children performed better on the tense/lax-vowel task than on the tense-vowel and lax-vowel tasks. The figure also shows that the bilingual children performed better overall than the monolinguals.

Figure 6. 6: Mean score on the English vowel tests for the monolinguals and bilinguals



A three-way ANCOVA was carried out with Task (tense-vowel, lax-vowel and tense/lax-vowel) and Position (syllable 1, syllable 2) as the within subject variables and Group as the between subject variable. Since the phonological task involved a memory component (the children had to remember three non-words), we wanted to establish that any differences found in performance on the task were likely to be caused by differences in

awareness of vowel sounds as opposed to being a by-product of poor memory. Therefore, memory was added as a co-variate.

There was no main effect of Task ($F[2,144] = 2.666$; $p < 0.075$) or Position ($F[1,72] = 0.003$; $p < 0.96$), but there was a main effect of Group ($F[1,72] = 44.433$; $p < 0.000$). There was also an interaction of Task by Group ($F[2,144] = 11.453$; $p < 0.000$) and Position by Group ($F[1,72] = 11.892$; $p < 0.001$).

The main effect of Group was caused by the bilingual children performing better overall than their monolingual counterparts.

A post-hoc Newman Keul's test using adjusted means showed the Task by Group interaction to be caused by the bilingual children performing better on the tense-vowel task than on the lax-vowel task and the tense/lax-vowel task. There was no significant difference in their performance on the lax-vowel task and the tense/lax-vowel task. The English monolingual children, on the other hand, performed better on the tense/lax-vowel task than on the lax-vowel task. There were no differences in their performance on the other tasks (all $p < 0.05$).

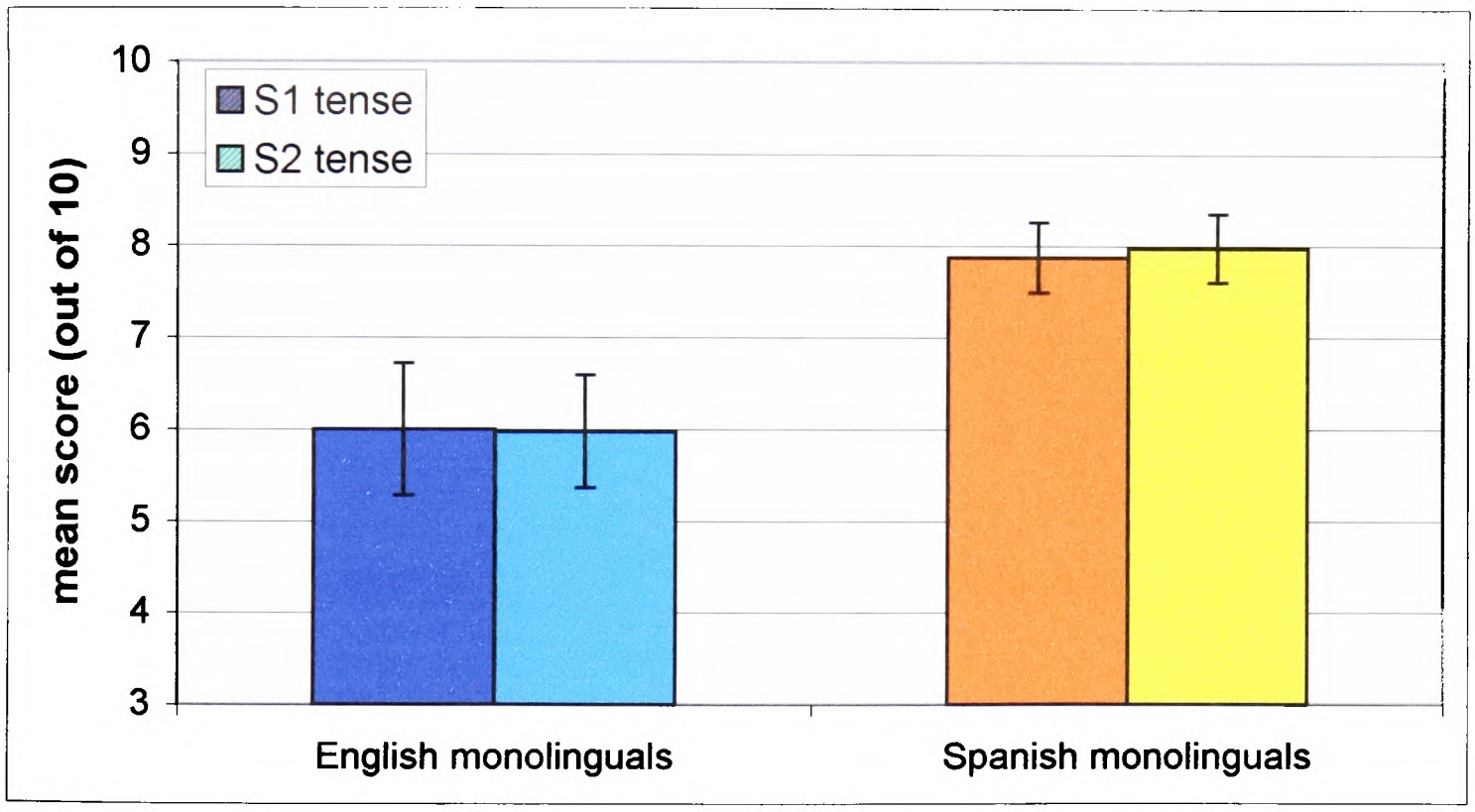
A post-hoc Newman Keul's test using the adjusted means showed that the Position by Group interaction was caused by the English monolingual children performing relatively worse on the second syllable tasks than on the first syllable tasks ($p < 0.05$), whereas the bilingual children performed similarly on first and second syllable tasks. This suggests that word position affects English monolingual children more than bilingual children.

In conjunction, these findings suggest that the bilingual vowel advantage is not due only to transfer of Spanish vowel awareness to English. The main effect of Group shows that the bilinguals' vowel advantage extends beyond tense vowels. Hence, it appears that bilingual children are better at analysing vowels than are English monolingual children. Interestingly, however, the bilingual children's performance on the tense-vowel task was better than their performance on the lax-vowel and the tense/lax-vowel tasks. This

suggests that tense vowels are particularly salient to these children, possibly as a consequence of their exposure to Spanish. Nevertheless, the need to discriminate two differing phonologies may also help them focus on the differences and hence to be more aware of vowel sounds overall than their monolingual counterparts.

English monolinguals vs. Spanish monolinguals

Figure 6. 7: Mean score on the tense vowel test for the English and Spanish monolinguals



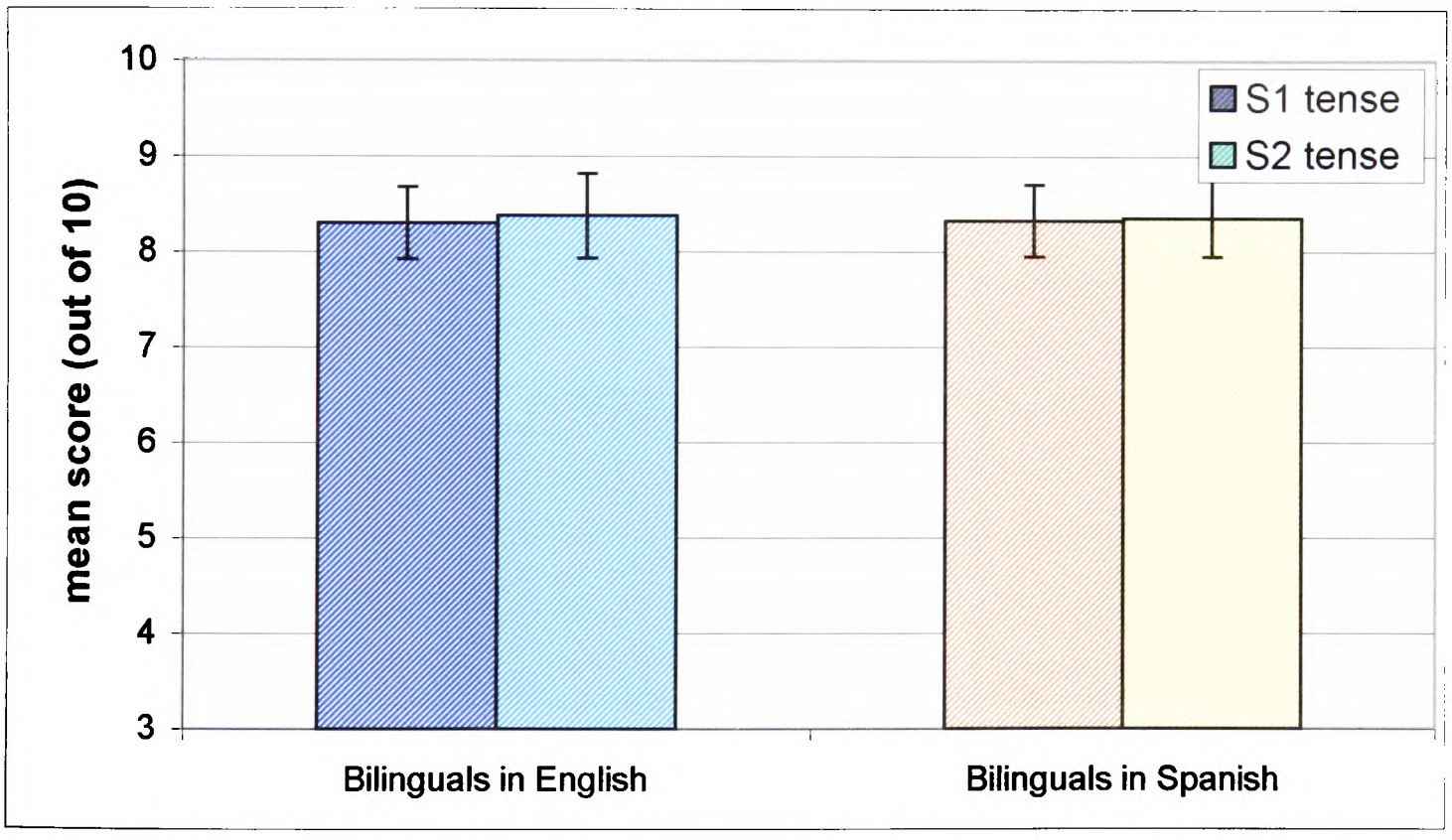
We predicted that the Spanish children would perform better than the English children, as was found in Experiment 1. The only comparison we can make is on the tense-vowel task, since this was the only phonological task given to the Spanish-monolingual children. Figure 6. 7 indicates that the Spanish children performed better on the tense-vowel task than the English children.

A two-way ANCOVA was carried out with Position as the within subjects variable and Group (English monolingual, Spanish monolingual) as the between subjects variable to

see if this difference was significant. Memory was put in as the co-variate. There was no main effect of Position ($F[1,77] = 0.064$; $p < 0.802$), but there was a main effect of Group ($F[1,77] = 40.881$; $p < 0.000$). This was caused by the Spanish monolingual children performing significantly better on the tense-vowel tasks than their English monolingual counterparts. This is a replication of the findings of Experiment 1 concerning vowel awareness, and suggests that vowel sounds are particularly salient in Spanish.

Bilinguals in English vs. bilinguals in Spanish

Figure 6. 8: Mean score on the tense vowel test for the bilinguals in English and Spanish

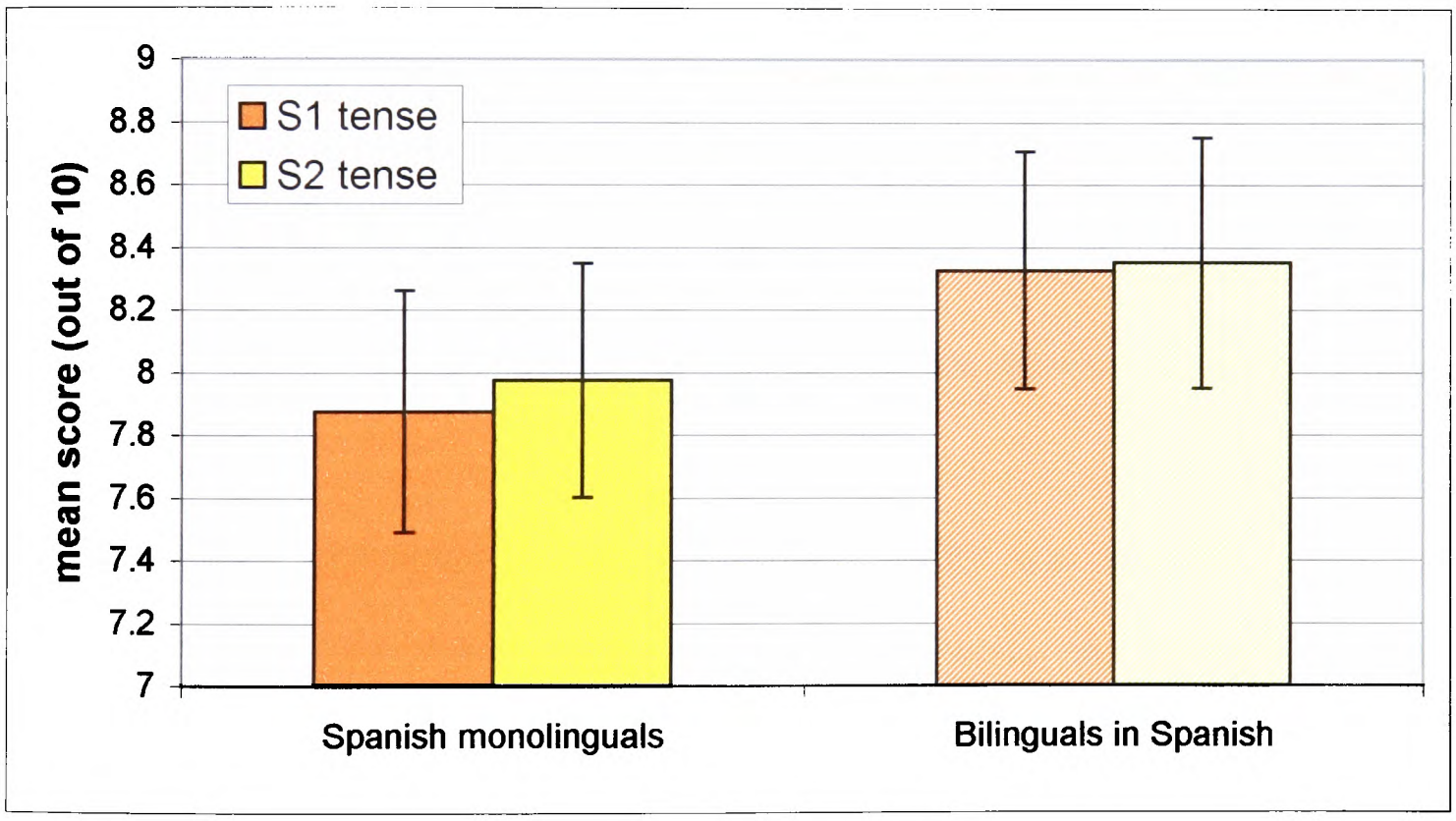


The only comparison that can be made is on the tense-vowel task, since this is the only phonological task given to the bilingual children in Spanish. We predicted that the bilingual children would perform better on the Spanish than on the English version of the vowel task, as they had in Experiment 1. Figure 6. 8 indicates that their performances were similar. A two-way repeated measures ANCOVA was carried out with Position and Language (English, Spanish) as the within subjects variables and Memory (English and

Spanish) as the co-variates. There was no main effect of Position ($F[1,37] = 0.396$; $p < 0.533$) or Language ($F[1,37] = 1.23$; $p < 0.275$). There were no significant differences between the group's performance on the English and Spanish versions of the tense-vowel tasks: the children were equally aware of tense vowels in each language. This suggests that the children are transferring awareness across languages. They may be able to use their knowledge of Spanish vowels to help them with the English-tense-vowel task.

Spanish monolinguals vs. bilinguals in Spanish

Figure 6. 9: Mean score on the tense vowel test for the monolinguals and bilinguals



One final comparison was between the bilingual children's and the Spanish monolingual children's performances on the Spanish tense-vowel task. Figure 6. 9 indicates that their performances were similar.

A two-way ANCOVA with Position as the within subjects variable and Group as the between subjects variable was conducted. Memory was put in as a co-variate. There

was no main effect of Position ($F[1,77] = 0.982$; $p < 0.325$) or of Group ($F[1,77] = 1.252$; $p < 0.267$). The two groups performed similarly on the tense-vowel tasks.

6.3.vi The relationship between vowel awareness and reading ability

Research in both Spanish and English has shown that phonemic awareness is related to reading ability. However, the majority of investigators have concentrated on consonant phonemes. Hence, this study investigated whether vowel awareness is also related to reading in these two languages. Correlations were therefore examined between each of the phonological tasks and each group's reading ability.

Monolinguals

Table 6. 5 shows the Spearman's rank correlations between the standardised reading tests and vocabulary, age, memory and vowel awareness for the English and Spanish monolingual children. Spearman's rank was used because not all of the data were normally distributed.

The English monolingual children's reading ability was correlated with their performance on all of the vowel tasks. Receptive vocabulary and memory were also correlated with reading skill. This provides good evidence that vowel awareness is important in English reading.

For the Spanish monolingual children reading was not correlated with vowel awareness. This is a surprising finding, given the quantity of evidence suggesting a link between reading ability and phonemic awareness. The finding cannot be put down to ceiling effects on the vowel tasks since very few children performed at ceiling. However, reading did correlate with age.

Table 6. 5: Spearman's rank correlations of the vowel tests with reading ability for the monolingual children

	English standardised reading	Spanish standardised reading
Vocabulary	.519**	.310
Age	.084	.355*
Memory	.542**	.076
Syllable 1 tense vowels	.368*	.265
Syllable 2 tense vowels	.510**	.191
Syllable 1 lax vowels	.351*	
Syllable 2 lax vowels	.328*	
Syllable 1 tense/lax vowels	.439**	
Syllable 2 tense/lax vowels	.413*	

** Correlation is significant at the .01 level (2-tailed); * Correlation is significant at the .05 level (2-tailed).

Bilinguals in English and Spanish

Table 6. 6 shows the correlations between phonological awareness and vocabulary, memory, and reading for the bilingual children in both of their languages.

Bilinguals in English

Table 6. 6 shows that for the bilingual children in English, reading ability was not correlated with English vowel awareness. English memory and vocabulary, on the other hand, were correlated with reading skill. This result is similar to that found in Experiment 1 in which phonological awareness was poorly correlated with reading ability for the bilingual children. The result is not a consequence of ceiling scores from these children, since very few children were at ceiling level on any of the tasks. This finding is

particularly difficult to interpret bearing in mind that the bilingual children were no worse at reading than were their English monolingual counterparts. The result suggests that bilingual children approach reading differently from their monolingual counterparts.

Table 6. 6: Spearman's rank correlations of the vowel tests with reading ability for the bilingual children

		English standardised reading	Spanish standardised reading
	English standardised reading		.269
	Age	.253	-.257
English	**Vocabulary**	.363*	-.203
	Memory	.400*	.193
	Syllable 1 tense vowels	.153	.237
	Syllable 2 tense vowels	-.064	.316*
	Syllable 1 lax vowels	-.003	.033
	Syllable 2 lax vowels	-.095	.340*
	Syllable 1 tense/lax vowels	.005	.111
	Syllable 2 tense/lax vowels	.299	.116
Spanish	**Vocabulary**	.167	.281
	Memory	.309	.107
	Syllable 1 tense vowels	.384*	.187
	Syllable 2 tense vowels	.064	.415**

** Correlation is significant at the .01 level (2-tailed); * Correlation is significant at the .05 level (2-tailed).

Bilinguals in Spanish

Table 6. 6 indicates that reading in Spanish is correlated with the awareness of Spanish vowels in the second syllable. Hence, for the bilingual children in Spanish, vowel awareness appears to play some part in reading. This result is interesting since the bilingual children seem to be reading using a different strategy from their monolingual counterparts. However, in this case, the bilingual children are the ones who seem to be using their phonological awareness in reading.

Bilingual children: Reading in L1/L2 and phonological awareness in L2/L1

Since bilingual children are exposed to two different phonologies and two different orthographies we wanted to know whether they use their vowel awareness in L1/L2 to help them read in L2/L1. Table 6. 6 shows the correlations found.

English reading was correlated with awareness of Spanish vowels in the first syllable. Reading in Spanish, on the other hand, was correlated with the English second-syllable lax- and tense-vowel tasks. Notably, reading ability was not correlated across languages. This is an interesting finding and suggests that the bilingual children's reading strategies for each language might be separate. However, they do seem to be capable of using their knowledge of phonology in one language for reading in the other language.

6.3.vii The relationship between vowel and spelling ability

Research in both Spanish and English has shown that phonemic awareness is related to spelling ability. However, the majority of investigators have concentrated on consonant phonemes. Hence, the study investigated whether vowel awareness is also related to spelling in these two languages. Correlations were therefore examined between each of the phonological tasks and each group's spelling ability.

Monolinguals

Table 6. 7 shows the Spearman's rank correlations between the standardised spelling tests and vocabulary, age, memory and vowel awareness for the English and Spanish monolingual children. Spearman's rank was used because not all of the variables were normally distributed.

Table 6. 7: Spearman's rank correlations of the vowel tests with spelling ability for the monolingual children

	English standardised spelling	Spanish standardised spelling
Vocabulary	0.362*	0.605**
Age	-0.016	0.524**
Memory	0.362*	0.383**
Syllable 1 tense vowels	0.268	0.174
Syllable 2 tense vowels	0.364*	0.495**
Syllable 1 lax vowels	0.211	
Syllable 2 lax vowels	0.341*	
Syllable 1 tense/lax vowels	0.371*	
Syllable 2 tense/lax vowels	0.465**	

** Correlation is significant at the .01 level (2-tailed); * Correlation is significant at the .05 level (2-tailed).

The awareness of vowels was correlated with spelling ability for both groups of children. This is as predicted. Vocabulary and memory were also correlated with spelling ability for both groups. However, age is only related to spelling ability for Spanish children. This may have been a consequence of Spanish children from the older year group performing better than those in the younger group because of their greater literacy experience.

Table 6. 8: Spearman's rank correlations of the vowel tests with spelling ability for the bilingual children

		English standardised spelling	Spanish standardised spelling
	English standardised spelling		0.591**
	Age	0.456**	0.293
English	Vocabulary	0.605**	0.187
	Memory	0.158	0.304
	Syllable 1 tense vowels	-0.058	0.016
	Syllable 2 tense vowels	-0.017	0.187
	Syllable 1 lax vowels	0.075	-0.011
	Syllable 2 lax vowels	-0.12	0.009
	Syllable 1 tense/lax vowels	0.02	0.117
	Syllable 2 tense/lax vowels	0.295	0.104
Spanish	Vocabulary	0.017	0.355*
	Memory	0.273	0.452**
	Syllable 1 tense vowels	0.342*	0.330*
	Syllable 2 tense vowels	0.101	0.348*

** Correlation is significant at the .01 level (2-tailed); * Correlation is significant at the .05 level (2-tailed).

Table 6. 8 shows the correlations between phonological awareness and vocabulary, memory, and spelling for the bilingual children in both of their languages.

Vowel awareness was not correlated with spelling ability for the bilingual children in English. This finding suggests that the bilingual children may not be using the same processes in spelling as their monolingual counterparts.

Vowel awareness was correlated with spelling ability for the bilingual children in Spanish. This was as predicted.

English vowel awareness was not related with the ability to spell in Spanish. This finding is not all that surprising given that the lax English vowels do not exist in Spanish. Spanish vowel awareness, however, was correlated with English spelling ability.

6.4 DISCUSSION

Vowel awareness

As predicted, we found that vowel awareness is greater for Spanish-speakers than it is for monolingual speakers of English. This finding suggests that vowels are more salient in Spanish than they are in English. It is possible that this is because of the increased number of English vowel sounds as compared to Spanish vowel sounds and the distinctness of Spanish vowels as compared to English vowels.

Furthermore, bilingual children are more aware of vowel sounds in English than are English children. This is, in part, because of a greater awareness of those vowels that exist in both the languages they speak, namely, tense vowels. The bilingual children performed similarly on the English and Spanish versions of the tense-vowel task. This suggests that some transfer of phonological awareness occurs across languages. However, this is not the whole explanation. The bilingual children also showed greater awareness of lax vowels in English than the English children. Hence it seems that exposure to two phonemically different languages causes children to focus on those differences, and consequently show more sensitivity to all of the vowel contrasts that exist.

One final point of interest concerns the fact that phoneme awareness existed at all for the English children. The evidence reviewed in Chapter 2.2.i.a showed that Spanish children do have some phoneme awareness at the early stages of reading. However, much of the work on English children's phonemic awareness reviewed in Chapter 2.1.i.a concluded that phonemic awareness does not develop until the child has learned to read. The children in the present study showed relatively sophisticated knowledge of phonemes given their reading abilities. It is possible that the discrepancy in results between the current investigations and those referred to in Chapter 2 is a consequence of methodology used. Many of the studies looking at beginning readers' phonemic awareness have employed task involving the direct manipulation of phonemes rather than tasks requiring simple discrimination. It is possible that

children's sensitivity to phonemes is greater than had previously been imagined.

Vowel awareness and literacy

The second aim of Experiment 2 was to determine whether vowel awareness is related to reading and spelling skill in English and Spanish.

Vowel awareness was correlated with reading and spelling for the English monolingual children. Phonemic awareness has been shown to be a good predictor of English children's reading and spelling ability (Bryant and Goswami, 1990). The present finding lends further support to the theory that phonemic awareness plays an important role in English literacy.

Spanish models of reading also suggest that phonemic awareness plays a central role in reading acquisition. The finding in this experiment that vowel awareness is not correlated with reading ability sheds doubt on these models. It is possible, however, that in the early stages of reading, Spanish children use their knowledge of phonemes to help them decode words. However, as they become more proficient readers, global or analogical strategies may be relied on to a greater extent. Since the children in this study were reading fluently, their reliance on phonemic awareness might have been diminished. Vowel awareness, however, was correlated with spelling ability. This suggests that phoneme awareness plays a more important role in spelling than in reading for Spanish children. It also suggests that different skills are necessary for reading and spelling in Spanish.

Of particular interest is whether bilingual children use the same strategies in reading as their monolingual counterparts in each language. The bilingual children's English vowel awareness was not correlated with reading ability. This is in stark contrast to the findings for the English monolinguals. Interestingly, reading skill did not differ between these two groups. This suggests that the bilingual children may not be employing the same strategy in reading as their monolingual counterparts. The finding is similar to that of Experiment

1, where the bilingual children's phonological awareness was also far less correlated with reading ability than it was for the English monolingual children. English vowel awareness and English spelling, however, were correlated for the bilingual children. This suggests that the monolinguals and bilinguals may employ similar spelling strategies in English.

In Spanish bilingual children must employ their vowel awareness in reading, since the two abilities were correlated. Once more, this is in contrast to the results found for the Spanish monolingual children. Again, it suggests that the two groups are not employing the same methods in reading. In spelling, on the other hand, vowel awareness and spelling ability were correlated in Spanish, just as they were for the monolinguals. This suggests that monolinguals and bilinguals employ similar spelling strategies.

Interestingly, vowel awareness and reading ability were correlated across languages for the bilingual children: Spanish vowel awareness plays a role in English reading, and English vowel awareness plays a role in Spanish reading. In spelling, Spanish vowel awareness was correlated with English spelling, but English vowel awareness was not correlated with Spanish spelling. This provides further support for the claim that bilingual children do not employ precisely the same mechanisms as their monolingual counterparts in either language, especially for reading. Rather, as a consequence of both their greater source of phonological knowledge (vowel awareness) and their exposure to two differing orthographic systems, they choose to employ strategies that take into account all of these factors. What these strategies might be, however, remains unclear.

CHAPTER 7

EXPERIMENT 2, PART II; VOWEL READING AND SPELLING

7.1 INTRODUCTION

The second question that arose from Experiment 1 concerns the relationship between vowel awareness and the reading (and spelling) of vowels for each group of children. More specifically, the question revolves around various representational levels of vowels that children may or may not possess. We already know that Spanish-speakers are more aware of vowel sounds than English-speakers, and that this awareness extends to English for bilingual children. However, we do not know whether this vowel advantage also reflects itself in reading and spelling. In other words, despite an increased vowel awareness, is it also the case that the 'advantaged' groups have improved orthographic representations of the vowel sounds (in Spanish for the Spanish monolinguals, in both Spanish and English for the bilinguals), enabling them to read and spell vowels more accurately than the English monolingual children?

In Spanish, one might imagine this to be the case. The relationship between vowel sounds and their orthographic representation is far more direct and consistent in Spanish than it is in English. Each vowel sound has one, and only one, orthographic representation.

However, what is of interest is how bilingual children read and spell vowel sounds in English. The orthographic representations of vowel phonemes are notoriously difficult in English. The same vowel sound can be written in various ways (e.g. /u/ can be written 'oo' as in balloon, or 'u' as in flute); and the same orthographic representation can be pronounced in various ways (e.g. 'oo' can be pronounced /u/ as in 'balloon', or /ʊ/ as in look). Furthermore, tense vowels are not spelled the same way in English and Spanish. Whereas in Spanish all vowel phonemes are represented with single graphemes, some tense

vowels in English require digraphs (e.g. /u/ can be spelled 'oo', /i/ as 'ee', 'ie' etc.). By examining bilingual children's vowel spelling and reading errors we may learn the extent to which they are able to distinguish between the Spanish and the English orthographic systems.

The second issue we wished to examine was the extent to which awareness of vowels plays a role in the ability to read and spell vowels for each group of children. We predicted that Spanish-speakers would show a stronger relationship between vowel awareness and vowel reading and spelling because of the transparent nature of the Spanish orthography. However, not only is the relationship between vowel sounds and their orthographic representations more complex in English, but the pronunciation of a vowel sound often depends on the following consonant. Hence, we expected the English children to show fewer correlations between their awareness of vowels and their ability to read and spell them.

In order to look at how children read and spell vowels, and whether this is related to their awareness of vowels, we asked children from the three groups to read and spell those vowels for which we also tested awareness (in Chapter 6).

7.2 METHOD

7.2.i Participants

The participants were the same children that took part in the first part of the experiment, discussed in Chapter 6.

7.2.ii Non-word reading task

English

The non-words used in the English non-word-reading-test were taken from the materials created for the phonological tasks. Ten words were chosen with stressed first syllable tense vowels, 10 with stressed first syllable lax vowels, 10 with stressed second syllable tense vowels and 10 with stressed second syllable lax vowels.

Table 7.1 gives examples of the words used. For a complete list of the materials, see Appendix 2.

Table 7. 1: Examples of the English non-word reading task

bimpid	tondors
tarslan	garndod
fooster	filsul
lormpes	bimpeed
vastir	gandod

Spanish

The non-words used in the Spanish-non-word-reading-test were the same as those

in the English version of the task. However, there were a total of 20 words for the Spanish-speakers, since those non-words containing lax vowels were not included in this test.

Table 7. 2 gives a list of some of the words used. For a complete list of the materials, see Appendix 2.

Table 7. 2: Examples of the Spanish non-word reading task

fuster	kuncad
vastir	gandod
kongen	dolsal
dintal	gilson
kendus	fempar

7.2.iii Non-word spelling task

English

Table 7. 3: Examples of the English non-word spelling task

/bImpId/	/tIstan/
/talsən/	/lIndIl/
/fustə/	/poctin/
/lɔmpes/	/fIlsɜl/
/bʊltən/	/lendol/

___ = stressed syllable

The non-words used in the English non-word-spelling-test were the same as those used in the non-word-reading-test. However, only half of the words were used: Five words

were chosen with stressed first syllable tense vowels, five with stressed first syllable lax vowels, five with stressed second syllable tense vowels and five with stressed second syllable lax vowels. Table 7. 3 gives some of the examples of the words used. For a complete list of the materials, see Appendix 2.

Spanish

The non-words used in the Spanish-non-word-spelling-test were the same as those in the English version of the task. However, there were a total of 10 words for the Spanish-speakers, since those non-words containing lax vowels were not included in this test. Table 7. 4 gives a list of the words used.

Table 7. 4: Examples of the Spanish non-word spelling task

/fuster/	/tistan/
/gandod/	/poctin/
/kongen/	/lendol/
/dintal/	/palsed/
/kendus/	/kancud/

___ = stressed syllable

It should be noted that the bilingual children received the same tense vowels in the English and Spanish non-word reading and non-word spelling tests. However, for the reading test it was stressed that the non-words had to be read "as if they were English" or "as if they were Spanish", and in the spelling test, the words were pronounced either as Spanish words or as English words.

7.3 RESULTS

The study aimed to investigate how children from the three linguistic backgrounds read and spell vowels. It was predicted that Spanish-speakers would have fewer difficulties than English-speakers in reading and spelling vowels because of the highly regular nature of the grapheme-to-phoneme correspondences for vowels in Spanish. Since vowel phonemes are not always represented by single graphemes in English, the study also aimed to investigate whether both the number of graphemes that represented the vowels, and whether vowel type (tense or lax) affects the ability to read and spell vowel phonemes for the English-speakers (both monolingual and bilingual). We expected the children to have greater difficulty in reading and spelling vowel phonemes that are orthographically represented with two graphemes than with one grapheme. Any differences between the bilingual and the monolingual speakers of English would tell us whether each group has a different understanding of the relationship between phonology and orthography (for vowels) in English. The responses of the bilingual children were of particular interest from this point of view, since it was anticipated that their understanding of the mapping between phonology and orthography in English may be affected by their understanding of the (more consistent) mapping in Spanish.

The other question that was of interest was whether awareness of vowel sounds was related to the ability to read and spell them. If you have a good awareness of vowel sounds, does this make it easier to represent them orthographically?

7.3.i The ability to read vowels in non-words

We coded the data by giving a score for vowels in first syllables and a score for vowels in second syllables regardless of whether these vowels were tense or lax. This was because, since the children were reading the words, they had the choice over which syllable

contained primary stress. Stress, in turn, decided whether certain orthographic sequences would be read as tense vowels or as lax vowels. For example, the 'a' in the second syllable of 'tarlsan' may be pronounced as /a/ (tense), if it is stressed, or /ə/ or /ʌ/ (lax), if it is unstressed. As long as the child gave an acceptable reading of the vowel sound they were scored as correct.

Below we compare the groups' performances. The raw scores were converted into percentage incorrect scores. This was because the English-speakers read twice as many vowel sounds as the Spanish-speakers.

In carrying out the analyses of variance the assumptions of normality and homogeneity of variance have been violated. However, in order to do repeated-measures analysis ANOVA needed to be used since non-parametric tests do not allow this. It was necessary to do repeated-measures analysis in order to look at within-group differences and to compare the bilingual children across languages. Since some of the data was almost discreet, it was not possible to use transformations to adjust to normal distribution. Nevertheless, the ANOVA test is remarkably insensitive to violations of the assumptions (Box, 1953; Boneau, 1960). Furthermore, since the data was positively skewed, violating the assumptions makes it less likely that a significant effect will be found. Hence, a significant effect will only be found for large differences. For a fuller explanation of the violation of assumptions and how this should not affect the results, see Appendix 5.

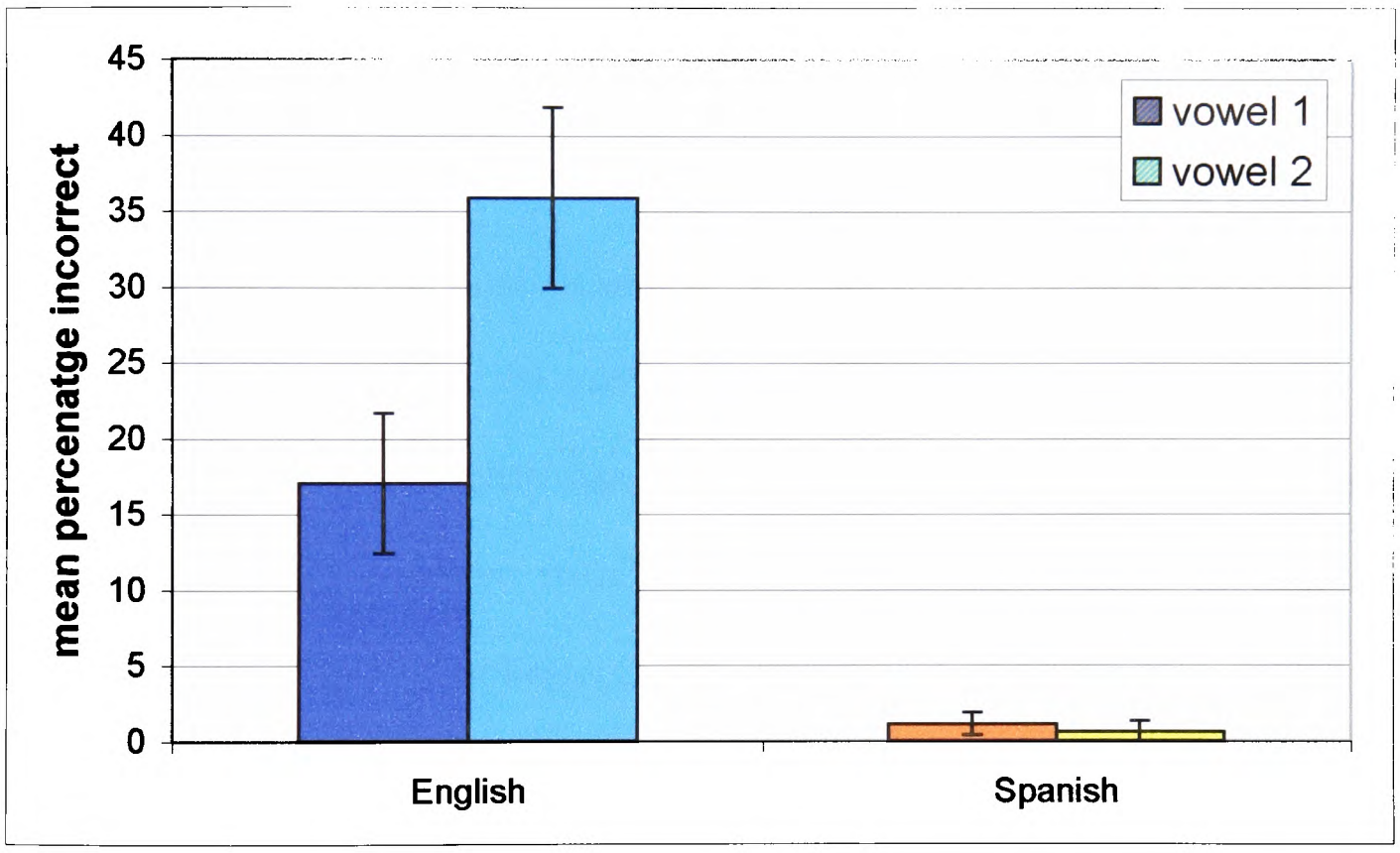
The orthographic representations of vowel phonemes in Spanish are far simpler than in English. We therefore expected the Spanish-speakers (both monolingual and bilingual) to perform better on both the V1 and the V2 tasks than the English-speakers.

English monolingual vs. Spanish monolingual

Figure 7.1 shows that the Spanish children made far fewer vowel reading errors

than the English children. In order to see if this difference was significant we carried out a two-way ANOVA with Vowel Position (syllable 1, syllable 2) as the within subjects variables and Group as the between subjects variable. There was a main effect of Vowel Position ($F[1,78] = 80.765$; $p < 0.000$) and of Group ($F[1,78] = 100.637$; $p < 0.000$). There was also an interaction of Vowel Position by Group ($F[1,78] = 89.8271$; $p < 0.000$).

Figure 7. 1: Mean errors for non-word vowel reading for English and Spanish monolinguals



The main effect of Group was caused by the Spanish children making fewer vowel reading errors than the English children. The highly regular nature of PGCs for Spanish vowels had led us to predict this result. A post-hoc Newman Keul's test showed the interaction to be caused by the English children reading vowels in the first syllable better than in second syllable vowels ($p < 0.05$), while the Spanish children read vowels in the first and second syllable equally well. This suggests that word position has a greater effect on vowel reading for English children than it does for Spanish children.

Some English vowels are spelled with digraphs whereas all Spanish vowels are

spelled with single graphemes. Hence, the poor performance of the English children might be caused primarily by an inability to read vowels represented with two graphemes. Hence we further analysed the data to compare the English and Spanish monolingual children's ability to read single grapheme vowels. Since the English children read 30 single grapheme vowels whereas the Spanish children read only 20, we converted their single-grapheme vowel reading error scores to percentages to compare the groups.

A two-way ANOVA was conducted with Vowel Position as the within subjects variables and Group as the between subjects variable. There was no main effect of Vowel Position ($F[1,78] = 3.444$; $p < 0.067$) but there was a main effect of Group ($F[1,78] = 147.972$; $p < 0.000$). There was also an interaction of Vowel Position by Group ($F[1,78] = 5.755$; $p < 0.019$). Both the main effect of Group and the interaction of Vowel Position by Group were caused for the same reasons as the original analysis (both $p < 0.05$).

Hence, it is not just the number of graphemes that represent vowels that make vowels harder to spell in English than in Spanish. It might, tentatively, be suggested that it is Spanish children's greater vowel awareness that allows them to underpin vowel phonemes more accurately orthographically than English children. However, it could also be the inconsistency of PGCs for vowels in English that makes even single grapheme vowels harder to read in English than in Spanish. For example, the same single grapheme vowel can be pronounced in various alternative ways in English (e.g. 'u' may be read as /ʌ/, as in fun, or /ʊ/, as in bull). In Spanish, on the other hand, each vowel grapheme has only one possible pronunciation.

Bilinguals in English vs. bilinguals in Spanish

Figure 7. 2: Mean errors for non-word vowel reading for bilinguals in English and Spanish

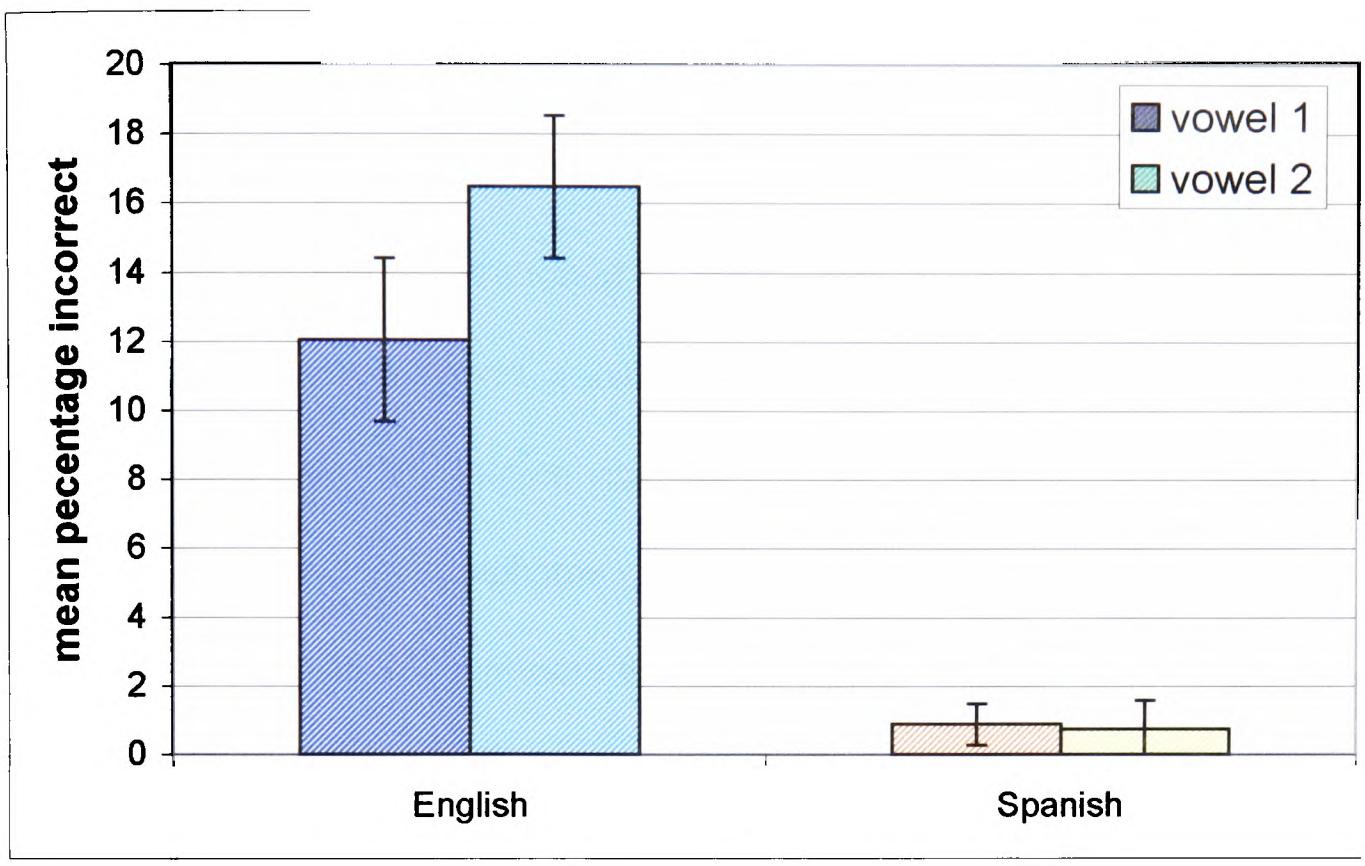


Figure 7. 2 indicates that the bilingual children were better at reading Spanish vowels than English vowels. To compare the bilingual children's performance across languages, a two-way repeated measures ANOVA was carried out with Vowel Position and Language (English, Spanish) as the within subjects variables. There were significant main effects of Vowel Position ($F[1,38] = 17.644$; $p < 0.000$) and Language ($F[1,38] = 170.588$; $p < 0.000$). There was also an interaction of Vowel Position by Language ($F[1,38] = 26.52$; $p < 0.000$).

The main effect of Language was caused by the children reading vowels more accurately in Spanish than in English. This result is as predicted given the transparent nature of the Spanish orthography. A post-hoc Newman Keul's test showed the interaction to be caused by the children reading first syllable vowels more accurately than second syllable vowels in English ($p < 0.05$), but reading first and second syllable vowels equally well in Spanish. This suggests that word position effects reading more in English than in

Spanish.

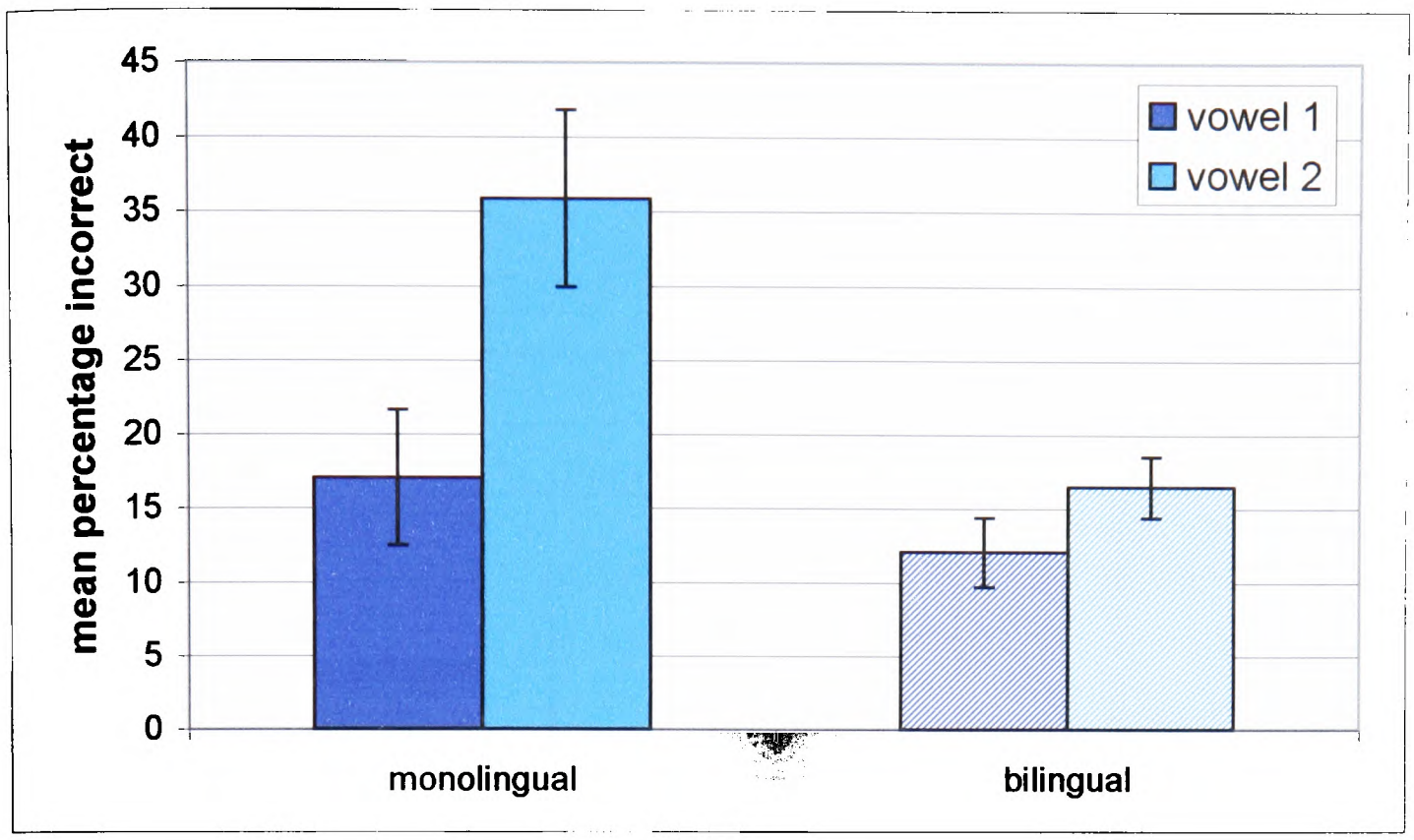
Since some of the English vowels in the reading task were represented by one grapheme and some were represented by two graphemes, whereas all of the Spanish vowels were represented by single graphemes, the study also compared the bilingual children's ability to spell single grapheme vowels in their two languages.

A two-way ANOVA with Vowel Position and Language as the within subjects variables was carried out. We found no main effect of Vowel Position ($F[1,38] = 1.565$; $p < 0.219$). There was, however, a main effect of Language ($F[1,38] = 84.566$; $p < 0.000$). This was caused by the children reading Spanish single grapheme vowels significantly better than English single grapheme vowels. The important factor is, therefore, not just the number of graphemes that represent the vowel sound. Vowels are simply easier to read in Spanish than in English. However, this finding also suggests that the difficulty the bilingual children have in reading second syllable English vowels is specific to digraph as opposed to single grapheme vowels, since the bilingual children were reading first and second syllable single grapheme English vowels equally well.

English monolinguals vs. bilinguals in English

From Figure 7. 3 we see that the bilingual children read English vowels more accurately than the monolingual children. A two-way ANOVA with Vowel Position as the within subjects variable and Group as the between subjects variable was carried out to see if this difference was significant. There was a main effect of Vowel Position ($F[1,77] = 115.53$; $p < 0.000$) and Group ($F[1,77] = 19.405$; $p < 0.000$). There was also an interaction of Vowel Position by Group ($F[1,77] = 44.307$; $p < 0.000$).

Figure 7. 3: Mean errors for English non-word vowel reading for monolinguals and bilinguals



The main effect of Group was caused by the bilingual children reading English vowels more accurately than the monolingual children. This finding is very interesting. It suggests that the bilingual children have a better understanding than English children of how English vowel sounds are represented orthographically. The main effect of Vowel Position was caused by children reading first syllable vowels more accurately than second syllable vowels.

The interaction was caused by the bilingual children performing better than the English monolinguals on the second vowel task ($p < 0.05$) but not the first vowel task. This suggests that monolingual children have a particular problem with reading the ends of words. Bilingual children, on the other hand, are not as greatly affected. This might be because of their exposure to Spanish reading. Since Spanish words tend to be longer than English words, children may not be as fazed by word length.

Spanish monolinguals vs. bilinguals in Spanish

Figure 7. 4: Mean errors for Spanish non-word vowel reading for monolinguals and bilinguals

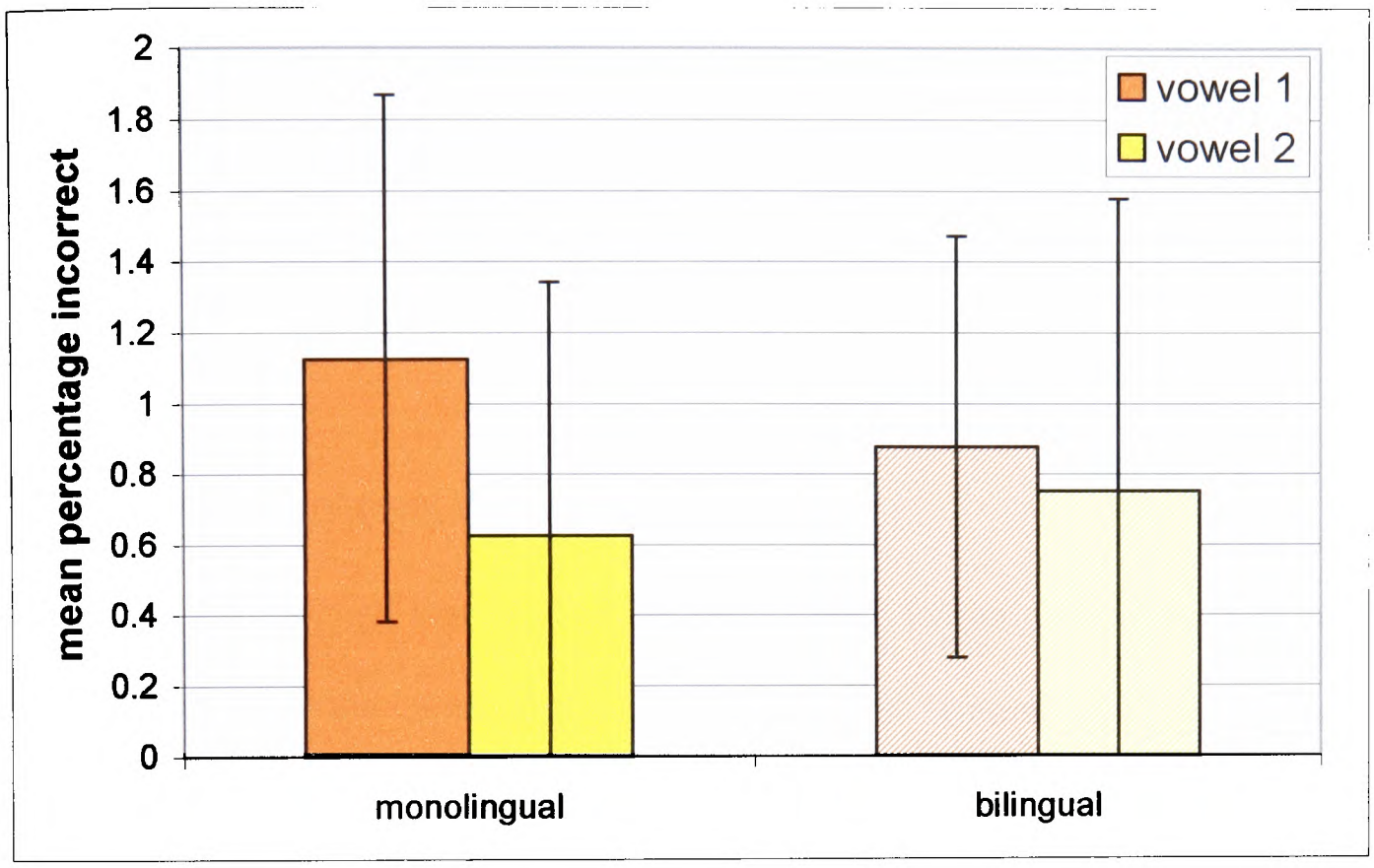


Figure 7. 4 shows that bilingual and monolingual speakers of Spanish found vowel sounds equally easy to read. A two-way ANOVA with Vowel Position as the within subjects variable and Group as the between subjects variable was carried out to verify this. There was no main effect of Vowel Position ($F[1,78] = 0.494$; $p < 0.484$) or Group ($F[1,78] = 0.000$; $p < 1.000$). Both groups read vowels equally well and there was no difference in ability to read vowels in first and second syllables.

7.3.i.a Summary

From the above analyses we can see that English-speaking children have greater difficulty in reading vowels than Spanish-speakers. This might be because of the more direct mapping from vowel graphemes to vowel phonemes in Spanish.

We have also seen that the position of the vowel within the word affects the ability to read the vowel more for English monolingual children than for any other group. Furthermore, it was shown that bilingual children have a better understanding than English children of how English vowel sounds are represented orthographically. It may tentatively be suggested that since bilingual children have to learn to read in two languages they pay more attention to how phonology maps onto orthography in each language. This enables them to have more accurate phonology-to-orthography representations in each language, which in turn makes them better readers. This appears to be true at least for vowel sounds.

7.3.i.b Single graphemes vs. digraphs

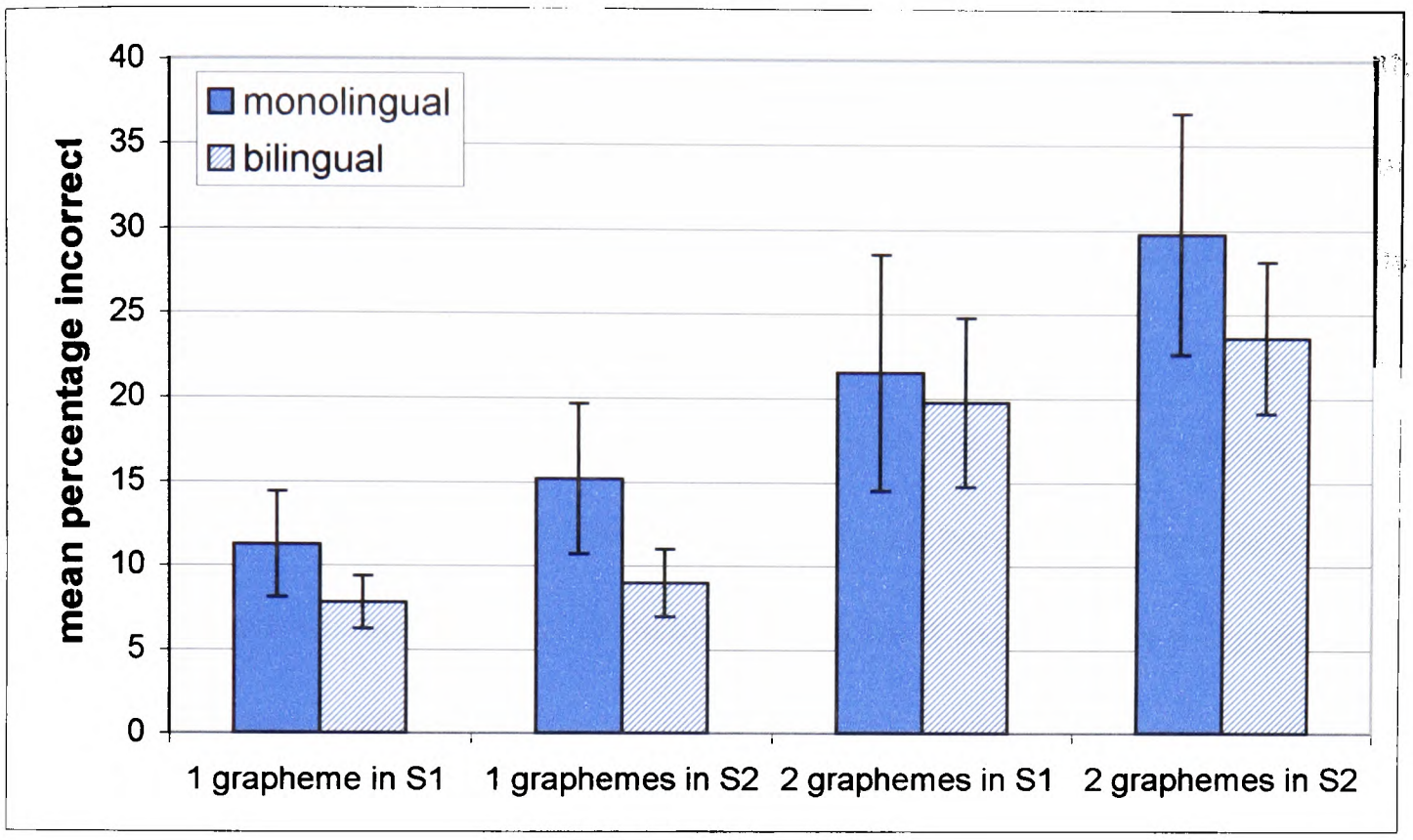
We have argued that English-speakers find it harder to read vowels than Spanish-speakers because the relationship between vowel sounds and their corresponding orthographic representation(s) is more complex in English than in Spanish. In order to determine whether it is orthographic complexity that makes vowels hard to read in English, we looked at whether vowel phonemes that are represented by digraphs (two letters) are harder to read than those represented by a single grapheme. The English-speakers' data were scored again. One point was given for each correct reading of a single grapheme vowel in syllable 1, one point for each correct reading of a single grapheme vowel in syllable 2, one point for each correct reading of a vowel digraph in syllable 1, and one point for each correct reading of a vowel digraph in syllable 2.

Since there were 30 single grapheme vowels in syllable 1 and only 10 vowel digraphs in syllable 1, and 30 single grapheme vowels in syllable 2 and only 10 vowel digraphs in syllable 2, we used the percentage incorrect scores to compare the groups' performances.

Figure 7. 5 shows the percentage of English vowels represented with one or two

graphemes in either the first or second syllable that were incorrectly read by the monolinguals and bilinguals.

Figure 7. 5: Percentage of first and second syllable English vowels represented with one or two graphemes read incorrectly



As can be seen from Figure 7. 5, both groups of children were more likely to read a vowel sound correctly if it was represented by one rather than two graphemes. Both groups read first syllable vowels correctly more often than second syllable vowels. The bilingual children were better at reading vowels overall than the monolingual children.

A three-way ANOVA was conducted with Number of Graphemes (one or two) and Vowel Position (syllable 1, syllable 2) as the within subject variables, and Group (monolingual, bilingual) as the between subjects variable to see if any of these differences were significant. There were main effects of Number of Graphemes ($F[1,77] = 72.753$; $p < 0.000$), Vowel Position ($F[1,77] = 23.906$; $p < 0.000$), and Group ($F[1,77] = 4.389$; $p < 0.039$). There were also interactions of Vowel Position by Group ($F[1,77] = 6.931$; $p < 0.01$) and Vowel Position by Number of Graphemes ($F[1,77] = 5.415$; $p < 0.023$).

All of the children were more likely to read a vowel correctly if it was represented by a single grapheme rather than a digraph. Vowels in the first syllable were easier to read than second syllable vowels. The bilingual children read vowels more accurately than the monolingual children. However, there were no group differences in reading single graphemes or digraphs.

A post-hoc Newman Keul's test showed the Vowel Position by Group interaction to be caused by the bilingual children reading second syllable vowels more accurately than the monolinguals ($p < 0.05$) but there was no significant difference between their reading of first syllable vowels.

A post-hoc Newman Keul's test showed the Vowel Position by Number of Graphemes interaction was caused by the difference between being able to read vowels in the first versus the second syllable being significant if the vowel is a digraph ($p < 0.05$) but not if it is a single grapheme.

Together, these results suggest that both English monolingual children and bilingual children have similar difficulties with vowel digraphs as compared to single vowel graphemes. Furthermore, digraphs are particularly hard to read if they are in the second syllable of the word.

However, the bilingual children appear to have a better overall understanding of how vowel phonemes are represented orthographically, since their overall reading performance for the vowels was better than that of the English monolinguals.

The results also suggest that the position of the vowel within the word does not affect the ability to read it as much for bilingual as for monolingual children.

7.3.ii The relationship between vowel awareness and non-word vowel reading

The study investigated the relationship between the awareness of vowels and the

ability to read them. Good correlations would indicate that children are directly using their knowledge of vowel sounds to help them read vowels. We expected to find stronger correlations for the Spanish-speakers than for the English-speakers since the research discussed in Chapter 3.3 suggests that Spanish children rely more heavily on a GPC route in reading than do English children.

Table 7. 5, Table 7. 6, and Table 7. 7 show the correlations between vowel awareness and non-word reading for the English monolingual, the Spanish monolingual children and the bilingual children (in English and Spanish), respectively. The numbers highlighted in blue are the correlations that may indicate whether GPCs are being drawn.

English monolinguals

Table 7. 5: Spearman's rank correlations for the non-word vowel reading scores with vowel awareness for the English monolinguals

Non-word vowel reading	First syllable vowel	Second syllable vowel
Vowel awareness task		
First syllable tense-vowels	.318*	.348*
First syllable lax-vowels	.306	.280
First syllable tense/lax-vowels	.487**	.321
Second syllable tense-vowels	.393*	.410*
Second syllable lax-vowels	.356*	.349*
Second syllable tense/lax-vowels	.419*	.486**

** Correlation is significant at the .01 level; * Correlation is significant at the .05 level.

Table 7. 5 shows that English children's ability to read vowels is related to their ability to discriminate them in an oddity task. This suggests that there is a direct relationship between vowel awareness and vowel reading for these children.

Spanish monolinguals

Table 7. 6: Spearman's rank correlations for the non-word vowel reading scores with vowel awareness for the Spanish monolinguals

Non-word vowel reading	First syllable vowel	Second syllable vowel
Vowel awareness task		
First syllable tense-vowels	-.043	.063
Second syllable tense-vowels	.066	.228

Table 7. 6 shows that the Spanish children's ability to read vowels is not correlated with their awareness of vowel phonemes. This result may be due to the high scores from most of the children on the vowel non-word-reading task. Alternatively, it could indicate that GPCs are not drawn for vowels by Spanish children.

Bilinguals in English and Spanish

Bilinguals in English

The bilingual children read vowels more accurately in English than their monolingual counterparts. The study aimed to investigate whether this was due to their greater awareness of vowel phonemes. In order to ascertain this correlations were investigated between non-word reading of vowels with performance on the phonological tasks.

Interestingly, there were no significant correlations between the bilingual children's ability to read vowels and their phonological awareness of them. These findings suggest that the bilingual children are not using the same method as their monolingual counterparts to read vowels.

Table 7. 7: Spearman's rank correlations for the non-word vowel reading scores with vowel awareness for the bilinguals in English and Spanish

	Non-word vowel reading	English		Spanish	
		first syllable vowel	second syllable vowel	first syllable vowel	second syllable vowel
	Vowel awareness task				
English	First syllable tense-vowels	.005	-.011	.188	-.110
	Second syllable tense-vowels	-.028	.009	.396*	.034
	First syllable lax-vowels	-.066	.089	-.041	-.070
	Second syllable lax-vowels	.033	.248	-.009	.115
	First syllable tense/lax-vowels	-.059	.064	.108	-.003
	Second syllable tense/lax-vowels	.307	.279	.117	.200
Spanish	First syllable tense-vowels	.179	.093	.460**	-.012
	Second syllable tense-vowels	.064	.042	.208	.020

** Correlation is significant at the 0.01 level; * Correlation is significant at the .05 level.

Bilinguals in Spanish

Table 7. 7 shows that the ability to read first syllable vowels is correlated to the awareness of vowels in the first syllable. However, the ability to correctly read second syllable vowels is not related to the awareness of second syllable vowel sounds.

Is non-word vowel reading in L1/L2 related to phonological awareness in L2/L1?

Table 7. 7 shows the correlations between the bilingual children's English and Spanish non-word vowel reading scores and their English and Spanish vowel awareness scores.

The only significant cross-language correlations were between the bilingual children's ability to read Spanish vowels in the first syllable and the ability to discriminate English tense vowels from one another in the second syllable. This suggests that reading in Spanish might enhance sensitivity to English tense vowels.

In summary, the results were not as predicted. English children appear to be using PGCs more than Spanish children, and bilingual children do not appear to use their knowledge of English vowel sounds to help them read those same vowels.

7.3.iii The ability to spell vowels in non-words

The study only investigated the spelling of those vowels found in stressed syllables. This is because in English, vowels are lengthened when stressed, whereas unstressed vowels are correspondingly shortened, centralised and muffled, losing their distinctive resonance. In Spanish, such perturbations are slight, but in English they are so marked that unstressed vowels merge into schwa (Stanley-Whitley, Ch. 3, p.53).

It was predicted that Spanish-speakers would spell vowels more accurately than English-speakers. Another aim of the study was to determine whether bilingual children had more accurate orthographic representations of English vowels because of their greater awareness of them, or whether their knowledge of the Spanish orthography impinged on their English spelling.

Each of the tense vowels correctly spelled in a stressed syllable, was given one point (max. score of five points for each syllable). For the English-speakers, one point was

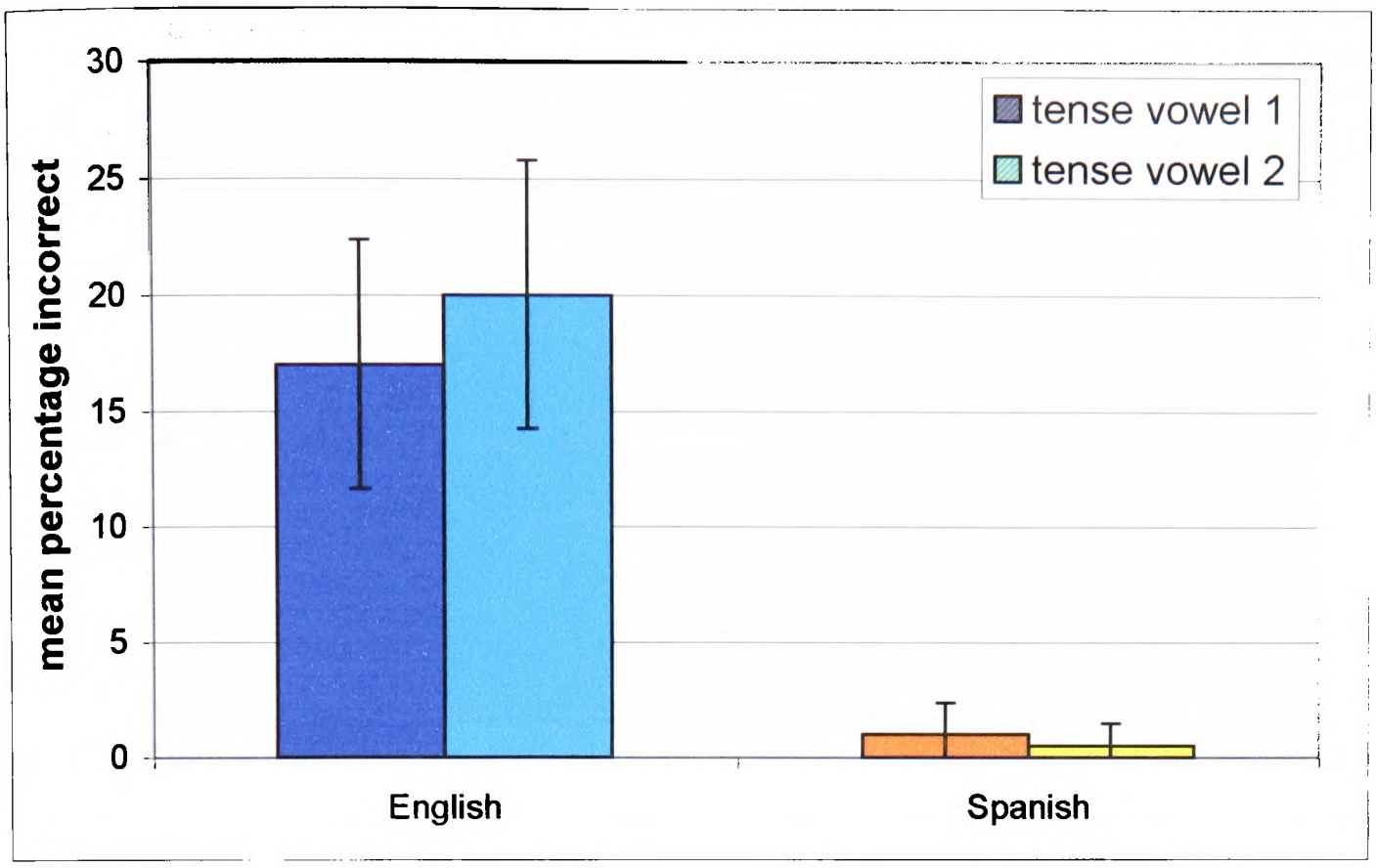
given for each of the lax vowels correctly spelled in a stressed syllable, (max. score of five points for each syllable). Comparisons between the groups' abilities to spell non-word vowels are shown below. The raw scores were converted to percentages because the English-speakers spelled twice as many vowel sounds as the Spanish-speakers. Just as with the non-word reading data, here too, in carrying out the analysis of variance the assumptions of homogeneity of variance and normality are violated. However, there are good theoretical and empirical reasons to believe that the analysis is largely immune to these violations (see Appendix 5 for a full explanation).

English monolinguals vs. Spanish monolinguals

Comparisons were only made between the groups' performance on tense vowel spelling because these are the only words the Spanish children spelled. It had been anticipated that the Spanish monolingual children would be more successful in their vowel spellings than their English monolingual counterparts for two reasons. Firstly, as shown in Chapters 5 and 6, their vowel awareness is greater. Secondly, PGCs are much more consistent in Spanish than in English. This is particularly true for vowels.

Figure 7. 6 shows the mean number of correct spellings for the stressed tense first and second syllable vowels for each group. The Spanish children were better at spelling tense vowels than the English children. In order to test the significance of this, a two-way ANOVA was conducted with Vowel Position as the within subjects factor, and Group as the between subjects factor. There was no main effect of Vowel Position ($F[1, 78] = 0.553$; $p < 0.459$), but there was a main effect of Group ($F[1,78] = 55.931$; $p < 0.000$). Spanish children were better at spelling vowels than English children. This was exactly as anticipated.

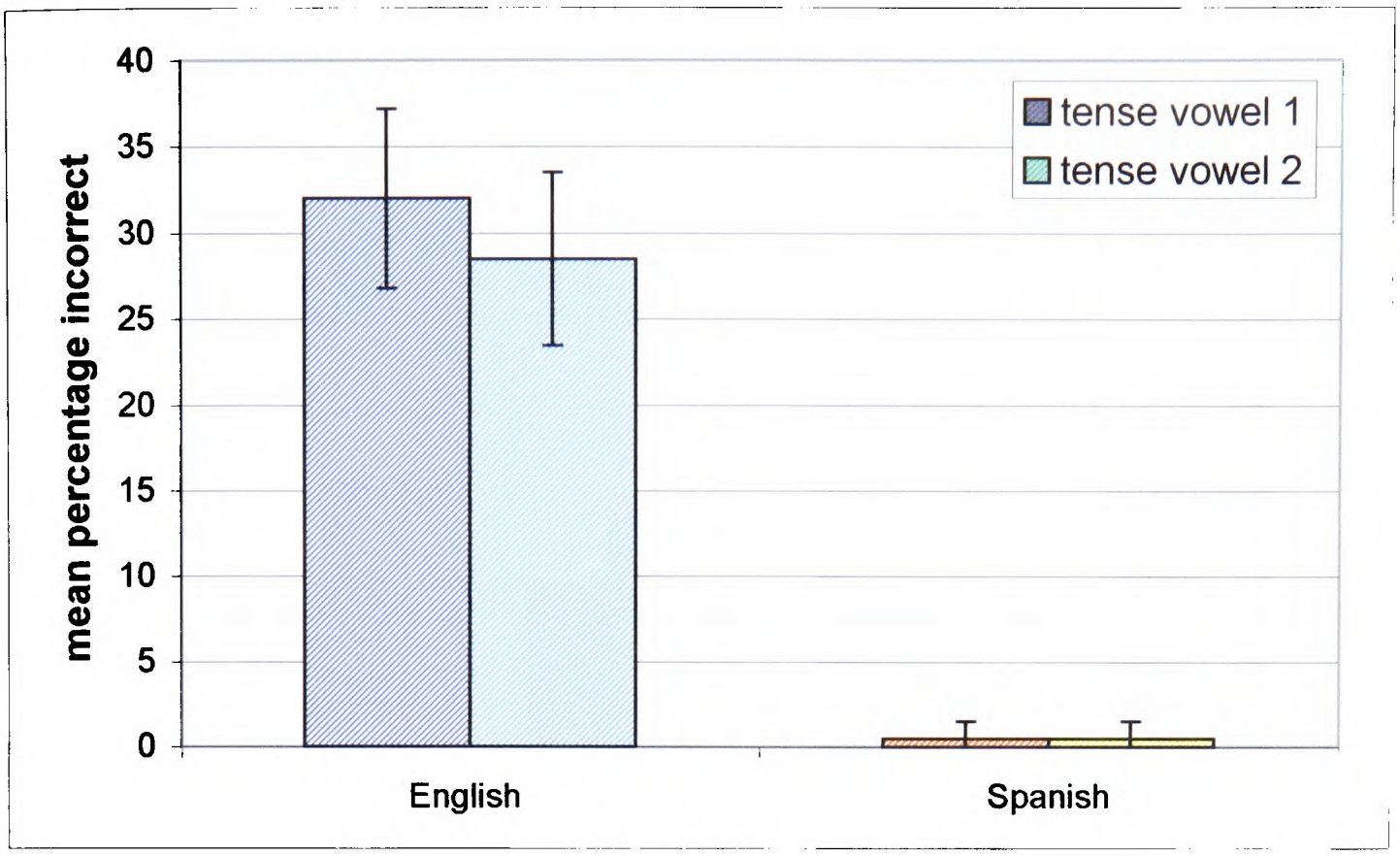
Figure 7. 6: Mean errors for non-word vowel spelling for English and Spanish monolinguals



Bilinguals in English vs. bilinguals in Spanish

An aim of the study was to investigate whether the bilingual children were more accurate in their spelling of Spanish tense vowels than they were in their spelling of English tense vowels. Figure 7. 7 indicates that the bilingual children performed worse on the English spelling task than on the Spanish version of this task. To check the significance of this result we conducted a repeated measures two-way ANOVA with Vowel Position and Language (English, Spanish) as the within subjects variables. There was no main effect of Vowel Position ($F[1,39] = 1.854$; $p < 0.181$), but there was a main effect of Language ($F[1,39] = 162.483$; $p < 0.000$). The children were better at spelling stressed tense vowels in Spanish than in English.

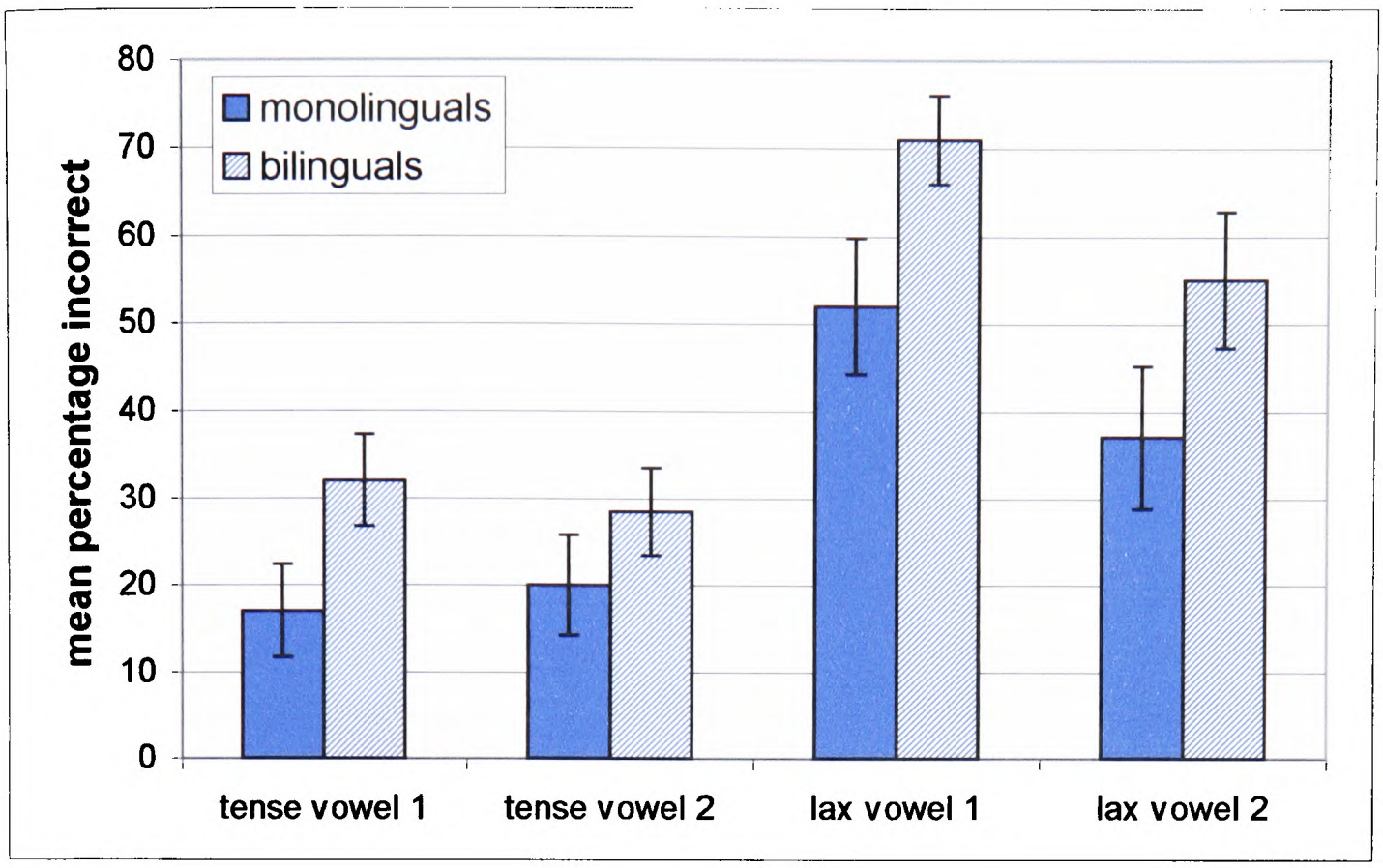
Figure 7. 7: Mean errors for non-word vowel spelling for bilinguals in English and Spanish



English monolingual vs. bilinguals in English

Figure 7. 8 shows the monolingual and the bilingual children's performances on the English non-word vowel spelling task. The bilingual children performed worse overall than their monolingual counterparts on both the tense and lax vowels, in both first and second (stressed) syllables. To ascertain whether this difference was significant a three-way ANOVA was carried out with Vowel Position (syllable 1, syllable 2) and Vowel Type (tense, lax) as the within subjects variables, and Group as the between subjects variable. There were main effects of Vowel Position ($F[1,78] = 16.22$; $p < 0.000$), Vowel Type ($F[1,78] = 195.389$; $p < 0.000$) and Group ($F[1,78] = 23.28$; $p < 0.000$). Children found it easier to spell first syllable vowels than second syllable vowels. They were also better at spelling tense vowels than lax vowels. Lastly, monolingual children spelled vowel sounds more accurately than bilingual children.

Figure 7. 8: Mean errors for English non-word vowel spelling for the monolinguals and bilinguals



This last result is particularly interesting since it suggests that monolingual children have a better orthographic underpinning of vowel phonemes than do bilingual children, the opposite result to that found for non-word vowel reading. We will return to this point in Section 7.4.

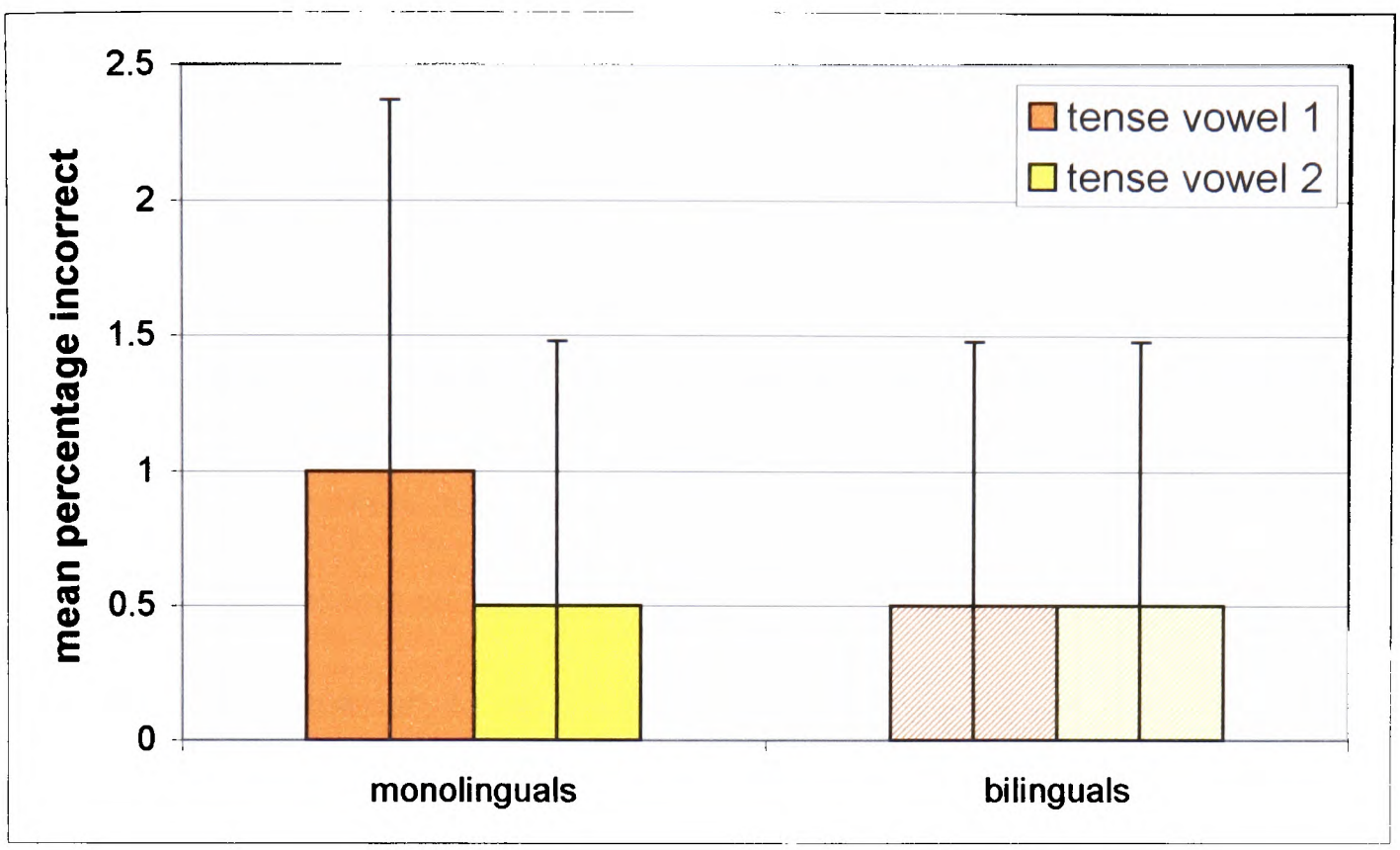
Spanish monolinguals vs. bilinguals in Spanish

A final aim was to investigate whether the bilingual children were worse than their monolingual counterparts in Spanish at spelling stressed tense vowels.

Figure 7. 9 shows that there was very little difference between the groups. A two-way ANOVA was carried out with Vowel Position as the within subjects variable and Group as the between subjects variable to see if the difference was significant. There was no main effect of Vowel Position ($F[1,78] = 0.196$; $p < 0.659$) or of Group ($F[1,78] = 0.209$; $p < 0.649$). Both groups found the spelling of non-word stressed syllable tense

vowels equally easy.

Figure 7. 9: Mean errors for Spanish non-word vowel spelling for monolinguals and bilinguals



7.3.iii.a Single graphemes vs. digraphs

For English-speakers, whether a vowel is tense or lax might not be the only thing that makes it hard to spell. Rather, the difficulty may lie in the number of graphemes that are required to spell the vowel sound. Of the first syllable stressed vowels in the non-word-spelling test given to the English-speaking children, two of the tense vowels and three of the lax vowels were spelled with digraphs; three of the tense vowels and two of the lax vowels were spelled with single graphemes. Of the second syllable stressed vowels, two of the tense vowels and three of the lax vowels were spelled with digraphs; three of the tense vowels and two of the lax vowels were spelled with single graphemes.

The study aimed to investigate whether the English-speaking children found vowels

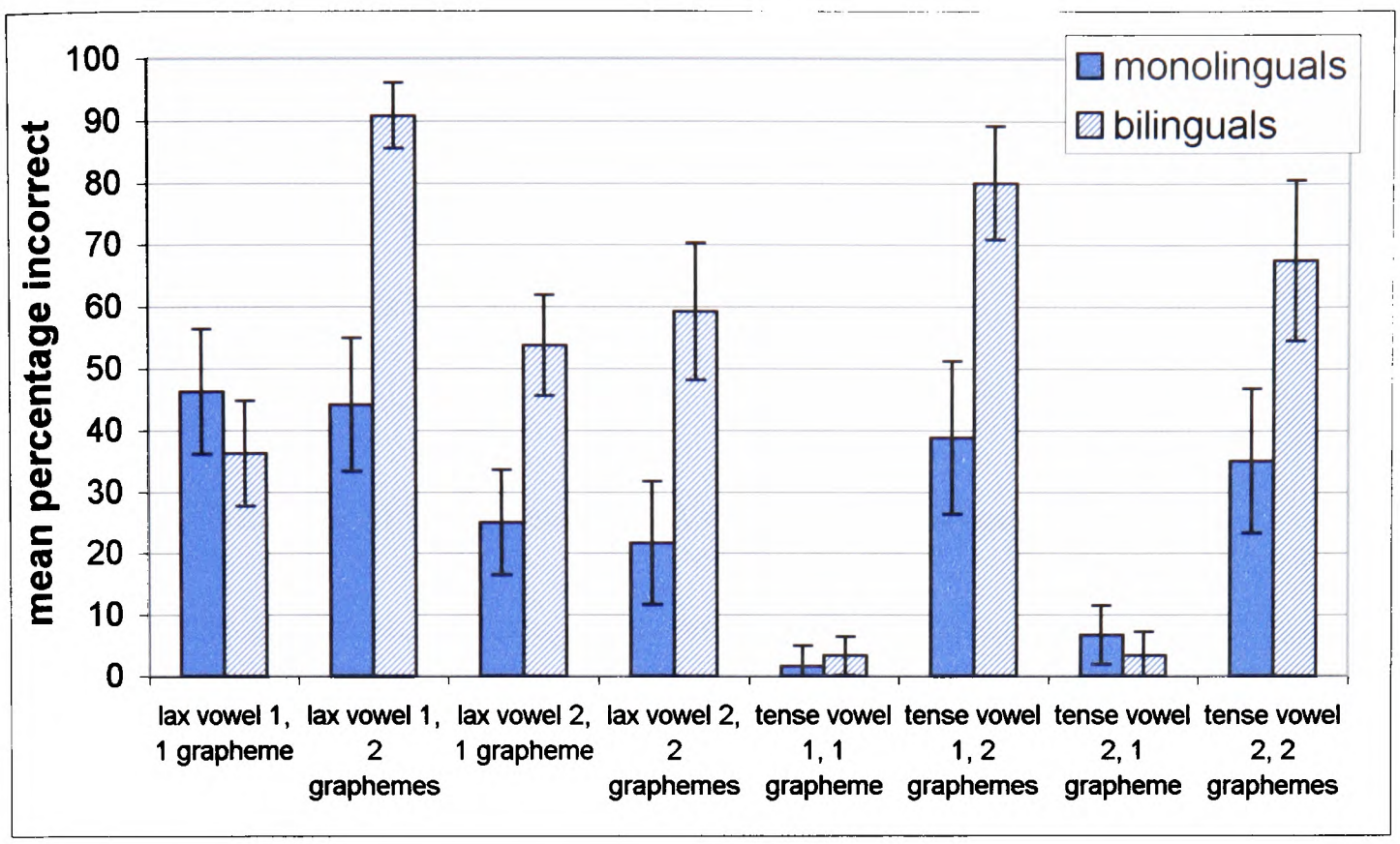
requiring digraphs harder to spell than vowels requiring single graphemes. If this were the case then it would suggest that these children had not yet orthographically underpinned the vowel. Another aim was to find out whether there was any difference in difficulty of spelling tense vowels that required digraphs versus lax vowels that required digraphs. A further aim was to find out whether there were any differences between the bilingual and the monolingual speakers of English in terms of their ability to spell vowel phonemes consisting of digraphs or single graphemes.

The bilingual children made three main types of vowel spelling error. One type of error was to spell the English vowel sounds as if they were Spanish. They either represented tense vowels requiring digraphs (e.g. /u/ = 'oo'; /i/ = 'ee') with single graphemes corresponding to those used in Spanish (/u/ = 'u', /i/ = 'i'). Another error was to miss out the 'r' necessary to represent the lax vowel (e.g. /ɔ/ = 'or', or 'aw', or 'ough', or 'au', but the children spelled it 'o'). The third type of mistake involved using an inappropriate vowel grapheme in order to represent a lax vowel (e.g. /ʊ/ = 'oo' or 'u', but the children spelled it 'a'). Hence, it appears that bilingual children have particular difficulty in spelling vowel sounds that require more than one grapheme.

Since there were different numbers of tense and lax vowels requiring single graphemes and digraphs all of the scores were turned into percentages so that we could compare them. Figure 7. 10 shows the performance of each group on each vowel type.

The figure shows that both groups made fewer errors on single grapheme vowels than on vowel digraphs. They also made fewer errors on tense than on lax vowels. Furthermore, the monolingual children generally made fewer errors than the bilinguals. To see if these differences were significant, a four-way ANOVA with Vowel Position, Number of Graphemes (single, digraph) and Vowel Type were put in as the within subjects variables. Group (monolingual, bilingual) was the between subjects variable.

Figure 7. 10: Percentage of first and second syllable tense and lax vowels represented with one or two graphemes incorrectly spelled



There were main effects of Vowel Position ($F[1,78] = 18.037$; $p < 0.000$), Number of Graphemes ($F[1,78] = 130.425$; $p < 0.000$), Vowel Type ($F[1,78] = 68.95$; $p < 0.000$) and Group ($F[1,78] = 43.316$; $p < 0.000$). There were also interactions of Number of Graphemes by Group ($F[1,78] = 38.023$; $p < 0.000$), Vowel Position by Number of Graphemes ($F[1,78] = 28.786$; $p < 0.000$), Vowel Position by Number of Graphemes by Group ($F[1,78] = 14.962$; $p < 0.000$), Vowel Position by Vowel Type ($F[1,78] = 11.851$; $p < 0.001$), Vowel Position by Vowel Type by Group ($F[1,78] = 10.218$; $p < 0.002$), Number of Graphemes by Vowel Type ($F[1,78] = 61.381$; $p < 0.000$), Vowel Position by Number of Graphemes by Vowel Type ($F[1,78] = 5.414$; $p < 0.023$), and Vowel Position by Number of Graphemes by Vowel Type by Group ($F[1,78] = 12.416$; $p < 0.001$).

The main effect of Group was caused by the monolingual children being better overall at spelling vowels than the bilingual children. The main effect of Vowel Position was caused by first syllable vowels being spelled more accurately than second syllable

vowels. The main effect of Number of Graphemes was caused by the children spelling single grapheme vowels more accurately than vowel digraphs. The main effect of Vowel Type was caused by the children spelling tense vowels more accurately than lax vowels.

The four-way interaction is too difficult to interpret. The only other interactions of interest were the Number of Graphemes by Vowel Type interaction and the Vowel Position by Number of Graphemes by Group interaction.

Figure 7. 11: Number of Graphemes by Vowel Type interaction

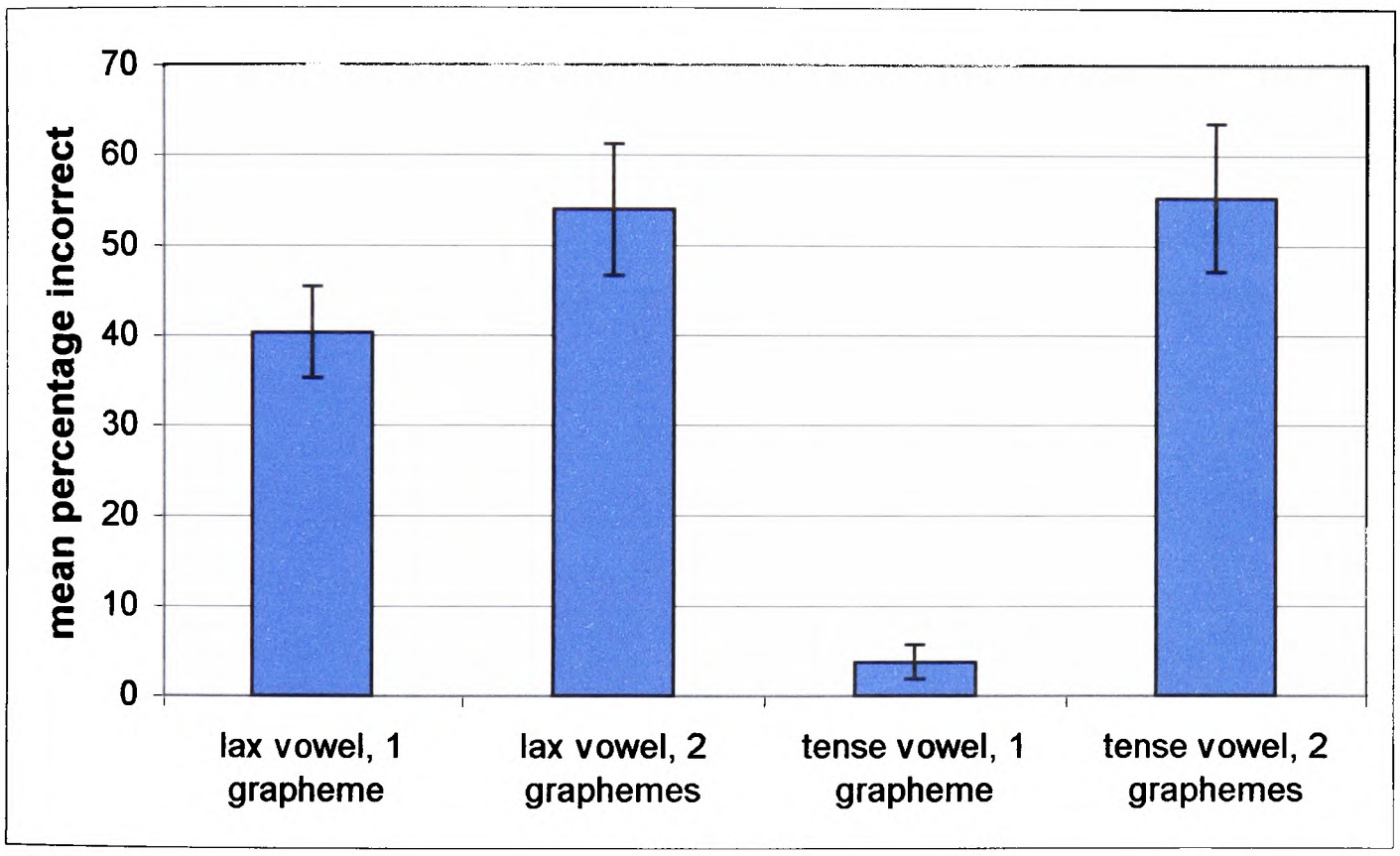
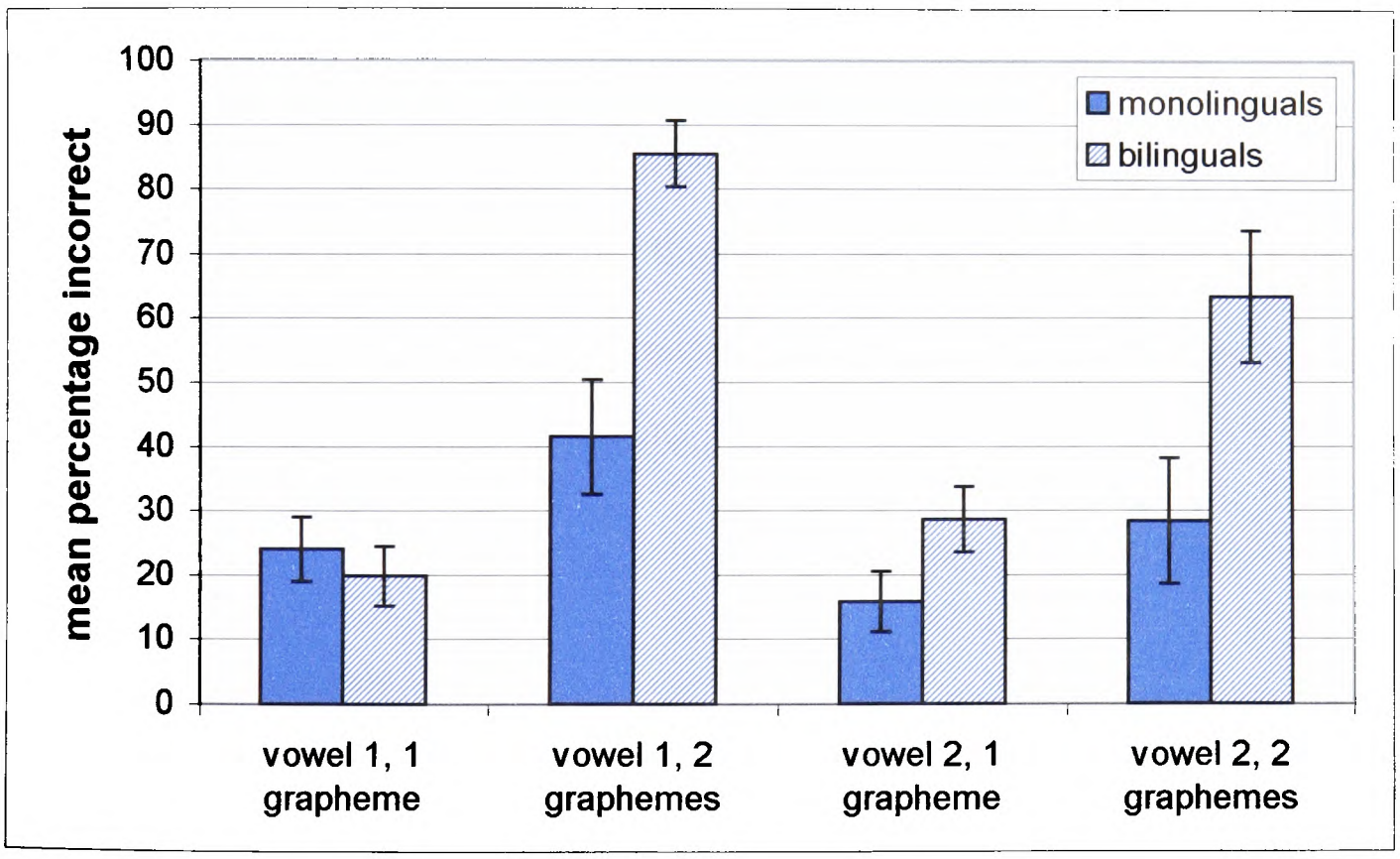


Figure 7. 11 shows the interaction of Number of Graphemes by Vowel Type. A post-hoc Newman Keul's test showed this interaction was caused by significantly more errors being made on lax than on tense single grapheme vowels ($p < 0.05$), whereas similar numbers of vowel digraphs errors were made on tense and lax vowels.

Figure 7. 12 shows the interaction of Vowel Position by Number of Graphemes by Group. A post-hoc Newman Keul's tests showed that this interaction was caused by the bilingual children making significantly more errors on second syllable digraphs than on first syllable digraphs ($p < 0.05$), whereas the monolingual children performed similarly on first and second syllable digraphs. The bilingual children also made more second syllable vowel digraph than single grapheme vowel errors ($p < 0.05$), whilst the monolingual children made similar number of errors on single grapheme and digraph vowels in the second syllable.

Figure 7. 12: Number of graphemes by vowel position by group interaction



The post-hoc test also revealed that the bilingual children made more digraph errors than did the monolingual children in both the first and second syllable ($p < 0.05$). It also revealed that the monolingual children were better than the bilingual children at spelling single grapheme vowels in the second syllable ($p < 0.05$).

In summary, it would appear that both groups have particular difficulties with spelling digraphs, but this difficulty is more pronounced for the bilingual children than it is for the monolinguals. Furthermore, both groups appear to have more difficulty with lax vowel spelling than tense vowel spelling. However, the difference between the groups' ability to spell tense and lax vowels is more pronounced for the lax vowels than for the tense vowels.

7.3.iv The relationship between vowel awareness and non-word vowel spelling

It was predicted that the relationship between vowel awareness and vowel spelling would be stronger for Spanish-speakers than for English-speakers because of the transparency of the Spanish orthography. Another aim of the study was to investigate whether bilingual children use their enhanced vowel awareness of English vowel sounds to help them spell vowel sounds in English. The correlation tables below show the correlations found for each of the groups. The correlations highlighted in blue are those that may indicate the use of PGCs in spelling.

English monolinguals

The ability to distinguish tense vowels in the first syllable from one another was not correlated with the ability to spell these vowels in either the first or second syllable. The same was true for lax vowels. However, the ability to distinguish tense from lax vowels in the first syllable was correlated with the ability to spell lax vowels. This finding is very interesting. It suggests that only those children who realise that, for example, /I/ is different from /i/, have an orthographic underpinning of these lax vowel phonemes. Those children who do not realise the difference between tense and lax versions of the same vowel spell the lax version incorrectly.

Table 7. 8: Spearman's rank correlations for vowel awareness with non-word vowel spelling for the English monolinguals

Spelling	Tense vowel 1	Tense vowel 2	Lax vowel 1	Lax vowel 2
Vowel awareness				
Tense vowel 1	.209	.234	.148	.336*
Lax vowel 1	.326*	.232	-.002	.276
Tense/lax vowel 1	.142	.462**	.383*	.341*
Tense vowel 2	.363*	.428**	.170	.201
Lax vowel 2	.199	.035	-.036	.095
Tense/lax vowel 2	.224	.236	.182	.308

** Correlation is significant at the .05 level; * Correlation is significant at the .01 level.

Spanish monolinguals

Table 7. 9: Spearman's rank correlations for vowel awareness with non-word vowel spelling for the Spanish monolinguals

Spelling	Tense vowel 1	Tense vowel 2
Vowel awareness		
Tense vowel 1	-.200	.143
Tense vowel 2	-.287	-.021

As can be seen from Table 7. 9, the ability to spell vowels in non-words was not correlated with awareness of them. This finding suggests that Spanish children do not use PGCs to spell vowels. However, the lack of correlations might have been caused by the high performance of most of the children on the non-word spelling of vowels.

Bilinguals in English and Spanish

The ability to spell both tense and lax vowels in both English and Spanish was not correlated with vowel awareness in either English or Spanish. This finding suggests that bilingual children do not use PGCs to spell vowels in either English or Spanish.

Table 7. 10: Spearman's rank correlations for vowel awareness with non-word vowel spelling for the bilinguals in English and Spanish

	Spelling	English				Spanish	
		tense vowel 1	tense vowel 2	lax vowel 1	lax vowel 2	tense vowel 1	tense vowel 2
	Vowel awareness						
English	tense vowel 1	.008	-.061	.213	-.264	.036	.036
	tense vowel 2	-.003	-.308	.056	-.377*	-.064	.235
	lax vowel 1	.207	-.059	.133	-.111	.100	-.178
	lax vowel 2	.027	-.107	.025	-.230	.128	.128
	tense/lax vowel 1	.081	.023	-.096	-.005	-.149	-.007
	tense/lax vowel 2	.154	.060	.055	.154	.213	-.163
Spanish	tense vowel 1	.173	.026	.006	.113	.194	-.100
	tense vowel 2	-.003	.003	.132	-.250	-.086	.193

* Correlation is significant at the .01 level.

The lack of correlations found between Spanish vowel awareness and Spanish non-word vowel spelling mimics the findings for the Spanish monolingual children. However, the lack of correlation between these two tasks in English in no way resembles the English monolingual children's results. The bilingual children appear to be approaching the task of spelling differently from their monolingual counterparts.

Finally, the ability to spell non-word vowels in L1/L2 was not correlated with awareness of these vowels in L2/L1. This suggests that children are not directly using their

awareness of vowel sounds in L1/2 to help them spell vowels in L2/1.

7.3.v The relationship between reading vowels and spelling vowels

The ability to read and the ability to spell are often considered to be related. This study investigated whether this is true by examining how non-word vowel reading and non-word vowel spelling were correlated with one another for each of the groups.

English monolinguals

Table 7. 11: Spearman's rank correlations for non-word vowel reading with non-word vowel spelling for the English monolinguals

Reading	Vowel 1	Vowel 2
Spelling		
Tense vowel 1	.329*	.296
Tense vowel 2	.470**	.392*
Lax vowel 1	.394*	.377*
Lax vowel 2	.469**	.540**

** Correlation is significant at the .05 level; * Correlation is significant at the .01 level.

As can be seen from Table 7. 11, the ability to read and spell vowels was highly correlated for English children. This suggests that the processes involved in reading and spelling are similar. If children have an understanding of how a vowel sound is orthographically underpinned, then they will use this knowledge equally in reading and spelling.

Spanish monolinguals

As can be seen from Table 7. 12, the ability to read and spell vowels in Spanish was not significantly correlated. This may be because the transparency of the Spanish language

means that an orthographic underpinning of vowels is not necessary in the same way that it is in English. Every time children come to read or write a vowel sound they may simply apply GPCs or PGCs. This finding also suggests that the processes involved in reading and spelling in Spanish may not be related.

Table 7. 12: Spearman's rank correlations for non-word vowel reading with non-word vowel spelling for the Spanish monolinguals

Spelling	Tense vowel 1	Tense vowel 2
Reading		
Tense vowel 1	-.114	-.080
Tense vowel 2	-.065	-.046

Bilinguals in Spanish and English

Table 7. 13: Spearman's rank correlations for non-word vowel reading with non-word vowel spelling for bilinguals in English and Spanish

	Reading	English		Spanish	
		vowel 1	vowel 2	vowel 1	vowel 2
Spelling					
English	tense vowel 1	.446**	.484**	.143	.023
	tense vowel 2	.276	.191	.084	-.033
	lax vowel 1	-.109	-.053	.012	-.136
	lax vowel 2	.393*	.283	.093	-.096
Spanish	tense vowel 1	-.208	-.225	-.074	-.046
	tense vowel 2	-.045	.026	-.074	-.046

** Correlation is significant at the 0.05 level; * Correlation is significant at the 0.01 level.

Bilinguals in English

The ability to read vowels in the first syllable was related to the ability to spell tense vowels in the first syllable and lax vowels in the second syllable. The ability to read vowels in the second syllable was correlated with the ability to spell tense vowels in the

first syllable. Therefore, in contrast with the English monolingual children, the bilingual children did not show very strong correlations between vowel reading and spelling. This suggests that the bilingual children do not approach reading in the same way as their monolingual counterparts.

Bilinguals in Spanish

The reading and spelling of vowels in Spanish were not correlated for the bilingual children. This finding is the same as that for the Spanish monolingual children, and suggests that reading and spelling are not two sides of the same coin for Spanish-speakers.

Bilinguals in English and Spanish

The ability to read vowels in English was not related to the ability to spell vowels in Spanish. Similarly, the ability to read vowels in Spanish was not correlated with the ability to spell vowels in English. This might be because the processes required for reading and spelling vowels in each language are different. Whereas in Spanish you need simply to apply PGCs in both instances, reading vowels in English is not nearly so simple. Not all vowels can be read in this way. However, reading single grapheme vowels in English/Spanish was not related to spelling single grapheme vowels in Spanish/English. Therefore, even for vowels that can be read and spelled in both languages by applying PGCs, the process does not appear to be the same in English and Spanish.

7.4 DISCUSSION

Reading and spelling vowels is easier in Spanish than it is in English. This is true for both monolingual- and bilingual-speakers of each language. It would appear that Spanish-speakers find it easier to underpin their phonological representations of vowels orthographically than do English-speakers.

The results of the reading and spelling of non-word vowels for the English-speakers are very interesting. Whilst the bilingual children were better at reading non-word vowels than their monolingual counterparts, they were worse at spelling these same vowels.

From the reading results it might be suggested that bilingual children have better orthographic representations of English vowel sounds than do monolingual speakers of English. However, if this were the case, one would also expect them to spell vowels more accurately. Yet the reverse was found.

One explanation of these apparently contradictory findings is that bilingual children treat reading and spelling as two independent skills. In reading, their knowledge of how orthographic representations of vowel sounds correspond to the sounds themselves is more advanced than it is for monolingual children. However, in spelling, the bilingual children may have a worse understanding than monolinguals of how vowel phonemes are represented orthographically.

Reading English non-word vowels was not very related to spelling English non-word vowels for the bilingual children, whereas it was for the monolingual children. This adds further credence to the hypothesis that bilingual children treat reading and spelling as two separate skills requiring two distinct approaches. Interestingly, the ability to read non-word vowels was not related to the ability to spell non-word vowels for the Spanish-speakers either. If learning to read and spell in Spanish simply requires using GPCs and PGCs, it is possible that the Spanish children do not learn to make the connection between reading and spelling when they begin to acquire literacy, simply because the processes

involved in acquiring each skill are relatively easy. Hence, bilingual children may have been adopting a Spanish-approach to English literacy by keeping reading and spelling separate from one another. If this is the case, then they could have orthographic-to-phonological mappings for the reading of English vowels, but not phonological-to-orthographic mappings for the spelling of English vowels.

Another reason why bilingual children have particular problems with spelling English vowels is implied by the type of errors they make. All of the English-speaking children generally found vowel digraphs harder to spell than single vowel graphemes. Yet this difficulty was significantly more marked for the bilingual children than it was for the monolingual children. Hence, the bilingual children's difficulty might be in a lack of understanding that English vowel phonemes often need to be represented with more than one grapheme. Since this is not the case in Spanish, the bilingual children's reliance on their knowledge of how Spanish phonology and orthography correspond to one another might have clouded their ability to realise that the same correspondences do not exist in English.

Indeed, if we look at the kind of errors made in non-word vowel spelling, we see that the bilingual children often represented vowel sounds orthographically as if they were Spanish vowels. For example, when spelling /i/, they would write 'i' instead of 'ee' or 'ei' and so on. Similarly, when asked to spell /ɔ/, they would produce an 'o' rather than 'au' or 'or' and so on. They appear to rely too heavily on their knowledge of orthographic representations of vowels in Spanish, and consequently (mis-)apply these representations when they spell vowels in English.

Hence, we may tentatively suggest that bilingual children are better at reading vowels than are monolingual children because they have a more sophisticated understanding of how orthographic representations of vowels correspond to vowel sounds. However, in spelling vowels bilingual children are at a disadvantage for two principal

reasons. They do not realise that reading and spelling are two highly related skills and hence cannot use their knowledge of the correspondences between orthography and phonology gained from reading in order to help them spell. Secondly, they rely too heavily on their knowledge of Spanish spelling. This causes them to spell English vowel sounds in a manner appropriate for Spanish, but entirely wrong for English.

CHAPTER 8

EXPERIMENT 3: CONSONANT AWARENESS AND READING

8.1 INTRODUCTION

In the previous two experiments we found that vowel awareness is greater for Spanish-speaking children than it is for English monolingual children. Furthermore, we found that bilingual children have greater English vowel awareness than their monolingual counterparts. Since we only looked at vowel awareness, we cannot be sure that this increased sensitivity is general to all phonemes, or whether it is specific to vowels. The present investigation aimed to replicate the finding of Experiments 1 and 2 concerning vowels, and to determine whether the vowel advantage extends to consonant phonemes.

It was argued in Chapters 5 and 6 that the bilingual children's enhanced awareness of English vowel sounds was due to their exposure to two languages. More specifically, it was suggested that the advantage was caused by both the ability to focus more closely on those parts of their languages that differ from one another, and by transfer of vowel awareness from Spanish to English. Since the vowel systems of English and Spanish differ, these phonemes might be ones to which bilingual children pay particular attention. We wanted to know whether bilingual children would show a similar advantage for consonant sounds.

8.1.i Consonant awareness

Two main factors concerning consonant awareness were interesting: firstly, the position of the consonant sound within the word; and secondly, the type of consonant.

'Position' was manipulated by testing children's awareness of both word-initial consonants (onsets) and word-final consonants (codas). The evidence discussed in Chapter 2.1.i.a indicates that the onset unit is relatively more salient than the coda unit in English. However, there is little comparative evidence of this sort in Spanish. In fact, the available evidence suggests that onsets might not be very salient in Spanish, since speakers of this language appear to phonologically underpin the syllable as a 'body+coda' unit (see Chapter 2.2.i.b). Hence, our aim was to study whether there would be a difference between English- and Spanish-speakers' awareness of consonants that were either onsets or codas of words.

The second factor to be considered was the type of consonant sound. Much of the work conducted on phonemic awareness has failed to take into account that there are different types of consonants, distinguishable primarily by their differing acoustic-phonetic properties. If different consonant sounds differ in articulatory dimensions some may be harder to perceive than others. In other words, it is not enough to ask "Are children aware of consonants as a whole?" Instead, we need to ask, "Is awareness of stop consonants, for example, greater than awareness of nasal consonants?" We therefore examined similarities and differences between the extent to which children from different linguistic backgrounds are aware of the four different consonant types: stops, fricatives, nasals, and liquids.

8.1.ii Predictions

If the vowel advantage of Experiments 1 and 2 was found because vowels are more accessible in Spanish than they are in English, there might not be any cross-linguistic differences for consonant awareness. Differences in awareness between English and Spanish would only be expected for those phonemes that differ considerably in the acoustic-phonetic parameters used to determine them in each language. English and

Spanish have very different vowel systems. However, as discussed in Chapter 2.3.iii, consonant sounds are more linguistically similar in English and Spanish than are vowels (the acoustic-phonetic differences between the two languages are not so marked), and furthermore, there are similar numbers of consonant sounds in each language (24 in English vs. 20 in Spanish). Hence, on the face of it, there is no apparent reason why one group should have an advantage over the other.

Neither were bilingual children expected to show any differences in consonant awareness in English and Spanish, or to show any differences in consonant awareness from their monolingual counterparts in each language. It was hypothesised that the vowel advantage was caused by the bilingual children focussing on those aspects of their phonological systems that differed. However, since there are few linguistic differences between languages in terms of consonants, the children would not be expected to focus on these units, and hence, to be any more aware of them than monolingual children.

We also predicted that English-speakers would find the onset consonant task easier than the coda consonant task, whereas there would either be no difference or possibly a coda advantage for the Spanish-speakers.

We were uncertain as to whether certain consonant types would be more salient than other consonant types, and whether the salience of each consonant type would differ across languages.

8.1.iii Phoneme awareness and reading

Phoneme awareness is believed to be of importance in reading in both the English and Spanish languages. However, to our knowledge, no research has examined whether reading is more closely linked to the awareness of some phonemes than others. Experiment 2 found that the relationship between vowel awareness and reading is dependent on linguistic background. The second main aim of the present investigation was

to replicate the findings concerning vowel awareness and determine the relative contribution that each consonant type makes to reading skill.

If this relationship is dependent upon both the phonology and the orthography to which a child is exposed, then it is desirable to investigate how bilingual children's phonological awareness and reading are related within each of their languages.

8.2 METHOD

8.2.i Participants

Forty monolingual English first- and second-grade children (20 girls, 20 boys; age range 5yrs, 4mnths - 6yrs, 3mnths; mean age 5yrs, 8mnths), 40 monolingual Spanish first- and second-grade children (26 girls, 14 boys; age range 5yrs, 3mnths - 6yrs, 9mnths; mean age 6yrs, 0mnths), and 40 English-Spanish first- and second-grade bilingual children (28 girls, 12 boys; age range 5yrs, 2mnths - 6yrs, 4mnths; mean age 5yrs, 10mnths) took part in the study.

All the children came from middle socio-economic status backgrounds. The English monolingual children were pupils at a state school in Oxford. The Spanish monolingual children came from two different schools, one state and one private, in Madrid. The bilingual children came from two bilingual schools, both private, in Las Palmas de Grán Canaria. All of the bilingual schools' lessons were conducted in English only, apart from one-and-a-half hours a day of Spanish lessons[1]. None of the monolingual children had been instructed in, or were able to speak, any language other than their mother tongue.

8.2.ii Materials

8.2.ii.a Memory task

A memory test was given to ensure that the results of the phonological awareness tasks were not merely caused by the children's memory capacities. Since the phonological awareness tasks required the children to memorise three words in order to compare them

[1] The school days lasted one-and-a-half hours longer in these schools.

for sounds, any differences between groups in memory ability might affect their phonological awareness task scores. The same materials were used for the memory task as were used for the phonological awareness task.

8.2.ii.b Vocabulary task

For the English-speaking children, the 'BPVS' was used. For the Spanish-speaking children the 'Test de Vocabulary en Imágenes Peabody - Adaptación Española' was used. For an explanation of how this is administered see Chapter 5.3.ii.b.

8.2.ii.c Standardised reading task

A standardised reading task was administered in order to determine which types of consonant awareness and vowel awareness are correlated with reading in both English and Spanish. For the English-speaking children the 'Schonell Graded Word Reading Test' was used. For the Spanish-speaking children the 'Test de Análisis de Lectoescritura' was used. For an explanation of how this is administered see Chapter 5.3.ii.c.

8.2.ii.d Phonological awareness tasks

All of the words used in the experiment were disyllabic, with stress in the first syllable. Only common words that the children would understand were used. The consonants used were grouped into four different categories: nasals (/m n/), fricatives (/f s/), liquids (/l w r/), and stops (p k d t b/). Awareness of each type of consonant was tested in both word-initial (onset) and word-final (coda) position.

In word-initial position all of these consonants were used. In the Spanish word-final position task, only /n/, /s/, /r/, /d/ and /l/ were used, since there are constraints as to

which consonants are permissible at the ends of words in Spanish. Other than the two target words, (which only shared the target consonant), the three words used in each oddity task shared no phonemes.

The children were also given the vowel task that was used in Experiment 1 (see Chapter 5.3.ii.d).

Table 8. 1: The consonant and vowel phoneme tasks with examples

Position	Phoneme type	English example	Spanish example
Onset			
	Stop consonant	*tunnel, tuesdays, rubbish*	*verde, vista, cubo*
	Fricative consonant	*series, seven, model*	*sirve, sala, nudo*
	Nasal consonant	*music, maiden, farmyard*	*marcha, mueve, siglo*
	Liquid consonant	*lecture, label, minute*	*loco, leche, santa*
Coda			
	Stop consonant	*cornflake, music, private*	*hablad, coged, útil*
	Fricative consonant	*goldfish, toothbrush, ice-cream*	*teles, muchos, fácil*
	Nasal consonant	*magnum, victim, hairslide*	*piden, charlan, tuyos*
	Liquid consonant	*charcoal, angel, spirit*	*útil, cárcel, bollos*
First syllable			
	Vowel	*pancake, hamster, elbow*	*torno, bosque, lucha*
Final syllable			
	Vowel	*pancake, birthdays, tiger*	*meses, cogen, fácil*

For both the consonant and the vowel tasks, semantic links between words in the same task were kept to a minimum to ensure that the children were answering according to sound differences, rather than semantic differences.

Table 8. 1 gives a list of all the conditions with an example of each. For a full list of the words, see Appendix 3.

8.2.iii Procedure

All tests were administered to the children by a single experimenter fluent in both English and Spanish. Each monolingual child was tested on two occasions, each separated by approximately 24 hours, and each lasting between 15 and 25 minutes, depending on the speed of the child.

The bilingual children were tested in both English and Spanish and hence each child was tested on four separate occasions. Sessions 1 and 2 were administered on consecutive days. A one-week gap followed before Sessions 3 and 4 were carried out, again on consecutive days. For half of the bilingual children the first two sessions were conducted in English and the last two in Spanish, the other half of the children being tested in Spanish first and then English. All of the instructions were given in the language of the test, except for some of the bilingual children (particularly the younger ones) whose English was not good enough to understand the English instructions fully. These children received the instructions in both English and Spanish for the English tasks, although the tasks themselves were obviously conducted in English.

The order of the tests and the number of tests done in each session was counterbalanced for the children.

8.2.iii.a Memory task

In the memory task the experimenter read out the first three and the last three examples of the onset and coda phonological awareness tests and the first three examples of each of the vowel phonological awareness tests that the child had either done in a previous session or would do in a future session. The child simply had to repeat back the sets of three words to the experimenter. One point was given for each correctly remembered word, giving a possible total score of 54 points.

8.2.iii.b Phonological awareness tasks

The oddity task was used for all phonological units. For a description of how this is administered, refer to Chapter 5.3.ii.d. The children received four phonological tests: an onset test, a coda test, a first syllable vowel test and a second syllable vowel test. No distinction was made between nasal, fricative, liquid and stop consonants for the child.

For the two consonant tasks (onset and coda) the child was given two examples, followed by twenty trials. Out of the twenty trials, there were five tests each of nasal, fricative, liquid and stop consonants. The child scored one point for each correct answer, so there was a possible total score of five for each consonant type in the onset position, and five for each consonant type in the coda position.

For the two vowel tasks (initial syllable, final syllable) the child was given two examples, followed by five trials. The child scored one point for each correct answer, so there was a possible total score of five for the initial syllable vowel task and five for the final syllable vowel task.

The tests took place in a quiet room in the school. It was ensured that there would be as little noise as possible during the testing sessions so that the child could hear clearly all that was being said. The order in which the children received the individual trials of the phonological awareness task was randomised for each individual child.

8.3 RESULTS

8.3.i Vocabulary

As was pointed out in Chapter 5.4.i, it is important to make sure that there are no differences in vocabulary ability between the groups, since this is an indicator of their intellectual ability. Table 8. 2 below shows the mean percentile rank scores for each of the groups on the vocabulary test.

Table 8. 2: Mean percentile rank vocabulary scores for each of the groups

	English monolinguals	Bilinguals in English	Bilinguals in Spanish	Spanish monolinguals
Mean	64.450	2.630	51.9487	57.750
s.d.	23.906	3.412	22.565	29.806

A series of one-way ANOVA's were carried out to see if the differences were significant. We found no difference in receptive vocabulary between the English and Spanish monolinguals ($F[1,79] = 1.230$, $p < 0.271$) or the Spanish monolinguals and the bilinguals in Spanish ($F[1,78] = 0.948$, $p < 0.333$). However, the bilinguals performed worse in English than in Spanish ($F[1,37] = 184.330$, $p < 0.000$) and they performed worse in English than the English monolinguals ($F[1,77] = 249.123$, $p < 0.000$). It is possible that the bilingual children's limited exposure to English is the cause of their poor English vocabulary score. However, the most important comparisons to make are between the English monolinguals, the Spanish monolinguals and the bilinguals in Spanish. From the finding that they all have similar receptive vocabularies, it can be implied that all of the children were of a similar intellectual ability.

8.3.ii Memory

For the memory task, the children's raw scores (max. score = 54) were used to compare the groups both across languages (English vs. Spanish) and within languages (monolingual vs. bilingual).

Figure 8. 1: Mean raw scores for each of the groups

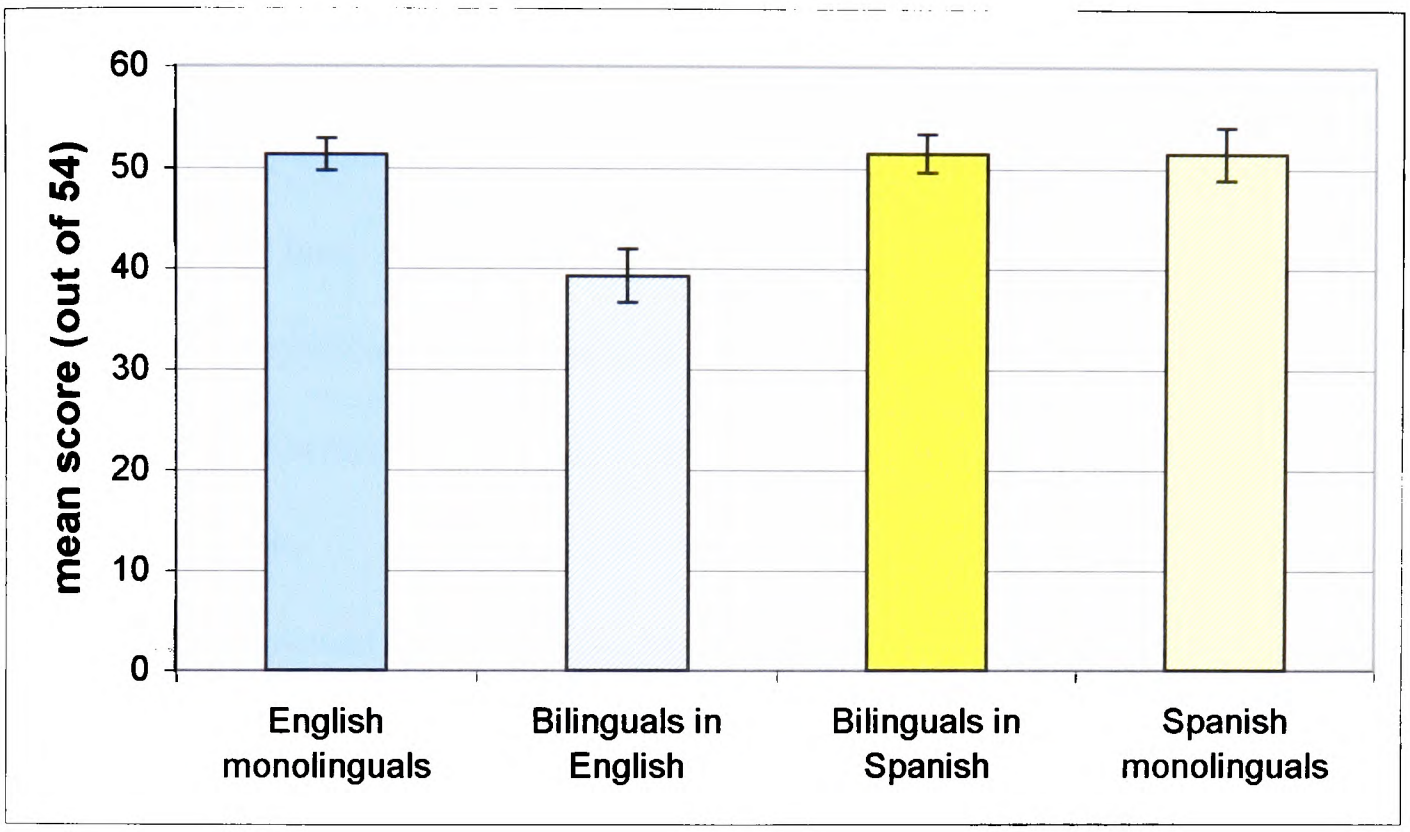


Figure 8. 1 shows that the mean scores for the English were 51.35 (s.d. = 5.11) for the monolingual children, and 39.4 (s.d. = 8.42) for the bilingual children. A one-way ANOVA was carried to see if there was a difference between the groups' performances. A significant result was found ($F[1,78] = 59.153$, $p < 0.000$). The bilingual children were significantly worse than the monolingual children on the English memory task.

Figure 8. 1 shows that the mean scores for the test in Spanish were 52.65 (s.d. = 3.66) for the monolingual children, and 51.5 (s.d. = 5.96) for the bilingual children. A one-way ANOVA was carried out to see if this difference was significant. There were no

significant differences between these scores ($F[1,79] = 1.081$; $p < 0.302$). Both groups showed similar memory capacities in Spanish.

Figure 8. 1 shows that the mean scores for the test in Spanish children were 52.65 (s.d. = 3.66), and 51.35 (s.d. = 5.11) for the English children. To determine whether there was a significant difference between these scores a one-way ANOVA was carried out. No significant difference was found ($F[1,79] = 1.71$; $p < 0.195$). The English and Spanish children showed similar memory capacities in their respective languages.

Figure 8. 1 shows a large difference between the scores obtained by the bilingual children in the Spanish memory task and the scores obtained by the same children in the English memory task. A one-way ANOVA was carried out to determine whether this difference was significant. A significant result was found ($F[1,38] = 114.311$; $p < 0.000$). The children performed much better on the Spanish memory task than on the English version of this task.

Overall it would seem that all of the children show similar memory capacities. The only exception to this is the bilingual children's English memory. Their memory for lists of three words is worse both than that of the English children, and than their own Spanish memory. This difference in memory capacity needs to be taken into account when analysing the phonological task data. The phonological task has an intrinsic memory component in it: if a child cannot remember the three words with which he or she is presented, she or he may not be able to distinguish between them, regardless of their phonological abilities.

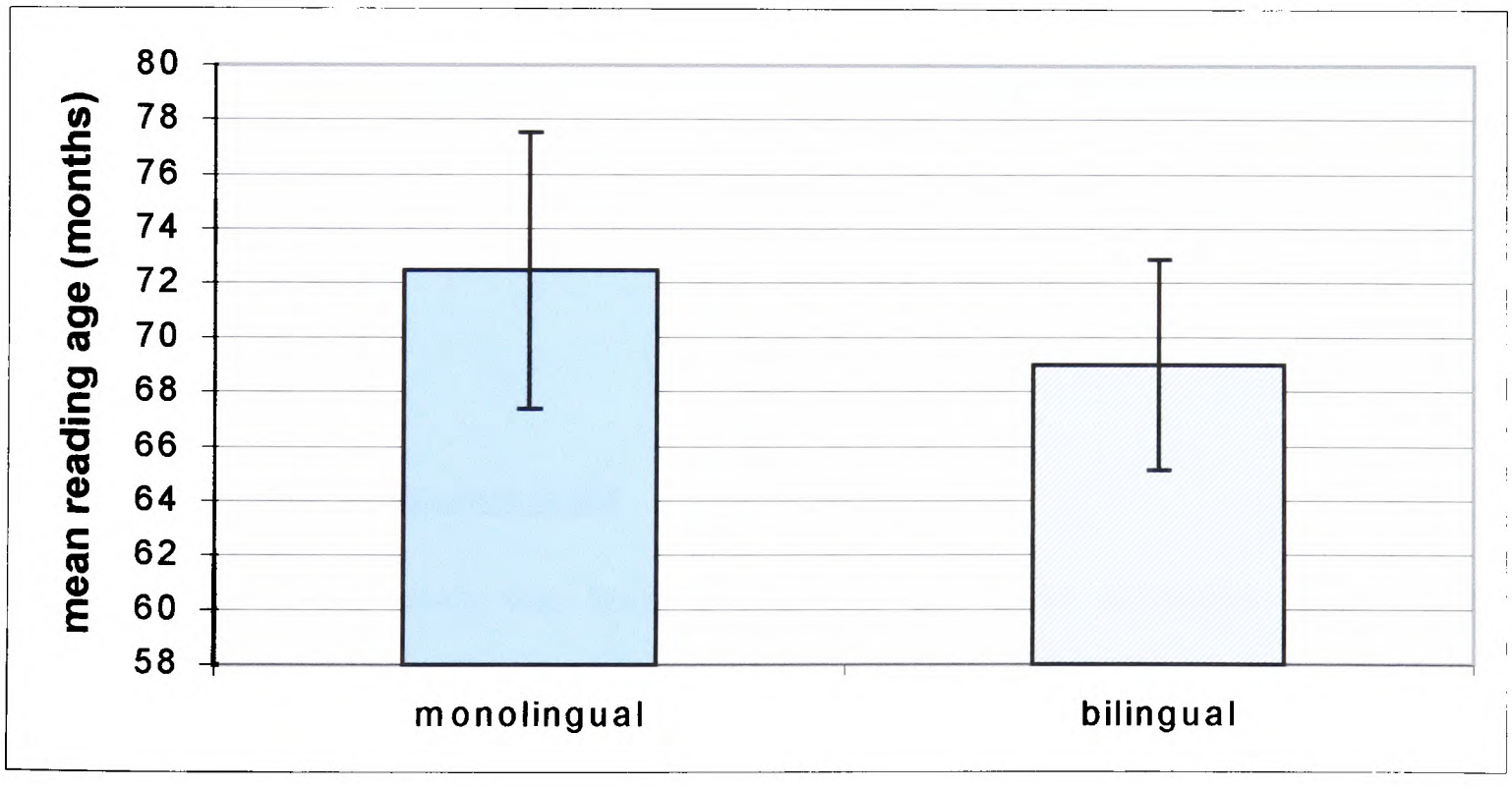
8.3.iii Standardised reading

For the reading task, the English-speaking children were scored in terms of age in years and months, and the Spanish children were marked in terms of grade-level. The

mean scores of the groups can be seen in Figure 8. 2 and Figure 8. 3. The groups were compared on reading ability within languages only. It was not possible to compare reading abilities across languages because the marking systems of the English and Spanish standardised reading tests were different.

In the English reading test, the mean reading age for the monolinguals was 6yrs 1mnth (s.d. = 16mnths), and for the bilinguals it was 5yrs, 7mnths (s.d. = 14mnths). A one-way ANOVA was carried out to see if this difference was significant. No significant difference was found ($F[1,77] = 1.124$; $p < 0.292$). This suggests that both groups have similar reading abilities.

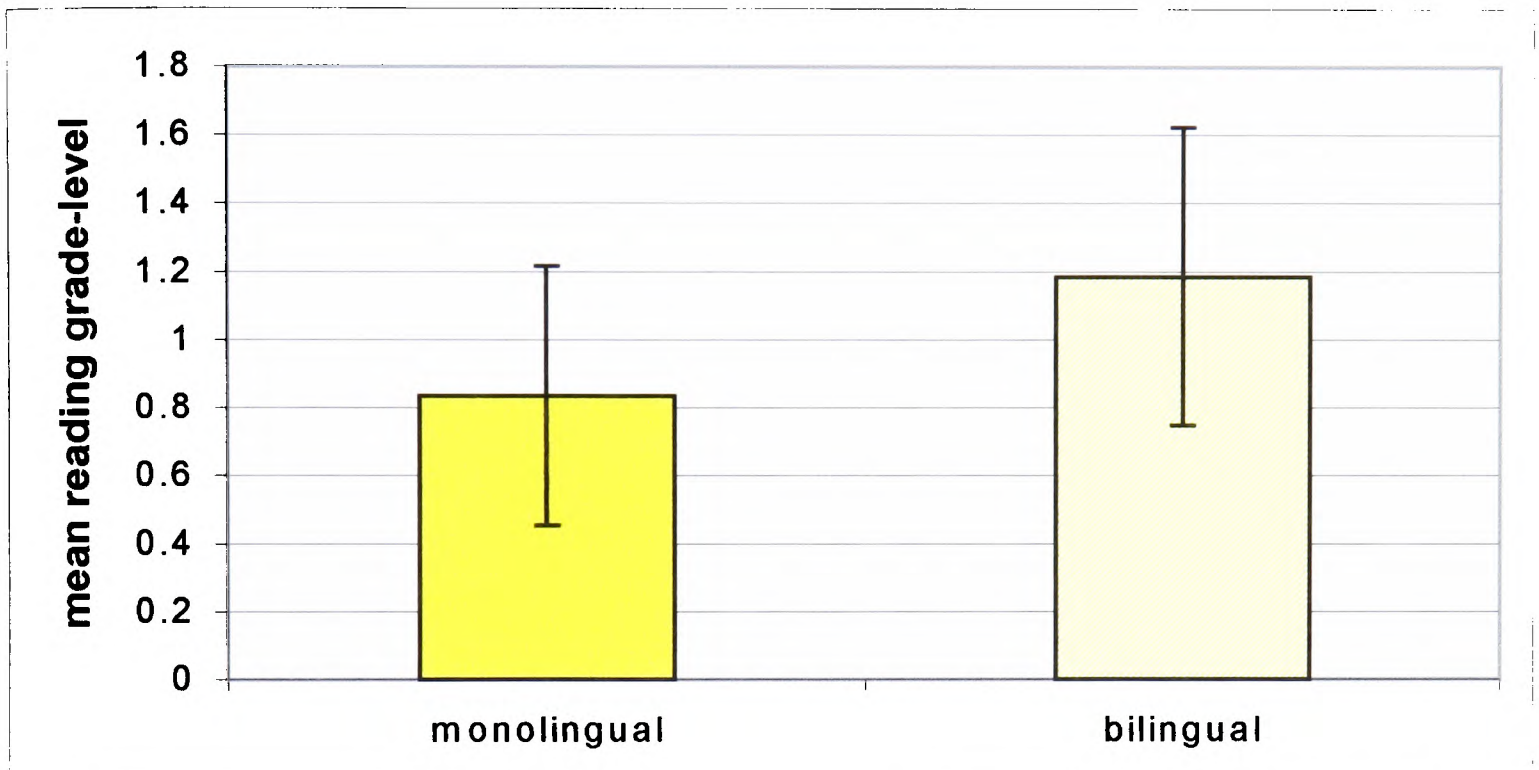
Figure 8. 2: Mean reading age for the English-speaking children on the Schonell Reading Test.



In the Spanish reading test, the mean grade-level for the monolingual children was 0.835 (s.d. = 1.23), and 1.1 (s.d. = 1.4550) for the bilingual children. A one-way ANOVA showed that the difference in reading grade level between the two groups was not

significant (F[1,78] = 1.396; p < 0.241). Hence, the bilingual and the monolingual children were reading at a similar level in Spanish.

Figure 8. 3: Mean reading grade level for the Spanish-speaking children.



8.3.iv Phonological awareness tasks

The aim of the study was both to replicate the vowel advantage found in the previous two experiments, and to determine whether this advantage extends to consonant phonemes. The vowel task results will be discussed first.

8.3.iv.a Vowel awareness

Table 8. 3 below shows the mean scores of each of the groups for the vowel tasks. The English monolingual children's performance on the vowel tasks was considerably worse than that of any other group.

A question to be investigated was whether exposure to different languages results in different amounts of vowel awareness. In other words, are Spanish-speakers more aware of vowels relative to English-speakers? The groups were therefore compared the across languages.

Table 8. 3: Mean scores on the vowel tasks for each group

	Vowel 1		**Vowel 2**	
	mean	**s.d.**	**mean**	**s.d.**
English monolingual	2.500	1.012	2.425	1.035
Spanish monolingual	3.525	1.109	3.325	0.997
Spanish bilingual	3.325	1.047	3.000	0.961
English bilingual	3.425	1.035	3.275	0.906

English monolinguals vs. Spanish monolinguals

It can be seen from Table 8. 3 that the Spanish monolingual children performed better on both vowel tasks than the English monolingual children. A two-way ANCOVA with Position (vowel 1, vowel 2) as the within subjects factor, and Group (English monolingual, Spanish monolingual) as the between subjects factor was carried out to determine whether there were any differences in performance between the two groups. Memory (raw score) was also included in the analysis as a co-variate. The phonological tasks had an intrinsic

memory component. Hence, it was necessary to make sure that any difference between the groups in memory was not determining the differences between the groups on the vowel tasks. This way, we could be sure that any differences in vowel awareness between the groups were likely to be a consequence of different amounts of phonological awareness.

There was a main effect of Group ($F[1,77] = 29.476$; $p < 0.000$), but not of Position ($F[1,77] = 2.151$; $p < 0.147$). The main effect of Group was caused by the English children performing worse than the Spanish monolinguals over both vowel tasks. This is what was found in Experiments 1 and 2.

Bilinguals in English vs. bilinguals in Spanish

The bilingual children's awareness of vowels was next compared across their languages to see if the language differences found for the monolingual children also held for the bilingual children. Table 8. 3 shows that there was very little difference between the bilingual children's performance on each of the vowel tasks across their languages. A two-way repeated measures ANCOVA with Position and Language (English, Spanish) as the within subjects variables, and Memory (English bilingual raw score, Spanish bilingual raw score) as the co-variate was carried out to see whether the differences in performance were significant. There were no main effects of Position ($F[1,36] = 0.001$; $p < 0.147$), or Language ($F[1,36] = 0.018$; $p < 0.894$). Hence, when memory is taken into account bilingual children are similarly aware of vowels in each of their languages.

The fact that the bilingual children performed just as well on the vowel tasks in English as in Spanish, yet the monolingual Spanish children performed significantly better than the English monolinguals on these tasks, suggests that some form of vowel awareness is being transferred across languages for the bilingual children. In order to verify this, we need to compare the bilingual and monolingual children's performance on the English

vowel tasks. The bilinguals would be expected to perform better on this task than their monolingual counterparts. Furthermore, it was necessary to compare the bilingual and monolingual children's performances on the Spanish versions of these tasks, to make sure that the bilingual children are performing just as well as their monolingual counterparts in Spanish.

English monolinguals vs. bilinguals in English

Table 8. 3 shows that the bilingual children appear to be performing better than their monolingual counterparts on both English vowel tasks. A two-way ANCOVA with Position as the within subjects factor, and Group as the between subjects factor was carried out to determine whether these differences are significant. Memory (raw score) was included as a co-variate. There was a main effect of Group ($F[1,77] = 12.26$; $p < 0.001$), but not of Position ($F[1,76] = 0.013$; $p < 0.908$). The main effect of Group was caused by the bilingual children performing better over the two vowel tasks than the English children. These results are the same as those obtained in Experiments 1 and 2.

Spanish monolinguals vs. bilinguals in Spanish

In order to verify that some sort of transfer of awareness was taking place for the bilingual children in English, we needed to see whether the bilingual children had similar Spanish vowel awareness to their Spanish monolingual counterparts. Table 8. 3 shows that the monolingual and the bilingual children's performance on the Spanish vowel tasks were very similar. In order to determine whether the differences between the two groups are significant, a two-way ANCOVA was carried out with Position as the within subjects variable, Group as the between subjects variable, and Memory (raw score) as the co-

variate. There were no main effects of Position ($F[1,77] = 2.668$; $p < 0.106$) or of Group ($F[1,77] = 2.207$; $p < 0.141$). Thus, there was no difference between the performance of the bilingual and the monolingual group on either of the vowel tasks.

Summary

Taken together, the results of the vowel analyses indicate that Spanish-speakers have an advantage over English monolingual speakers when it comes to vowel sensitivity. Furthermore, being exposed to both languages from an early age enhances your awareness of English vowels. These findings are in agreement with the results of Experiments 1 and 2.

8.3.iv.b Consonant awareness

The aim of the study was to determine:

a) whether Spanish-speaking children are more aware of consonant sounds than English-speaking children;
b) whether bilingual children show similar levels of awareness as their monolingual counterparts in each language;
c) whether there are differences in awareness of the different consonant types for each group, and;
d) whether there is any difference between onset and coda awareness for each group.

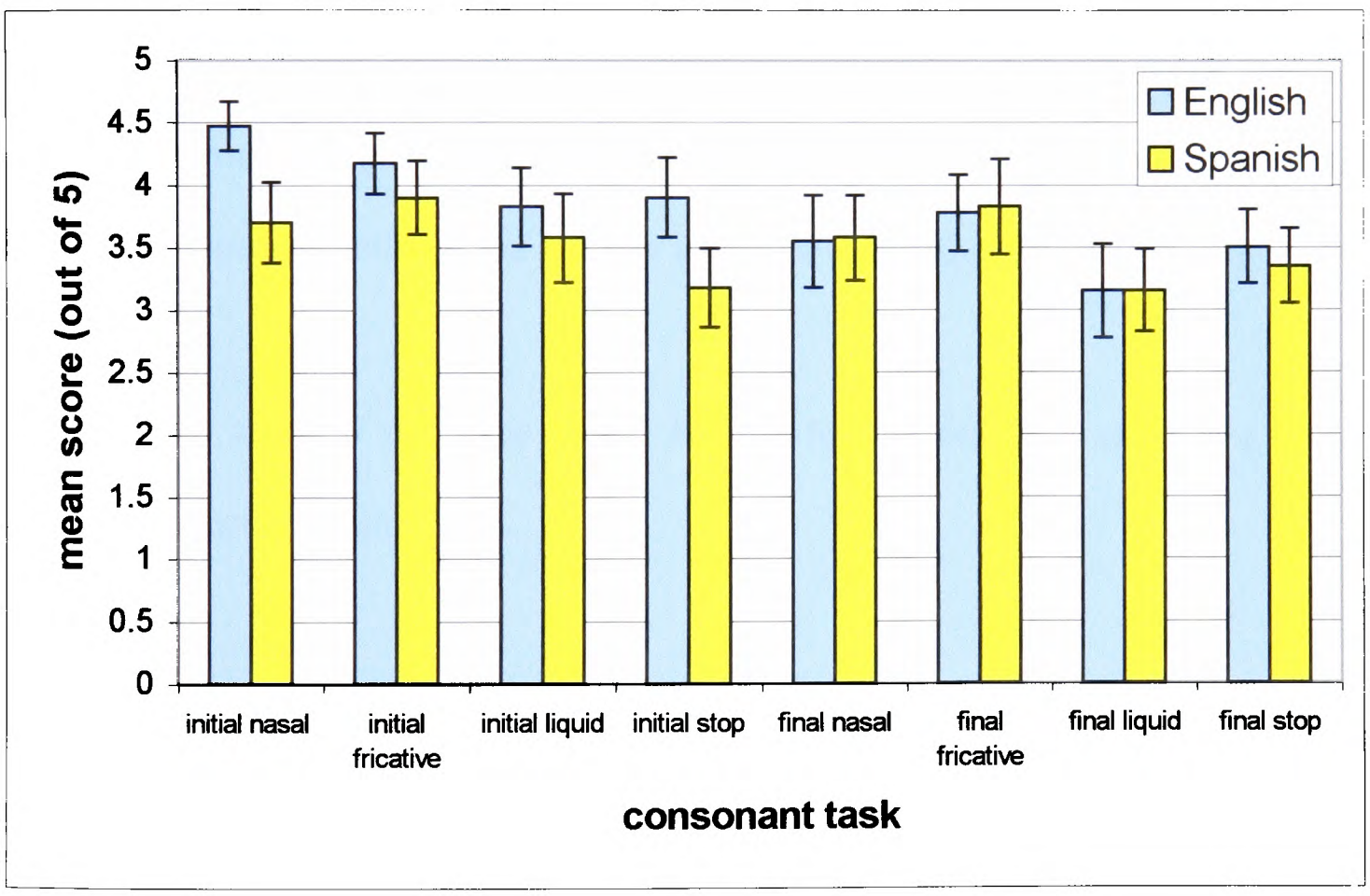
English monolinguals vs. Spanish monolinguals

From Figure 8. 4 we can see that the English and Spanish monolingual children performed similarly on the coda tasks, but that the English children were better at the onset

task. There was little difference in either groups' performances on the different types of consonant.

To determine whether any of these differences were significant, we carried out a three-way ANCOVA on the correct choices. Consonant Type (nasal, fricative, liquid, stop) and Position (onset, coda) were the within subjects factors, and Group (English monolingual, Spanish monolingual) was the between subjects factor. Memory was added as a co-variate.

Figure 8. 4: Mean scores on the consonant tasks for the English and Spanish monolinguals



There were no main effects of Consonant Type ($F[3,231] = 0.751$; $p < 0.523$) or Position ($F[1,77] = 0.009$; $p < 0.926$). However, there was a main effect of Group ($F[1,77] = 5.845$; $p < 0.018$), and an interaction of Position by Group ($F[1,77] = 16.058$; $p < 0.000$).

The main effect of Group was caused by the English children performing better overall than the Spanish children. A post-hoc Newman Keul's test using adjusted means

showed that the interaction was caused by the English children performing better on the onset than on the coda task, whereas there was no difference in performance on these two tasks for the Spanish children ($p < 0.05$). Furthermore, the post-hoc test showed that the English children performed better on the onset tasks than the Spanish children ($p < 0.05$), but there was no difference in the two groups' performances on the coda tasks.

This finding suggests that the onset is a more salient unit than the coda to English children, whereas onsets and codas are equally salient to Spanish children. It further suggests that the onset is a unit of particular salience to English children, since they are relatively more aware of it than are Spanish children.

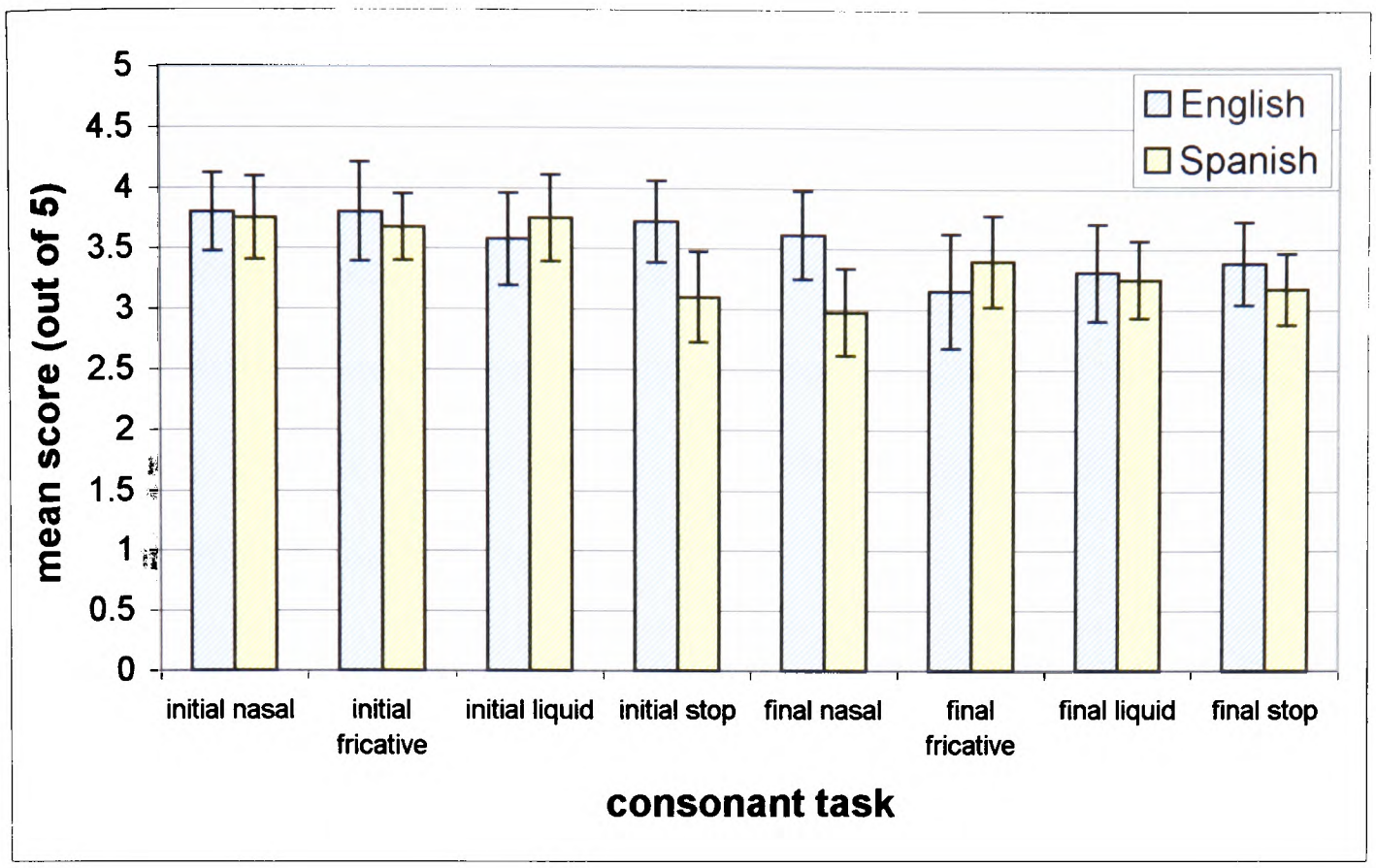
No differences in awareness of each consonant type were found for either group. Nor were differences found between the English monolingual and the Spanish monolingual children in terms of degree of sensitivity to the different consonant sounds. Hence, both English and Spanish children are equally aware of each stop, nasal, fricative and liquid consonants.

We next asked if the same would be true for the bilingual children's consonant sensitivity in their two languages.

Bilinguals in English vs. bilinguals in Spanish

From Figure 8. 5 it can be seen that the bilingual children performed marginally better on the English consonant tasks than on the Spanish consonant tasks, and this was true for both onset and coda consonants. However, there was little difference in their performance on the different consonant types in either language. A repeated measures three-way ANCOVA was carried out with Consonant Type, Position and Language (English, Spanish) as the within subjects factors. Memory (English, Spanish) was entered as a co-variate.

Figure 8. 5: Mean scores on the consonant tasks for the bilinguals in English and Spanish



There were no main effects of Consonant Type ($F[3,108] = 0.603$; $p < 0.615$) or Language ($F[1,36] = 2.791$; $p < 0.103$), but there was a main effect of Position ($F[1,36] = 6.009$; $p < 0.019$). This was caused by the children performing better on the onset than on the coda tasks.

These results suggest that bilingual children are equally aware of consonants in English and Spanish, and furthermore, they are equally aware of the four different consonant types.

We found that monolingual English children are more aware of onset consonants than are Spanish monolingual children. It is interesting that the bilingual children were not more aware of onsets in English than in Spanish. The lack of replication of an onset advantage in English might be a consequence of onset awareness transferring from English

to Spanish in the bilingual children. If this is the case, then we would expect the bilingual children to out-perform their Spanish monolingual counterparts on the onset tasks.

We next asked whether there were any significant differences between the monolingual and the bilingual speakers of each language. This would serve to answer two questions: firstly, whether being exposed to two different languages from an early age alters the relative amount of awareness of consonants as compared to monolingual children, and secondly, whether being exposed to two different languages affects relative sensitivity to the four different consonant types.

English monolinguals vs. bilinguals in English

Figure 8. 6: Mean scores on the English consonant tasks for the monolinguals and bilinguals

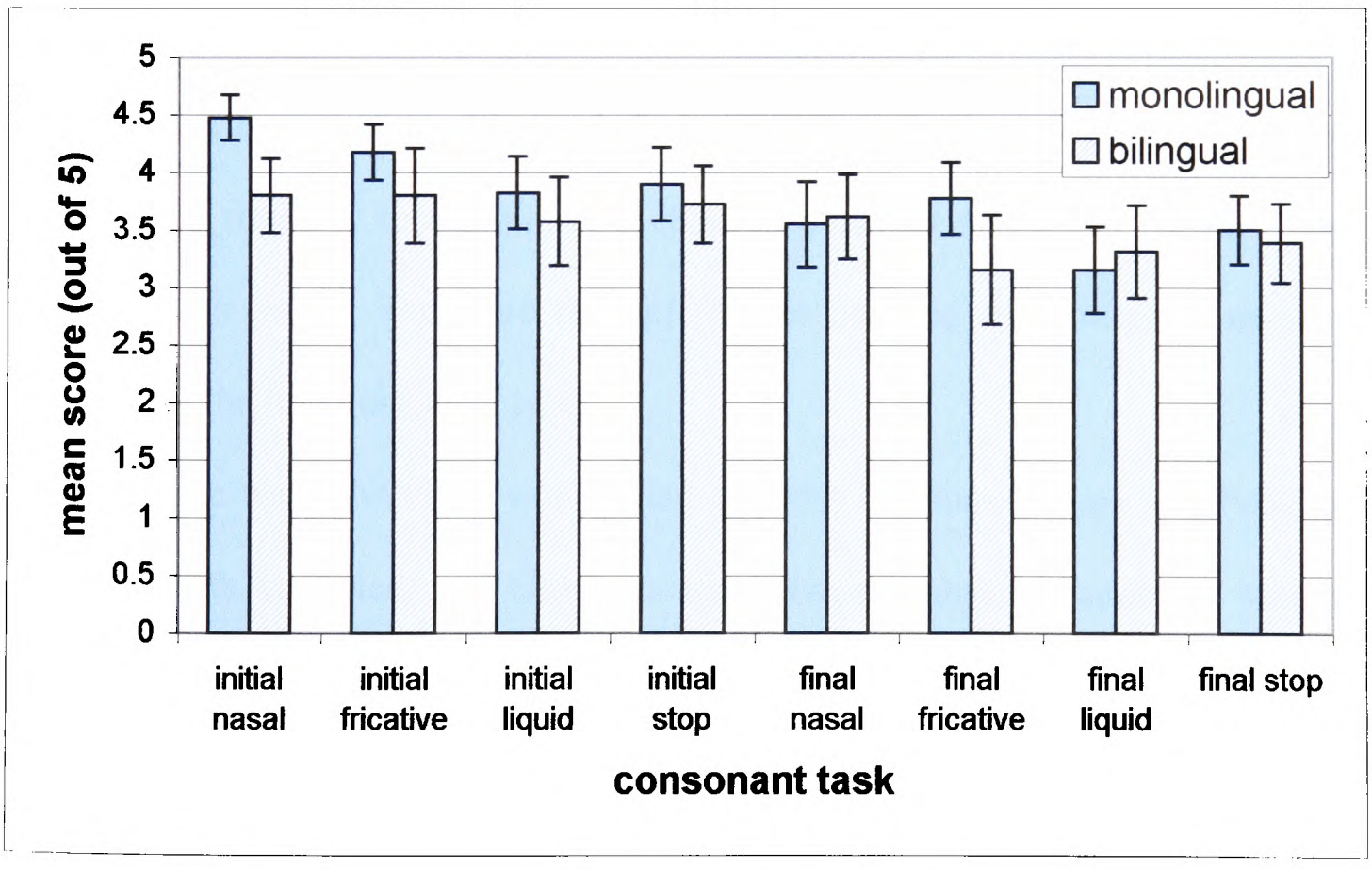


Figure 8. 6 shows the mean scores for the English monolinguals and the bilinguals in English. The monolingual children were slightly better at the onset tasks than the bilingual children, but there were very few differences on the coda tasks. There were also few differences between the awareness of the different consonant types between the groups. A three-way ANCOVA was carried out, with Consonant Type and Position as the within subject factors, and Group as the between subject factor. Memory was entered as a co-variate.

There were no main effects of Consonant Type ($F[3,228] = 0.824$; $p < 0.482$), Position ($F[1,76] = 1.084$; $p < 0.301$) or Group ($F[1,76] = 0.003$; $p < 0.955$).

The results indicate that monolingual and bilingual speakers of English show similar sensitivities to each of the consonant types. They also show that the two groups are similarly aware of consonants regardless of their position within the word.

Spanish monolinguals vs. bilinguals in Spanish

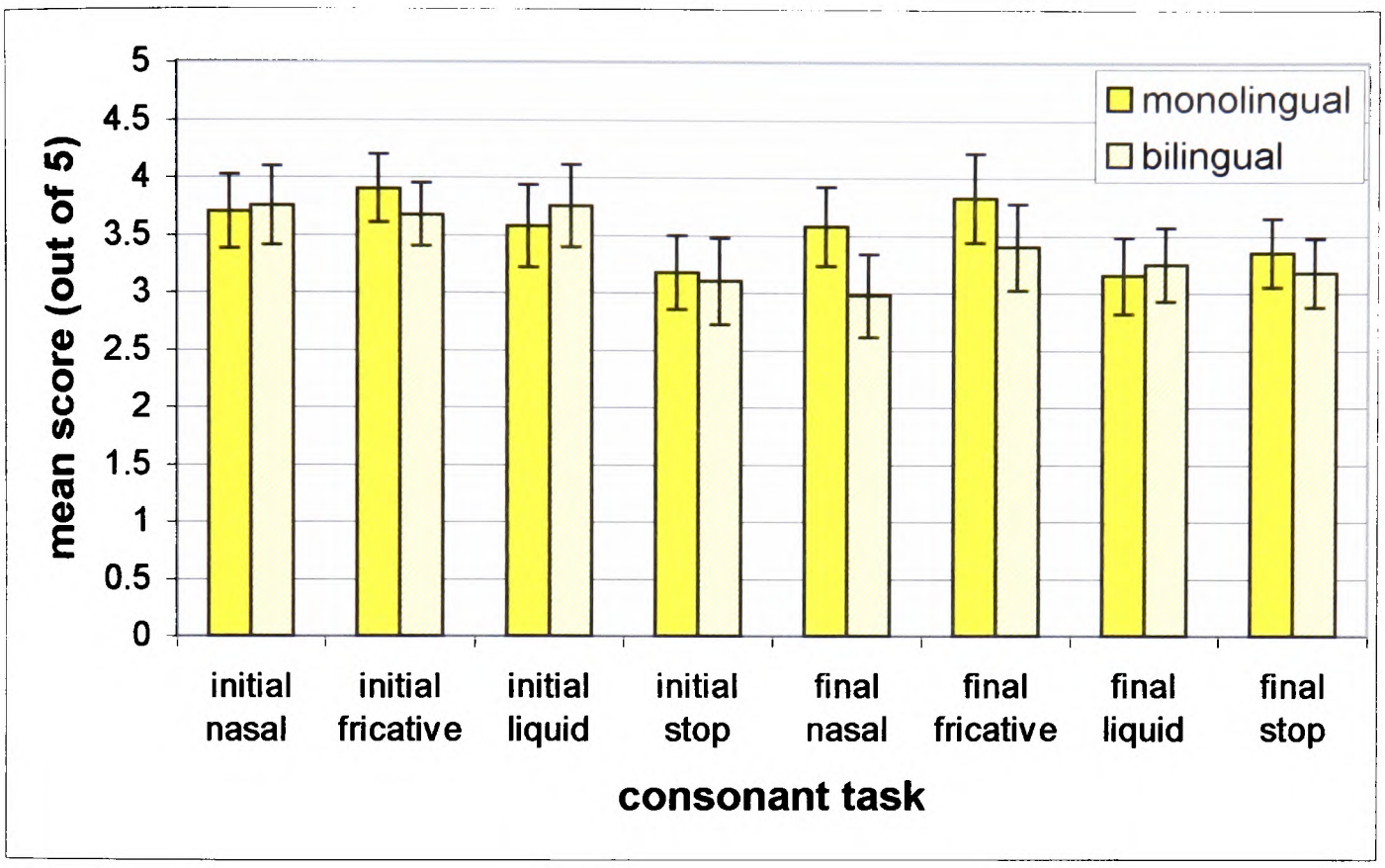
As can be seen from Figure 8. 7, for the Spanish tasks, the monolingual children perform very similarly to the bilingual children on onset tasks, and perform marginally better on coda tasks. There are few differences between the groups in terms of their awareness of the four consonant types.

A three-way ANCOVA was carried out with Consonant Type and Position as the within subjects variables, and Group as the between subjects variable. Memory was entered as a co-variate.

There was a main effect of Position ($F[1,77] = 5.964$; $p < 0.017$) but not of Consonant Type ($F[3,231$; $p < 0.737$; $p < 0.531$) or Group ($F[1,77] = 1.643$; $p < 0.204$). There was also an interaction of Position by Group ($F[1,77] = 4.162$; $p < 0.045$). A post-hoc Newman Keul's test using the adjusted means showed that this interaction was caused

by the bilingual children performing worse on the coda task than on the onset task ($p < 0.05$), whereas the difference in performance on these tasks was very small for the monolingual children.

Figure 8. 7: Mean scores on the Spanish consonant tasks for the monolinguals and bilinguals



Overall these results indicate that consonant type does not affect consonant awareness for any of the children. However, the position of the consonant within the word does have an affect on awareness of it. Both the monolingual-speakers of English, and the bilingual children (in each of their languages) were more aware of onset than coda consonants. This was not the case, however, for Spanish monolingual children, who showed similar awareness of onset and coda consonants. Finally, whilst the bilingual children showed no differences in consonant awareness from their monolingual counterparts, there were cross-linguistic differences between monolingual speakers' awareness of consonants. The Spanish monolingual children were less aware of onset

consonants than the monolingual-speakers of English. This suggests that the onset unit is a particularly salient one in English.

8.3.iv.c Consonant and vowel awareness

So far the consonant and the vowel phoneme tasks have been examined separately. It has been shown that Spanish-speakers have an advantage over monolingual English-speakers in vowel awareness, but not in consonant awareness. However, it is not known whether each group of children shows a similar amount of sensitivity to consonant as compared to vowel phonemes. In order to determine this, analyses were carried out on the percentage correct scores on the vowel and consonant tasks comparing the groups both across and within languages. Percentage correct scores were used because there were different numbers of consonant and vowel trials (40 consonant vs. 10 vowel).

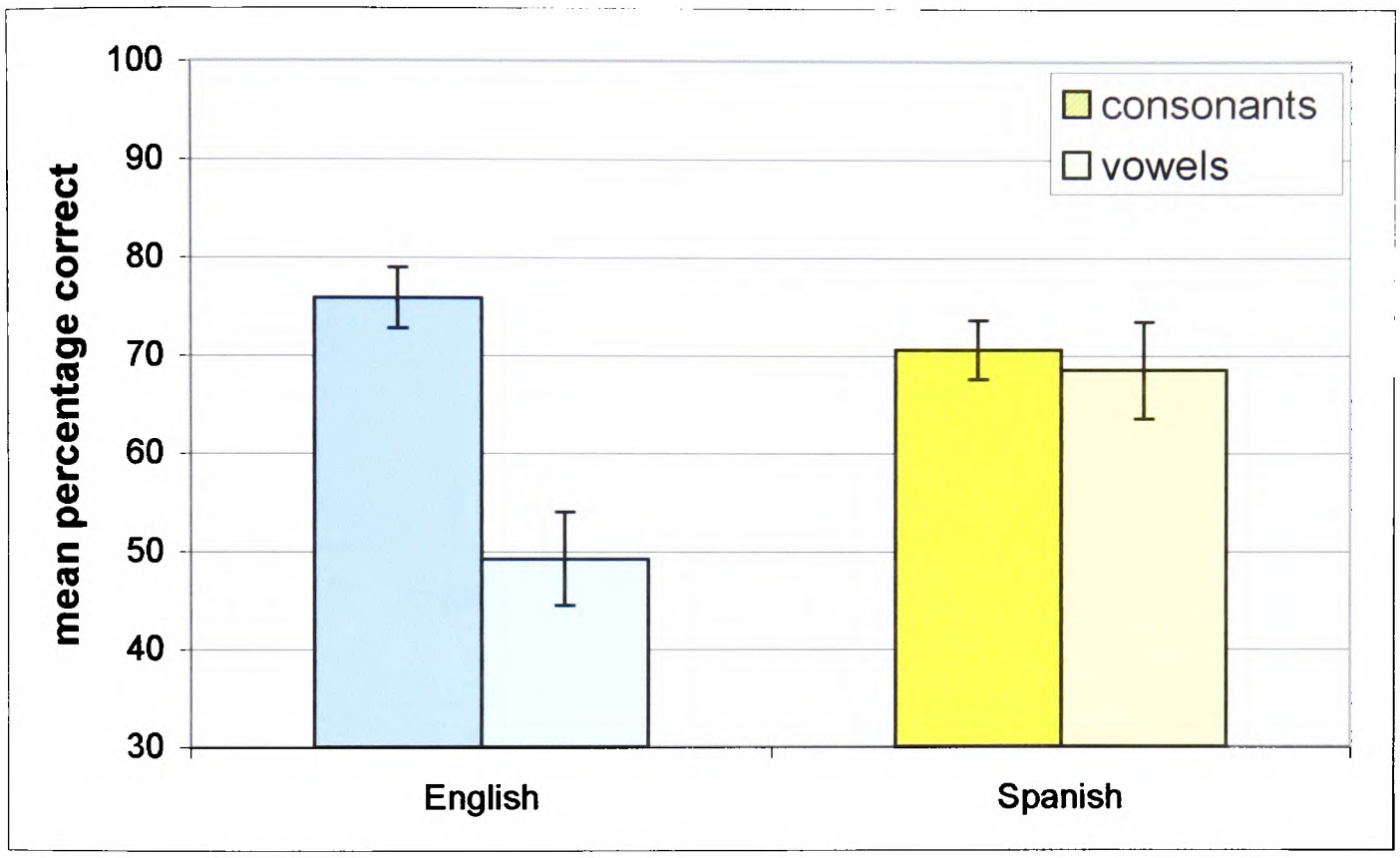
English monolingual vs. Spanish monolingual

Figure 8. 8 shows the mean scores on the consonant and vowel tasks for the English and the Spanish children. The Spanish children performed similarly on the consonant and the vowel tasks, whereas the English children were better at the consonant task. A two-way ANCOVA with Phoneme Type (consonant, vowel) as the within subjects variable, and Group as the between subjects variable and Memory as a co-variate was carried out to see if any of these differences were significant.

There were main effects of Phoneme Type ($F[1,78] = 51.704$; $p < 0.000$), and Group ($F[1,78] = 10.431$; $p < 0.002$). There was also an interaction of Phoneme Type by Group ($F[1,78] = 37.548$; $p < 0.000$). The main effect of Phoneme Type was caused by children being more aware of consonants than vowels overall. The main effect of Group was caused by the Spanish children performing better than the English children overall. A

post-hoc Newman Keul's test using the adjusted means showed the interaction to be caused by the English children being significantly more aware of consonant phonemes than vowel phonemes, whilst the Spanish children showed similar awareness of both types of phoneme.

Figure 8. 8: Mean percentage scores on the consonant and vowel tasks for the English and Spanish monolinguals



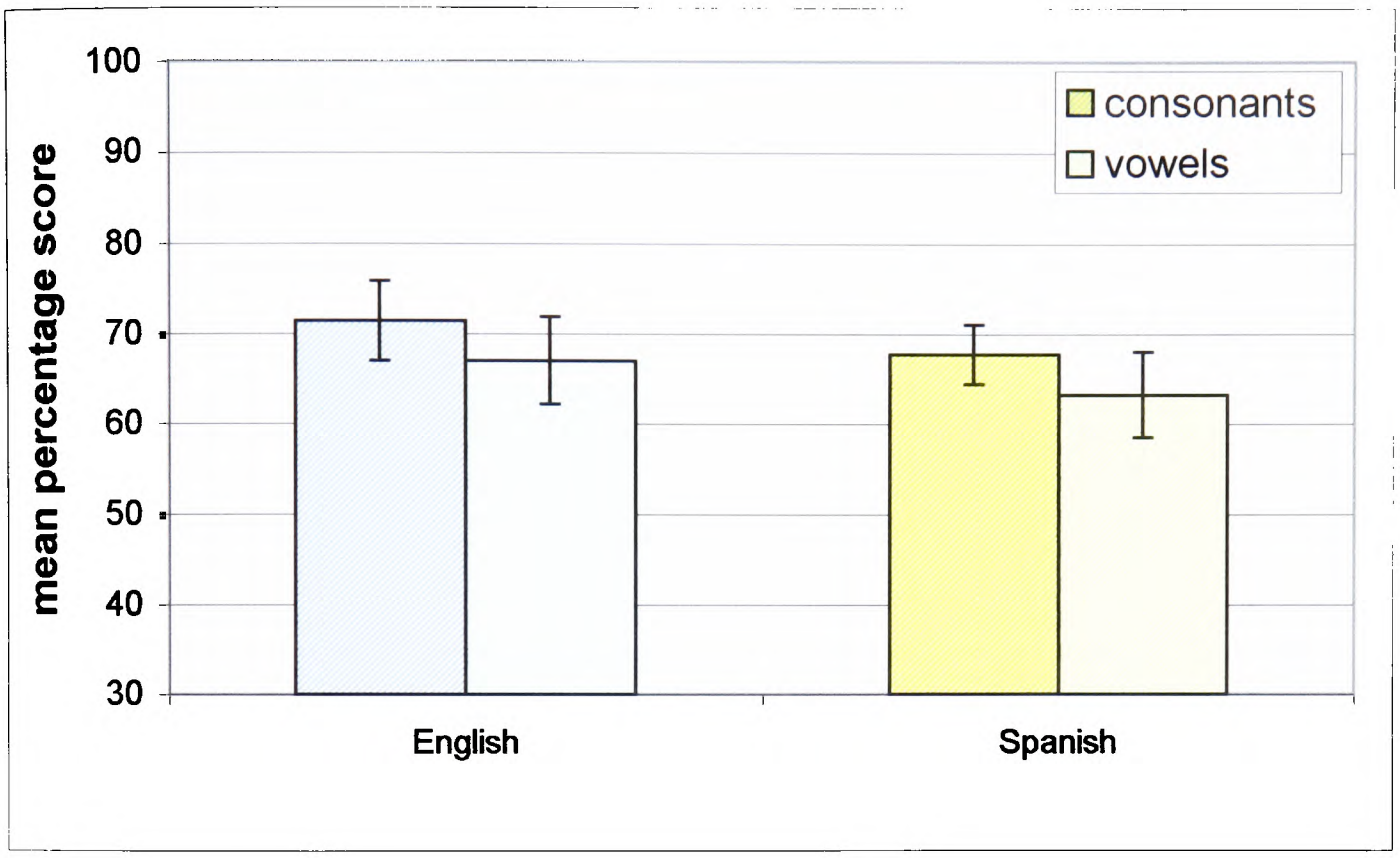
This finding suggests that, rather than vowel being particularly salient in Spanish, as was proposed in Chapter 6.4 vowels are particularly 'non-salient' units in English.

Bilinguals in English vs. bilinguals in Spanish

Figure 8. 9 shows that bilingual children are similarly aware of consonants and vowels in each of their languages. Moreover, it shows that they are similarly aware of consonants in English and Spanish, and likewise, that they are similarly aware of vowels in English and Spanish. A two-way repeated measures ANCOVA was carried out with Phoneme Type and Language (English, Spanish) as the within subjects variables, and

Memory (English memory, Spanish memory) as the co-variate to see if there were any significant differences.

Figure 8. 9: Mean percentage scores on the consonant and vowel tasks for the bilinguals in English and Spanish



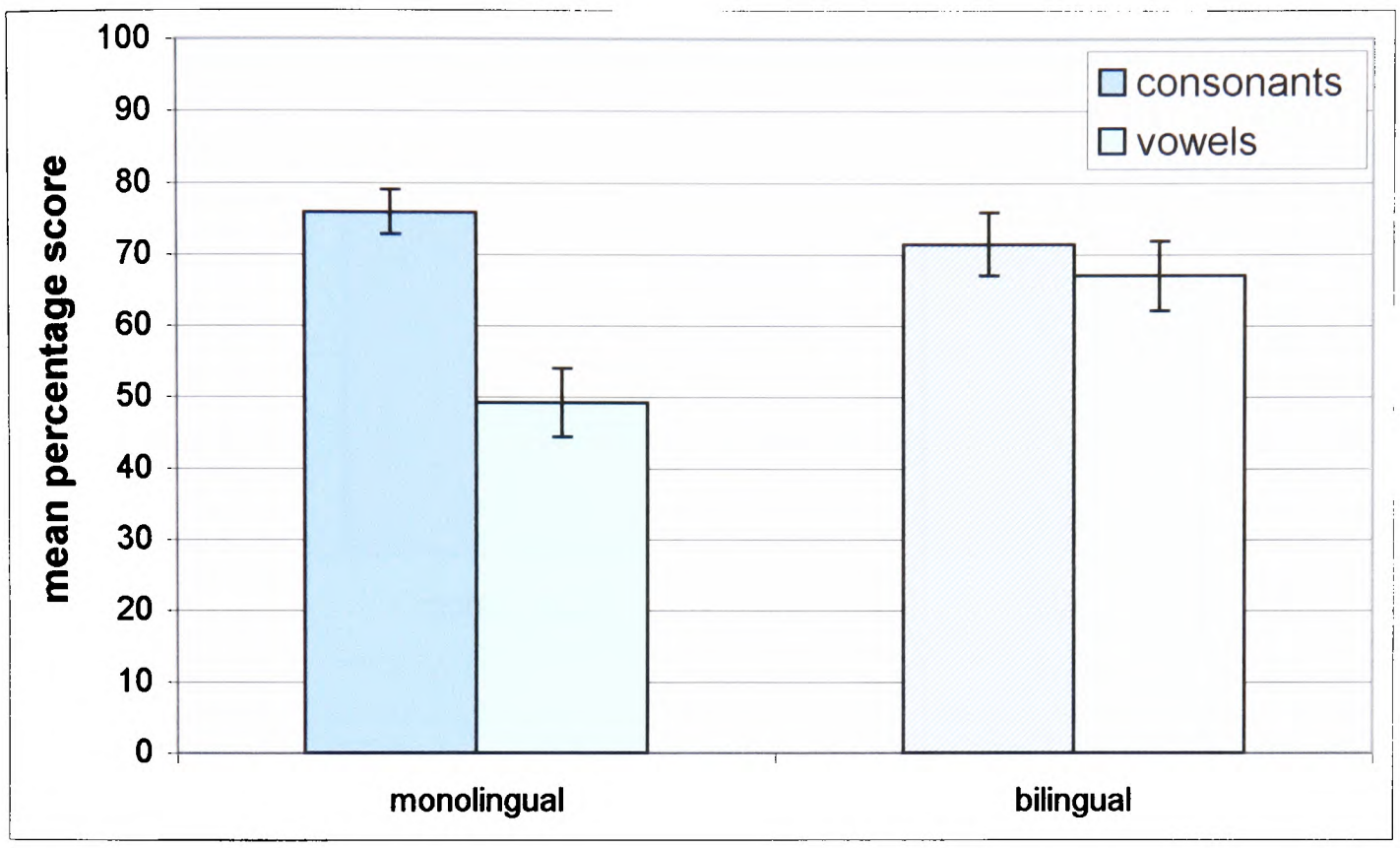
There was no main effect of Phoneme Type ($F[1,36] = 1.944$; $p < 0.172$) or Language ($F[1,36] = 0.578$; $p < 0.452$). This suggests that bilingual children are equally aware of consonants and vowels, and that their awareness of these phonemes does not differ from one language to the other.

English monolinguals vs. bilinguals in English

Figure 8. 10 shows that both monolingual and bilingual children are more aware of consonant phonemes than vowel phonemes, but that this difference is greater for the monolingual children. A two-way ANCOVA was carried out with Phoneme Type as the

within subjects variable, and Group as the between subjects variable and Memory as a co-variate to see if there were any significant differences.

Figure 8. 10: Mean percentage scores on the English consonant and vowel tasks for the monolinguals and bilinguals



There was a main effect of Phoneme Type ($F[1,77] = 60.803$; $p < 0.000$) and Group ($F[1,77] = 7.566$; $p < 0.007$). There was also an interaction of Phoneme Type by Group ($F[1,77] = 32.028$; $p < 0.000$). The main effect of Group was caused by the bilingual children performing better overall than the monolinguals. The main effect of Position was caused by the consonant tasks being easier overall than the vowel tasks. A post-hoc Newman Keul's test using the adjusted means showed the Phoneme Type by Group interaction to be caused by the monolingual children being more aware of consonants than vowels ($p < 0.05$) whilst the bilingual children were equally aware of consonants and vowels.

Spanish monolinguals vs. bilinguals in Spanish

Figure 8. 11: Mean percentage scores on the Spanish consonant and vowel tasks for the monolinguals and bilinguals

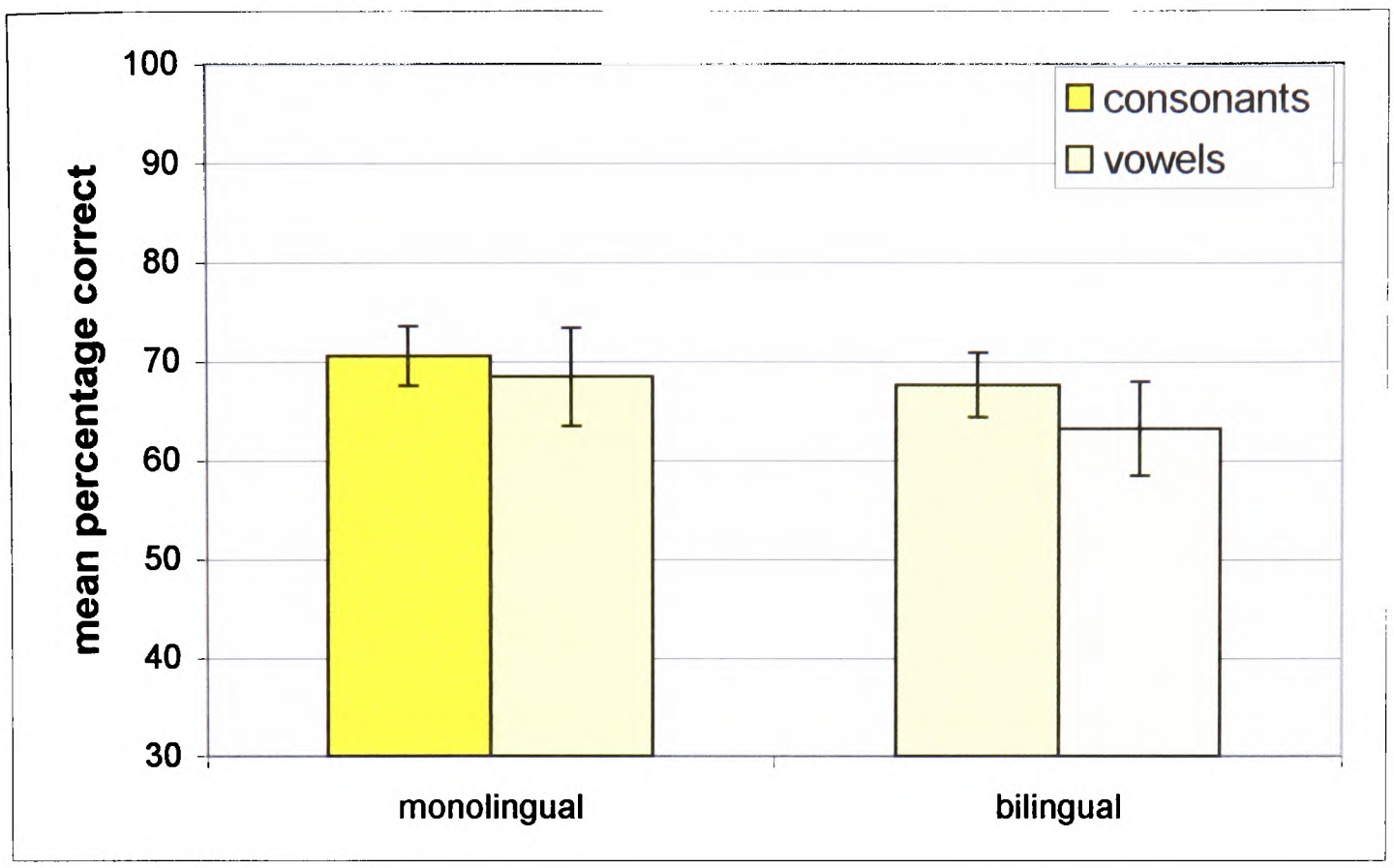


Figure 8. 11 shows that the monolingual-speakers of Spanish showed similar levels of vowel and consonant awareness. The same was true for the bilingual-speakers of Spanish. Furthermore, there were few differences between the groups in terms of their awareness of vowel and consonant phonemes. To see if any of these differences were significant, a two-way ANCOVA was carried out with Phoneme Type as the within subjects variable, and Group as the between subjects variable and Memory as a co-variate.

There was no main effect of Phoneme Type ($F[1,77] = 0.196$; $p < 0.659$) or Group ($F[1,77] = 3.422$; $p < 0.068$). Both groups were similarly aware of consonants and vowels.

8.3.iv.d Summary

These results suggest that in English, vowel phonemes are not at all salient. Monolingual-speakers of English show a large discrepancy between consonant and vowel

awareness. Spanish-speakers are no less aware of consonants than English-speakers, it is simply that they do not have the same difficulties as English-speakers with vowel phonemes. Instead, they find vowel phonemes just as easy to distinguish as they do consonants.

It seems quite probable that the cross-linguistic differences are due to the differing nature of the vowel systems in each language. Whereas Spanish vowel space contains only five, non-overlapping vowel phonemes, English vowel space is far more crowded. This presumably makes it much harder to distinguish between vowel sounds.

It is very interesting that the difficulties in distinguishing between English vowel phonemes are overcome by bilingual children. They showed similar sensitivity to both consonants and vowels in English. This suggests that they compare the vowel systems of each language. By focussing on the cross-language vowel differences in this way, they become more aware of those features that distinguish vowels from one another in English.

8.3.v The relationship between phoneme awareness and reading ability

The study aimed to determine which phonemic units were most highly correlated with reading ability for each group under study here. A further aim was to discover the relationship that holds between phonological awareness and reading ability in L1 and phonological awareness and reading ability in L2 for the bilingual children.

There is no difference between awareness of the different consonant types for any of the groups but there are differences in awareness of consonants in word-initial and word-final positions. Furthermore, vowel position does not affect vowel awareness. Hence, the correlations were calculated between mean scores for the onset and coda consonant tasks and vowel tasks as a whole and the standardised reading tasks for each group individually.

The results of this analysis for the English and Spanish monolinguals, the bilinguals on the English and Spanish tasks can be seen in Table 8. and Table 8. respectively.

Monolingual children

We began by looking at the monolingual children's correlations between the various phonological tasks and the various standardised tasks.

Table 8. 4: Spearman's rank correlations for the English and Spanish monolingual children

	English reading age	Spanish reading grade-level
Vocabulary	0.392*	.548**
Memory	0.547**	.294
Age	0.198	.695**
Onsets	0.553**	.588**
Codas	0.490**	.513**
Vowels	0.292	.250

Key: * means significant at the 0.05 level; ** means significant at the 0.01 level.

Table 8. 4 gives the correlations between for the English children. Reading ability is correlated with vocabulary, onsets and codas. This finding suggests that consonant (in particular onset) awareness, but not vowel awareness is related to reading in English. In Experiment 2 we found that vowel awareness was related to reading ability for English children. The present finding suggests that consonant awareness is important for reading from the earliest stages, but vowel awareness may not play a role until reading is more advanced.

Table 8. 4 gives the correlations between reading and phoneme awareness for the Spanish children. Vocabulary, age, onset and coda awareness are all significantly correlated with reading ability. Vowel awareness is not related to reading ability. This last result is unexpected given the evidence (reviewed in Chapter 3.2.ii) that phonemic awareness is important in Spanish reading. However, it is the same result as found in Experiment 2. This suggests that it is consonant rather than vowel awareness that plays a more important role in Spanish spelling.

Bilingual Children in English and Spanish

Table 8. 5 gives the correlations for the bilingual children in English and Spanish. Reading in English is correlated with age and onset awareness. Coda and vowel awareness are not significantly related to reading. This finding is contrary to research that indicates the importance of phonemic awareness in reading in English. However, it is in accordance with the findings of Experiments 1 and 2, where very few correlations were found between phonological awareness and reading ability for the bilingual children in English.

A tentative suggestion could be made that the English monolinguals and bilinguals approach English reading at this early age in a different way. It appears that monolingual children use their phonemic awareness to help them read to a greater extent than bilingual children.

Table 8. 5 also shows that Spanish reading ability is correlated with onset and vowel awareness for bilingual children.

It could be speculated that the bilingual children are using a different strategy(ies) from the monolingual children when reading in Spanish. However, rather than bilingual children using their phonemic awareness to a lesser extent than their monolingual counterparts, as was found in English, in Spanish, the bilingual children appear to be

making more use of their awareness of phonemes to help them read. This is in accordance with the results of Experiment 2.

Table 8. 5: Spearman's rank correlations for the bilingual children in English and Spanish

		English reading age	Spanish reading grade level
English	Age	.472**	.774**
	Reading age		.588**
	Vocabulary	-.260	-.034
	Memory	.309	.344*
	Onsets	.529**	.358*
	Codas	.173	.162
	Vowels	.269	.184
Spanish	Vocabulary	.056	.455**
	Memory	.436**	.535**
	Onsets	.471**	.325*
	Codas	.250	.215
	Vowels	.241	.393*

Key: * means significant at the 0.05 level; ** means significant at the 0.01 level

Table 8. 5 shows that reading ability in English is highly correlated with reading ability in Spanish. This is not a surprising finding, since one would expect that if a child had grasped the basic concept of reading as a process of decoding, then they should be able to apply their decoding principles in both languages.

However, there were few significant correlations between phonemic awareness in English and reading in Spanish, and between phonemic awareness in Spanish and reading

in English. This suggests that bilingual children are not directly employing their knowledge of L1/L2 phonology to help them decode L2/L1. Interestingly, however, where cross-language correlations do exist between Spanish phonemic awareness and English reading they occur precisely with those units that are important for reading in the respective language. Onset consonants are important for reading in English and it is precisely the awareness of Spanish onset consonants that is related to English reading ability. Similarly, it is onset awareness that is important for reading in Spanish, and it is awareness of English onsets that is related to Spanish reading ability.

8.4 DISCUSSION

8.4.i Phonological awareness

8.4.i.a Awareness of vowels

Our results have shown that an English-only environment results in poor vowel awareness relative to Spanish-speaking children. Being exposed to two linguistic environments, English and Spanish, makes this disadvantage disappear. Bilingual children are significantly more aware of English vowels than English monolingual children, whilst they are equally sensitive to vowels in English and Spanish. Furthermore, they are no less sensitive to Spanish vowels than their Spanish monolingual counterparts.

This finding further supports the evidence found in Experiments 1 and 2 that

a) vowels are particularly salient units in Spanish, and,

b) bilingual children analyse language differently from monolinguals.

However, the finding that Spanish monolinguals and bilingual children show equal sensitivity to consonant and vowel sounds whereas English monolinguals are more aware of consonants than vowels suggests that, rather than vowels being particularly salient units in Spanish, they are particularly 'non-salient' in English.

8.4.i.b Awareness of consonants

Consonant type

No differences were found in awareness of the different consonant types for any of the groups. In other words, English monolinguals are equally aware of the four different consonant types, as are Spanish monolingual children and as are bilingual children in both Spanish and English.

The finding that both English children and Spanish children show no difference in sensitivity to the various consonant sounds is contradictory to Treiman & Baron's (1981) and Jiménez & Haro García's findings (reported in Chapter 2.3.iii.b) that children are more sensitive to fricative consonants than stop consonants at the beginning of words.

One possible explanation for the different findings is the methodologies employed in the experiments. Both Treiman & Baron and Jiménez & Haro García used a phoneme isolation task in which the children had to explicitly isolate the initial phoneme of a word. The present investigation used the oddity task in which the child simply had to distinguish between two words that shared an initial phoneme and a word that did not. Various researchers have reported that children find the oddity task easier than the isolation task, and hence any differences in awareness between consonant sounds might have been masked by the simplicity of the task used in the present experiment. In particular, it might be easier to isolate fricative consonants than stop consonants precisely because the former can be pronounced in isolation, whereas the latter cannot. In an oddity task, the ability to pronounce a consonant in isolation is irrelevant. Hence, it is possible that the different methods employed in the present and in the Treiman & Weatherston and Jiménez & Haro García experiments are tapping into different types or levels of phonological awareness, and hence our results did not coincide.

Comparisons across languages also showed that the three groups of children showed exactly the same degree of sensitivity to each of the different consonant types. Hence, linguistic background does not appear to affect relative sensitivity to nasal, fricative, liquid and stop consonants. The results also indicate that the vowel advantage (reported in Chapter 5, Experiment 1 and Chapter 6, Experiment 2) that the Spanish-speakers had over the English-speakers does not extend to consonant phonemes. However, this result is not altogether surprising, since their are few(er) acoustic-phonetic differences between each of the different consonant types in English and Spanish. In other words,

from an acoustic/phonetic properties perspective, stop consonants do not differ greatly in English and Spanish, and the same can be said for nasal, liquid and fricative consonants.

However, this finding does suggest that bilingual children are not at a 'phonological advantage' due to an increased ability to approach language in an analytical manner (alternative 4, put forward in Chapter 2.4). Rather, the current finding points toward any advantage occurring only for those units that differ considerably between languages. In other words, bilingual children may focus on those units that are dissimilar in each language, and consequently become more aware of these units. Where systems are similar, there is no need for this increased attention. Given that consonant sounds are acoustically and linguistically similar in English and Spanish, bilingual-speakers will presumably encounter the same problems as their monolingual counterparts when trying to unambiguously determine the nature of the consonant sound.

Consonant position

The English-speaking children found it easier to detect onsets than codas. This finding was as expected for the English tasks, since past research has found word-initial sounds to be easier to detect than word-final sounds (see Chapter 2.1.i.a). The Spanish monolingual children, on the other hand, were equally aware of codas as onsets. This suggests that the onset/rime distinction does not play an important role in linguistic processing in this language.

Bilingual children are more aware of onsets than codas in both English and Spanish. The fact that an onset advantage was found for bilingual children in Spanish suggests that bilingual children may not process language in the same way in which their monolingual counterparts do. Rather the linguistic structure of both of their languages may influence how they process each of them.

Linguistic background also seems to affect relative sensitivity to consonants in different word positions. In particular, being exposed to English alone gives one an advantage over those exposed only to Spanish when it comes to onset awareness. This might be because of the status of the onset unit in the English language. Being exposed to both English and Spanish does not affect sensitivity to either onset or coda units: bilingual children showed no differences from either of their monolingual counterparts in sensitivity to either onset or coda consonants.

8.4.ii Phonological awareness and reading

The onset unit is important for reading in both English and Spanish. Codas play a more significant role in reading for monolingual children (both English and Spanish) than for bilingual children. Vowel awareness is only related to reading for the bilingual children in Spanish. Interestingly, for the both the Spanish monolingual children and for the bilingual children, age seemed to be the variable most strongly related to reading.

One very interesting finding is that bilingual children who are exposed to and taught about two different orthographies seem to approach reading differently from children exposed to and taught about only one orthography. More specifically, phonemic awareness appears to be of less importance in reading for these bilingual children as compared to their monolingual counterparts in each language. The correlations between phonemic awareness were either fewer (in English) or less strong (in Spanish) for the bilingual children than for the monolingual children. Whether other phonological units are of greater importance for bilingual children, or whether they are using some alternative strategy at this stage in their reading has yet to be determined. This is a point that we shall return to in Chapter 11.

However, it should also be noted that all of the children were at the beginning stages of reading. Hence, the relationship between phonemic awareness and reading might well change as the children become more proficient readers.

CHAPTER 9

EXPERIMENT 4, PART I; THE AWARENESS OF DOUBLE-CONSONANTS

9.1 INTRODUCTION

In this chapter we will look at the first part of an experiment that examined both phonological awareness and reading and spelling of word-medial double-consonants. This chapter will concentrate on the phonological part of the study. The reading and spelling part will be discussed in the next chapter.

Experiments 1, 2 and 3 indicated that only where there is a difference between the structure of English and Spanish does there appear to be a difference in phonological awareness between speakers of these languages. Furthermore, the phonological awareness of bilingual children appears to be directly affected by the structure of the languages to which the children are exposed. Greater phonological sensitivity in Language A (relative to monolingual speakers of Language A) occurs only for those units that are made particularly salient in Language B.

In Experiments 2 and 3 we examined consonant and vowel awareness. Consonant systems do not differ greatly between English and Spanish, whereas vowel systems do. Another difference between the language structures from which might result in a cross-linguistic difference in phonemic awareness, is the way in which children syllabify words.

There are good theoretical reasons why English- and Spanish-speaking children might place syllable boundaries differently. In English, syllable boundaries are 'murky'. There are usually various alternative ways of syllabifying the same word, all of which are acceptable (Derwing, 1993; Stanley-Whitley, 1986; Treiman and Zukowski, 1990). For example, the word 'butter' may be broken up as 'bu' 'tter', 'butt' 'er', or, 'but' 'ter'. The current belief is that where we decide to place the syllable boundary is based on:

- the sonority principle: each syllable must adhere to a sonority contour in which sonority rises to a peak in the middle of the syllable,
- the stressed principle: stressed vowels attract consonants, and,
- the legality principle: certain consonants cannot appear together in the same syllable (e.g. 'nl', 'pc'),

(Treiman and Zukowski, 1990).

These principles merely entail that speakers of English may be more predisposed to syllabify words in one way than in another, but there is no right or wrong way.

In Spanish, on the other hand, each word has one, and only one, possible syllabification (Stanley-Whitley, 1986). If the first consonant is a non-liquid and the second consonant is a liquid, then the double-consonant is a cluster onset of the second syllable (e.g. '*ha<u>bl</u>ar*' → '*ha*'-'*<u>bl</u>ar*'). Under any other condition, a double-consonant is split between syllables (e.g. *ma<u>nt</u>a* → '*ma<u>n</u>*'-'*<u>t</u>a*', *pe<u>rl</u>a* → '*pe<u>r</u>*'-'*<u>l</u>a*').

The way in which a word is syllabified may play a role in the awareness of the sounds within a word. We saw evidence in Chapter 2.3.ii.c that children have difficulty in analysing double-consonants into their constituent elements. These double-consonants were found either at the beginning or at the end of words. However, there is little evidence as to how children cope with double-consonants found in the <u>middle</u> of words. The present experiment looked at this. We predicted that the way in which word-medial double-consonants are analysed might be influenced by how the child syllabifies the word. If syllable boundaries are placed differently in English and Spanish, one might expect to find cross-linguistic differences in awareness of each consonant of word-medial double-consonants. Another aim of the study was to investigate how children would read and spell double-consonants in word-medial positions. The results of this will be discussed in Chapter 7.

Spanish-speakers split words into syllables such that

a) some words have medial double-consonants with one consonant belonging to each syllable (e.g. '*manta*' → '*man*' – '*ta*'). We termed this the 'split' condition since the consonants of the double-consonant are 'split' between syllables;

b) some words have medial double-consonants that are consonant cluster onsets of the second syllable (e.g. '*detras*' → '*de*' – '*tras*'). We termed this the 'joint' condition because the consonants of the double-consonant remain 'joint'.

Using this knowledge, we can make predictions about which consonants Spanish children should be more aware of. The first consonant of 'split' words is the singleton coda of the first syllable (e.g. *mac-tan*). The second consonant of 'split' words is the singleton onset of the second syllable (e.g. *mac-tan*). Since children have greater problems with coda awareness than with onset awareness, it is predicted that children should be more aware of the second than the first syllable in 'split' words. However, this prediction is based on the assumption that Spanish children split syllables into onsets and rimes. Given the findings of the previous experiment and the literature reviewed in Chapter 2.2.i.b the predicted result may not be obtained. If Spanish children split syllables into bodies and codas it is possible that the coda will be more salient than the onset for these children.

The first consonant of 'joint' words is the first consonant of the second syllable cluster onset (e.g. *ma-bran*). The second consonant of 'joint' words is the second consonant of the second syllable cluster onset (e.g. *ma-bran*). Since in onset clusters it is usually the second consonant that looses out to the first (see Chapter 2, 3.iii.c), it was predicted that children would be more aware of first than second consonants of 'joint' words.

In English, on the other hand, since there are no hard and fast rules dictating how to syllabify words, it is less predictable where children will place syllable boundaries. Consequently, it is necessary to take into account English-speaking children's

syllabification strategies before it is possible to make predictions about their relative awareness of the constituent elements of word-medial double-consonants. Derwing (1993), in an experiment examining English-speaking adults' syllabification strategies, found that almost without exception, word-medial double-consonants were split between syllables (e.g. den-tist). However, it is not possible to be sure that young children will choose this same method of syllabification. Hence, all the children were asked to syllabify the test materials, so that their results could be analysed according to where they placed syllable boundaries. We will return to the English children's predictions in Section 9.3.iv.

Another concern of the study was bilingual children's awareness of word-medial double-consonants. If bilingual children adopt either the Spanish or the English method of syllabification in both languages, then they would be expected to perform in a similar manner in both languages. If, on the other hand, they change syllabification strategy according to language, then they would be expected to behave similarly to their monolingual counterparts in each language.

The second and third aims of this experiment were to ascertain how the reading and spelling of medial double-consonants is related to general reading and spelling ability. This would enable further examination of the role that phonemic awareness plays in reading and spelling. Hence, all of the children were administered standardised reading and spelling tests.

9.2 METHOD

9.2.i Participants

Forty monolingual English third- and fourth-grade children (20 boys, 20 girls; age range 7yrs 11mnths - 9yrs 8mnths, mean age 8yrs 10mnths), 40 monolingual Spanish third- and fourth-grade children (25 boys, 15 girls; age range 8yrs 0mnths - 9yrs 11mnths, mean age 8yrs 11mnths) and 40 English-Spanish bilingual third- and fourth-grade children (26 boys, 14 girls; age range 8yrs 1mnth- 9yrs 9mnths, mean age 8yrs 8mnths) took part in the study.

All the children in the study came from relatively middle-class areas. The English monolingual children were all pupils at the same state school in Oxford. The majority of the Spanish monolingual children attended a state school on the outskirts of Madrid. The rest of the Spanish monolingual children attended a private school, also on the outskirts of Madrid. The bilingual children were pupils from two different bilingual schools in Las Palmas de Grán Canaria. Both of the bilingual schools' lessons were conducted purely in English, apart from one-and-a-half-hours of Spanish lessons each day[1]. None of the monolingual children had been instructed in, or were able to speak, any language other than their mother tongue.

[1] The school days in these schools also lasted one-and-a-half hours longer.

9.2.ii Tasks

9.2.ii.a Phonological tasks

Non-words were used so that the same experimental materials could be presented to all three groups of children. The non-words were all six letter disyllabic words with the stress in the first syllable and with double-consonants in the middle.

The vowel sounds, along with the initial and final phonemes were assigned so that the non-words sounded as realistic as possible in both languages. It was not possible to create a set of materials in which each of the non-words in each oddity task shared no letters other than the 'non-target' consonant of the double-consonants. Hence in the phonological awareness task the children were told that the two similar non-words shared a sound in the middle of the word, and that the 'odd-word-out' had a different sound in the middle of the word.

The initial phonemes of the non-words were the five most commonly occurring initial phonemes across both languages (c, p, m, s, and d). The final phonemes were those permissible in both English and Spanish (n, s, d, r, l)[2].

In order to obtain the double-consonants, a list of the most frequently occurring double-consonants in English and Spanish was compiled. From this list a select number of double-consonants were chosen that conformed to the necessary requirements. These requirements are explained below.

Four different types of non-word oddity task were created. Table 9. 1 describes them and gives an example of each. (For a complete list of the experimental materials see Appendix 4). The 'initial-split' task is an onset oddity task. The 'initial-joint' task is a

[2] In Spanish, these are virtually the only possible word-final phonemes.

second consonant of an onset cluster oddity task. The 'final-split' task is a coda oddity task. The 'final-joint' task is a first consonant of a cluster onset oddity task.

Table 9. 1: Phonological materials

Task name	Description of words	Example
Initial	The three words share the first consonant of the double-consonant	
Joint[3]	The double-consonant remains 'joint'. The odd-phoneme-out is the second consonant of the second syllable cluster onset	*ma-<u>bl</u>as po-<u>bl</u>el di-<u>br</u>un*
Split[3]	The double-consonant is 'split' between syllables. The odd-phoneme-out is the singleton onset of the second syllable	*me<u>n-d</u>er pu<u>n-d</u>an si<u>n-c</u>os*
Final	The three words share the final consonant of the double-consonant	
Joint[3]	The double-consonant remains 'joint'. The odd-phoneme-out is the first consonant of the second syllable cluster onset	*ma-<u>bl</u>an po-<u>bl</u>es du-<u>cl</u>ir*
Split[3]	The double-consonant is 'split' between syllables. The odd-phoneme-out is the singleton coda of the first syllable	*me<u>n-t</u>el pu<u>n-t</u>on di<u>s-t</u>ar*

However, it is important to note that the 'joint/split' distinction only applies for the Spanish-speaking children. It is known that in Spanish syllable boundaries are placed such that upon syllabification the non-words will be broken up in the way specified by Table 9. 1. However, in English the same word can be syllabified various alternative ways. Hence we cannot be sure that the English-speakers will be splitting the words in the way specified by Table 9. 1.

[3] N.B. The 'joint/split' distinction is only relevant for the Spanish-speakers. We cannot, a priori, be sure of where the English-speakers will choose to place syllable boundaries.

9.2.ii.b Vocabulary task

The English-speaking children (both monolingual and bilingual) were given the 'BPVS'.

The Spanish-speaking children (both monolingual and bilingual) were given the 'Test de Vocabulario en Imágenes Peabody'.

9.2.ii.c Standardised reading task

The English-speaking children were given the 'Schonell Graded Word Reading Test'.

The Spanish-speaking children were given the 'Test de Análisis de Lectoescritura'.

9.2.ii.d Standardised spelling task

The English-speaking children were given the 'Schonell Graded Word Spelling Test'.

The Spanish-speaking children were given the 'Test de Análisis de Lectoescritura'. Only a part of the entire test was given. This involved the dictation of two short passages, one aimed at Grade 3 children and one aimed at Grade 4 children. All the children in this study were given both passages.

9.2.ii.e Syllabification task

In the syllabification task, the children were asked to syllabify each of the 96 non-words of the phonological awareness task.

9.2.iii Procedure

All tests were individually administered to the subjects by a single experimenter fluent in both English and Spanish. Each of the monolingual children was tested on four occasions, each separated by approximately 24 hours, and each lasting between 15 and 25 minutes, depending on the speed of the child.

The bilingual children were tested in both English and Spanish and hence each child was seen on eight separate occasions. The first four sessions were separated by approximately 24 hours each, and the last four sessions were also separated by approximately 24 hours each. There was a gap of approximately one week between Sessions 1, 2, 3 and 4, and Sessions 5, 6, 7 and 8. Half of the children underwent the first four sessions in English and the second four sessions in Spanish; the other half of the children were tested in Spanish for the first four sessions and in English for the second four sessions. All of the instructions were given in the language of the test.

For all three groups the children were administered the non-word spelling test (see Chapter 10) on one day, followed by the standardised spelling test the following day. They were next given the phonological awareness tasks, and finally the non-word reading task (see Chapter 10).

The tests were administered in the same order for all of the children because it was important for the children to spell the non-words before they had any other exposure to them. This was because prior exposure, either oral or visual, might have helped them in analysing the words correctly (Treiman, 1985). It was also thought important that the children perform the phonological awareness task before they had seen the words visually, so that they would have no visual clues to help them work out why some words were similar and some words were 'odd-ones-out'. Since there were two different sorts of phonological awareness task, 'initial' and 'final', the ordering in which the children

received these two tasks was counterbalanced. No distinction was made between 'joint' and 'split' trials, and the order of the trials was randomised for each child.

The standardised tasks and the syllabification task were administered in conjunction with the non-word tasks according to time considerations. Given that each session was supposed to last a maximum of approximately 25 minutes, each non-word task was administered in the same session as a standardised task that allowed the session to last no longer than the specified time.

9.2.iii.a Phonological awareness tasks

For each of the two tasks (initial and final) the child was given two examples followed by 16 trial sessions. The child scored one point for each correct answer. Half of the words in the 'initial' task were of the 'split' kind and half were of the 'joint' kind. Half of the words in the 'final' task were of the 'split' kind and half were of the 'joint' kind. Hence there was a maximum score of eight points for each of the four different types of task ('initial split', 'initial joint', 'final split', 'final joint').

The oddity task was used (see Chapter 5.3.ii.d for an explanation of how this is administered).

9.2.iii.b Syllabification task

The children received the following instructions: "I am going to give you some words, and I want you to split them in two for me, leaving a gap between the two halves. So for example, if I were to say to you 'paper' you might say to me 'pa'...'per', or 'pap'...'er', or 'pap'...'per'. Do you think you can do that?" The experimenter then read out each non-word at a time and noted down the child's responses.

9.3 RESULTS

9.3.i Vocabulary

As was pointed out in Chapter 5.4.i, it is important to make sure that there are no differences in vocabulary ability between the groups, since this is an indicator of their intellectual ability. Table 9. 2 below shows the mean percentile rank scores for each of the groups on the vocabulary test.

Table 9. 2: Mean percentile rank vocabulary scores for each of the groups

	English monolinguals	Bilinguals in English	Bilinguals in Spanish	Spanish monolinguals
Mean	42.900	3.800	51.075	52.825
s.d.	28.032	6.780	26.537	23.974

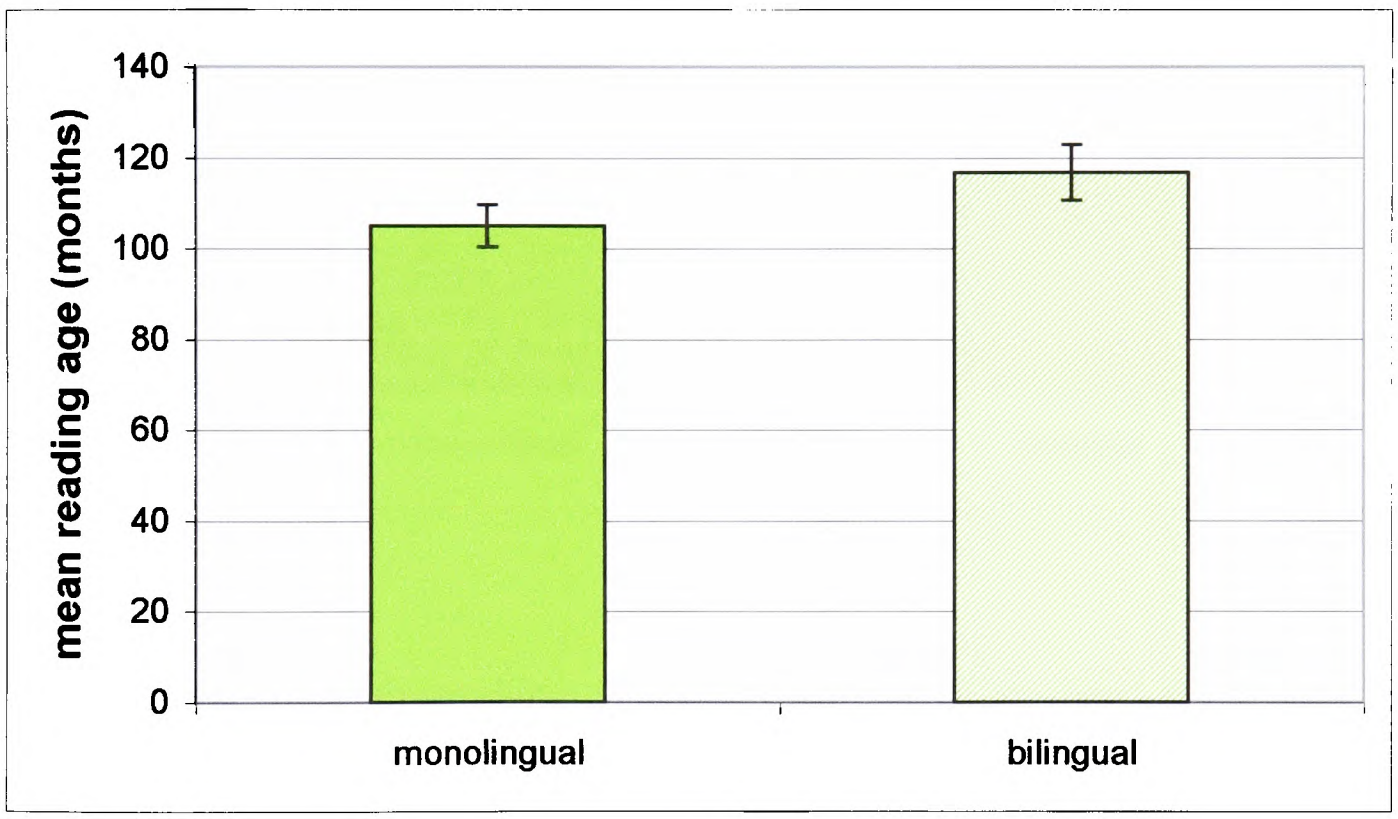
A series of one-way ANOVA's were carried out to see if the differences were significant. We found no difference in receptive vocabulary between the English and Spanish monolinguals ($F[1,79] = 2.896$, $p < 0.093$) or the Spanish monolinguals and the bilinguals in Spanish ($F[1,79] = 0.096$, $p < 0.758$). However, the bilinguals performed worse in English than in Spanish ($F[1,39] = 132.971$, $p < 0.000$) and they performed worse in English than the English monolinguals ($F[1,79] = 73.523$, $p < 0.000$). It is possible that the bilingual children's limited exposure to English is the cause of their poor English vocabulary score. However, the most important comparisons to make are between the English monolinguals, the Spanish monolinguals and the bilinguals in Spanish. From the finding that they all have similar receptive vocabularies, it can be implied that all of the children were of a similar intellectual ability.

9.3.ii Standardised reading

For the standardised reading tasks, the English-speaking children were scored in terms of age in years and months, and the Spanish-speaking children were marked in terms of grade-level. The mean scores for each of the groups can be seen in Figure 9. 1 and Figure 9. 2.

English-Speakers

Figure 9. 1: Mean English reading age for the monolinguals and bilinguals

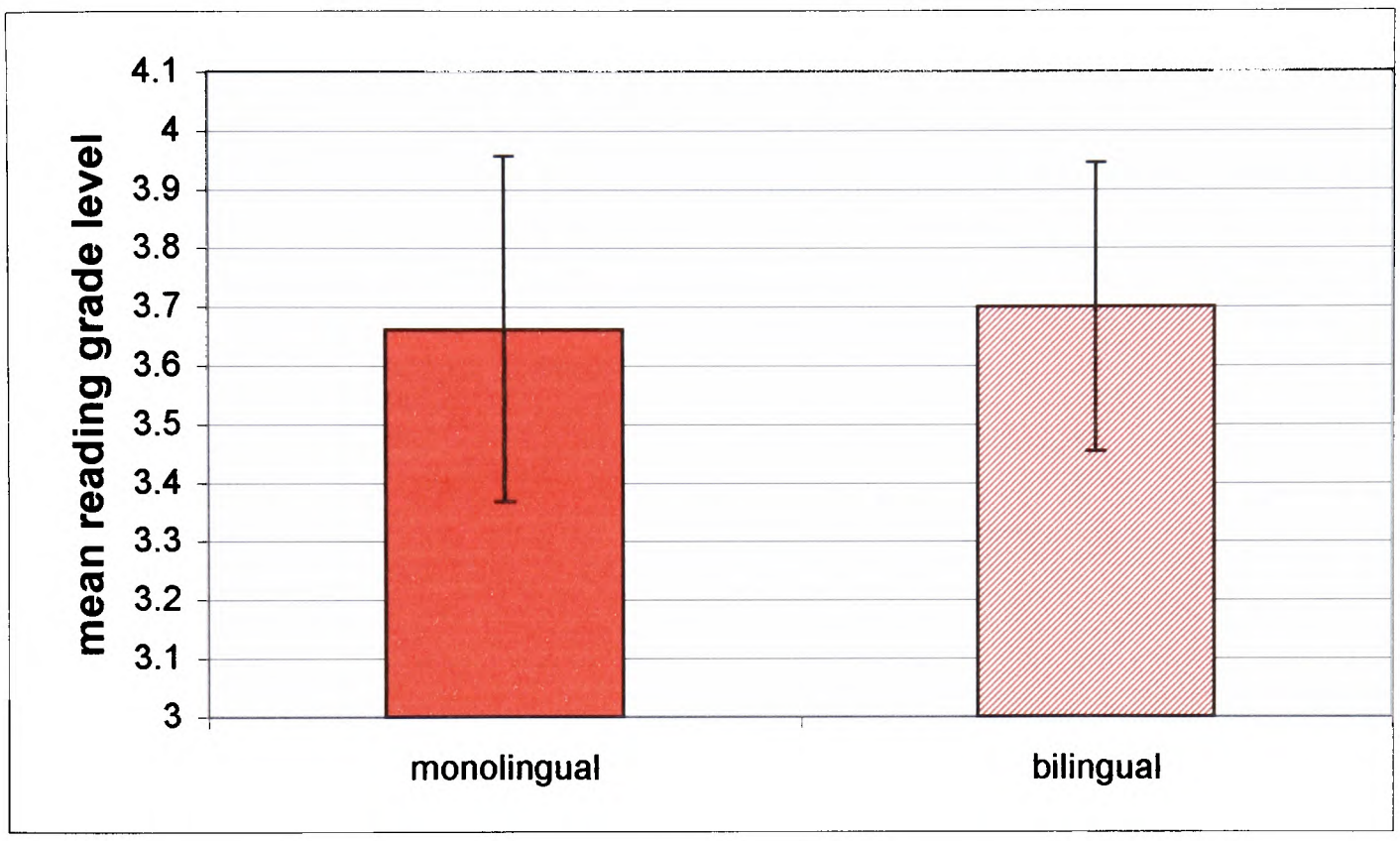


For the English reading test, the mean reading age for the monolingual children was 8yrs 9mnths (s.d. = 14.90mnths), and for the bilingual children the mean reading age was 9yrs 9mnths (s.d. = 20.03mnths). A one-way ANOVA showed that this difference was significant ($F[1,79] = 8.893$; $p < 0.004$). The bilingual children were on average a whole year ahead of their monolingual counterparts at reading in English. Furthermore, since their mean chronological age was 8yrs 8mnths, they were a whole year and one month ahead for their mean age. The mean age of the English monolingual children was 8yrs

10mnths, so they were not significantly below average in reading ability. Rather, the bilingual children were particularly good readers.

Spanish-Speakers

Figure 9. 2: Mean Spanish reading grade-level for the monolinguals and bilinguals



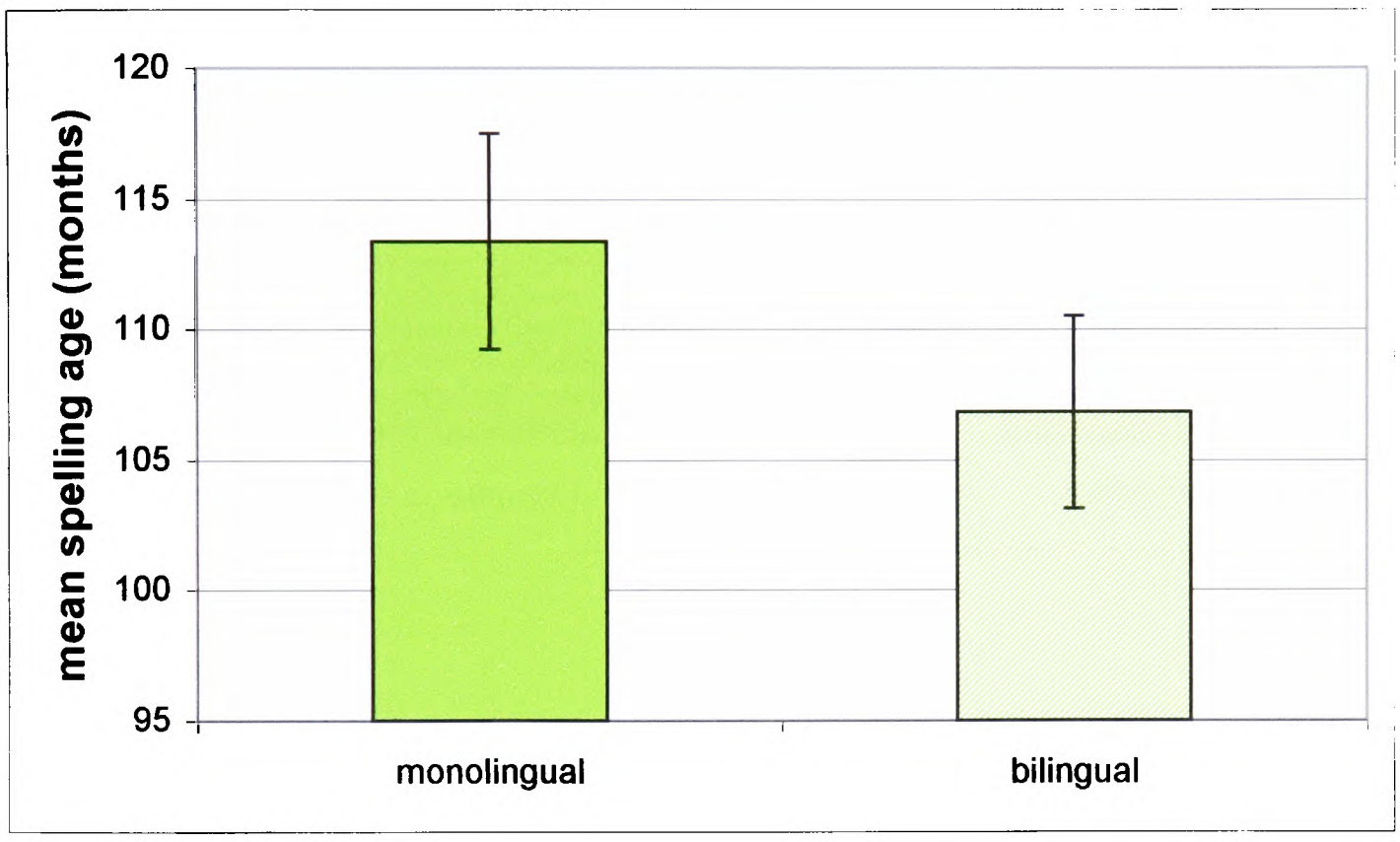
For the Spanish-speaking children, the mean reading grade-level for the monolingual children was 3.66 (s.d. = 0.95), and for the bilingual children it was 3.84 (s.d. = 0.89). A one-way ANOVA showed that this difference was not significant ($F[1,79] = 0.037$; $p < 0.848$). The reading abilities of the monolinguals and bilinguals were very similar.

9.3.iii Standardised spelling

The scores on the standardised spelling tests were converted in to spelling ages in years and months for the English task, and into grade-level for the Spanish task. The mean scores for each of the groups can be seen in Figure 9. 3 and Figure 9. 4.

English-Speakers

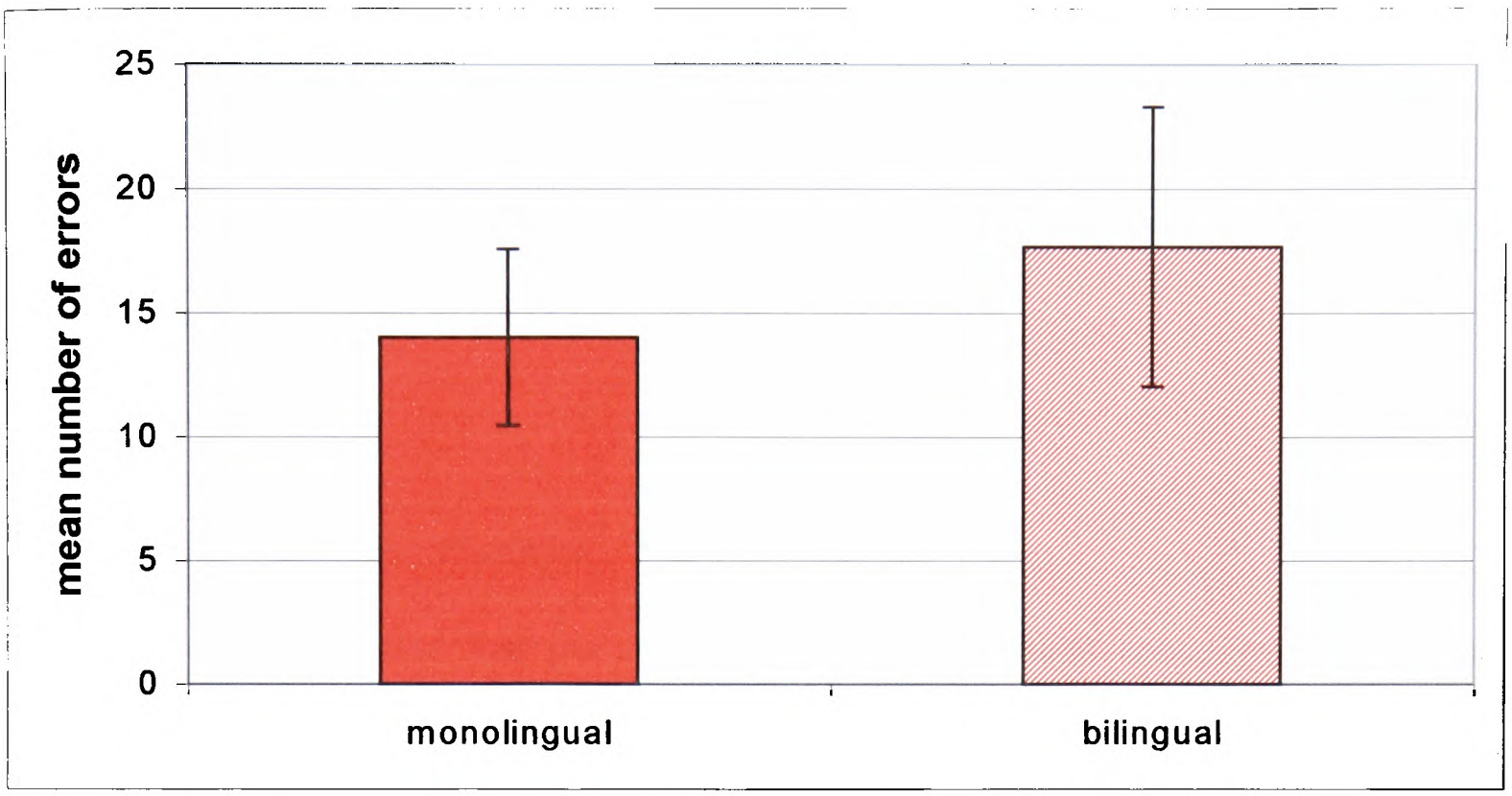
Figure 9. 3: Mean English spelling age for the monolinguals and bilinguals



As can be seen from Figure 9. 3, the English monolinguals achieved a mean spelling age of 9yrs 7mnths (s.d. = 13.34mnths), and the bilingual children obtained a mean age of 8yrs 10 mnths (s.d. = 11.95mnths). A one-way ANOVA showed this difference to be significant ($F[1,77] = 5.27$; $p < 0.024$). The monolingual children were better at spelling than the bilingual children. Note however, that these bilingual children were by no means below average in spelling. Indeed, their mean spelling age (8yrs, 10mnths) actually exceeded their average age (8yrs, 8mnths) by two months. Rather, the monolingual children were 'abnormally' good spellers.

Spanish-Speakers

Figure 9. 4: Mean Spanish number of spelling errors for the monolinguals and bilinguals



The Spanish-speakers' spelling scores were kept as raw scores. This was for two main reasons. Firstly, not all of the children completed both of the dictations. Twenty of the bilingual children (all in Year 3) only completed half of the harder dictation (aimed at a Year 4 spelling level), because they were too tired and their concentration had waned sufficiently for the experimenter to deem them not in a fit state to continue satisfactorily. Secondly, the way in which the spelling test is scored involves taking into account the quality (and not just the quantity) of errors produced. Hence, for a certain type of error (see Chapter 6.2.ii.d for a fuller description of the marking scheme), a child might be at Grade Level 3, whereas for a different error type, the child might be at Grade Level 4. Consequently, it was decided that the best way to compare the children was to use their raw scores for each error type summed over the easier (Grade 3) dictation, and half of the

harder (Grade 4) dictation (in other words, on the dictations that all of the children had completed).

Figure 9. 4 shows how the bilingual children compared with their monolingual counterparts on the T.A.L.E. spelling test. The monolingual children made an average of 14.00 (s.d. = 11.46) errors on the dictations, whereas the bilingual children made an average of 17.66 (s.d. = 17.67) errors on these same dictations. A one-way ANOVA showed this difference was not significant ($F[1,77] = 1.188$; $p < 0.279$). The bilingual children's spelling ability was similar to that of the monolinguals, despite the fact that they had had far less formal spelling training in Spanish.

9.3.iv Syllabification strategies

It was predicted that the awareness of the individual consonants of a double-consonant would be, in part, determined by the syllabification strategy adopted. Linguistic background may affect where individuals choose to place syllable boundaries, and hence may influence the way in which they perceive word-medial double-consonants. Therefore, when analysing the results of the phonological awareness tasks it was important to take into account the different syllabification strategies employed by different children.

The results of the syllabification task identified three alternative syllabification strategies (SS's):

- Syllabification Strategy 1 (SS1): involved splitting the words according to the 'joint' and 'split' categories;
- Syllabification Strategy 2 (SS2): involved splitting all of the words as if they were of the 'split' variety (i.e. each consonant of the double-consonant in the 'joint' words belonged to a different syllable. E.g. '*ma<u>bl</u>as*' → *ma<u>b</u>-<u>l</u>as*).

- Syllabification Strategy 3 (SS3): involved sometimes splitting 'joint' words as was expected, but usually splitting them as if they were of the 'split' variety. 'Split' words were always syllabified as expected.

All of the Spanish monolingual children and the bilingual children (in both languages) fell into SS1. Out of the English monolingual children, on the other hand, two fell into category SS1, 21 fell into SS2, and 17 fell into SS3.

Thus, only two English children syllabified words in the same way as the Spanish and the bilingual children. The rest of the English children chose different syllable boundaries from the Spanish-speakers. In the vast majority of instances they syllabified all of the words so that the double-consonant was split between the syllables. This is in accordance with Derwing's (1993) finding. Even those children who fell into SS3 only rarely syllabified words so that the double-consonant remained 'joint'. Hence, it was decided to discard the data from the two English monolinguals who syllabified words in the same way as the Spanish-speakers and instead compare the 38 English monolinguals who syllabified words differently from the Spanish-speakers against the other groups. It was assumed that the English and the Spanish children were not syllabifying words in the same way. Hence, the choice of where to place syllable boundaries has an effect on the ability to perceive each consonant of a double-consonant, then differences in 'joint' and 'split' tasks should be expected for the Spanish and the bilingual children, but not for the English children.

9.3.v 'New' predictions

Now that it was known how each group of children syllabified the materials used in the phonological tasks, predictions could be made as to how the different groups should perform.

It was predicted that the Spanish children and the bilingual children (in both languages), who syllabified the words according to the 'joint' and 'split' categories, would find the initial-split task easy, the final-joint task relatively easy, and the final-split and the initial-joint tasks difficult.

This was because the initial-split task involved distinguishing a singleton onset. The final-joint task involved distinguishing the first consonant of a cluster onset. Both of these should be relatively easy because, as discussed in Chapter 2.3.iv and 2.3.iii.c, children are sensitive to these phonological units. The final-split task required discriminating a coda consonant and the initial-joint task required discriminating a second consonant of a cluster onset. As discussed in Chapter 2.3.iv and 2.3.iii.c, children are relatively insensitive to these phonemes.

Note that these predictions apply not only to the monolingual and bilingual Spanish-speakers, but also to the bilingual children on the English version of the phonological task. This is because the bilingual children syllabified the English words in the same way as the Spanish-speaking children.

However, this prediction is based on the assumption that Spanish children split syllables into onsets and rimes. Given the findings of the previous experiment and the literature reviewed in Chapter 2.2.i.b the predicted result may not be obtained. If Spanish children split syllables into bodies and codas it is possible that the coda will be more salient than the onset for these children.

The English monolingual children, on the other hand, syllabified the vast majority of words as if they were of the 'split' variety. Hence, one would expect the 'initial' tasks to be easier than the 'final' tasks, and the 'split'/'joint' distinction to play no role. This is because the 'initial' tasks involve distinguishing a singleton onset, whereas the 'final' tasks involve distinguishing a coda. As discussed in Chapter 2.1.i.a, English children are more sensitive to onsets than they are to codas.

These expectations are summarised in Table 9. 3.

Table 9. 3: Level of difficulty of each task dependent on syllabification strategy

Task	Spanish-speakers	Example	English monolinguals	Example
Initial-joint	Hard, because second consonant of cluster onset	ma-**br**an	Easy, because singleton onset	ma**b**-**r**an
Initial-split	Easy, because singleton onset	ma**c**-**t**an	Easy, because singleton onset	ma**c**-**t**an
Final-joint	Easyish, because first consonant of cluster onset	ma-**br**an	Hard, because singleton coda	ma**b**-ran
Final-split	Hard, because singleton coda	ma**c**-tan	Hard, because singleton coda	ma**c**-tan

9.3.vi Phonological awareness tasks

We began by comparing the groups across languages and then went on to compare them within languages.

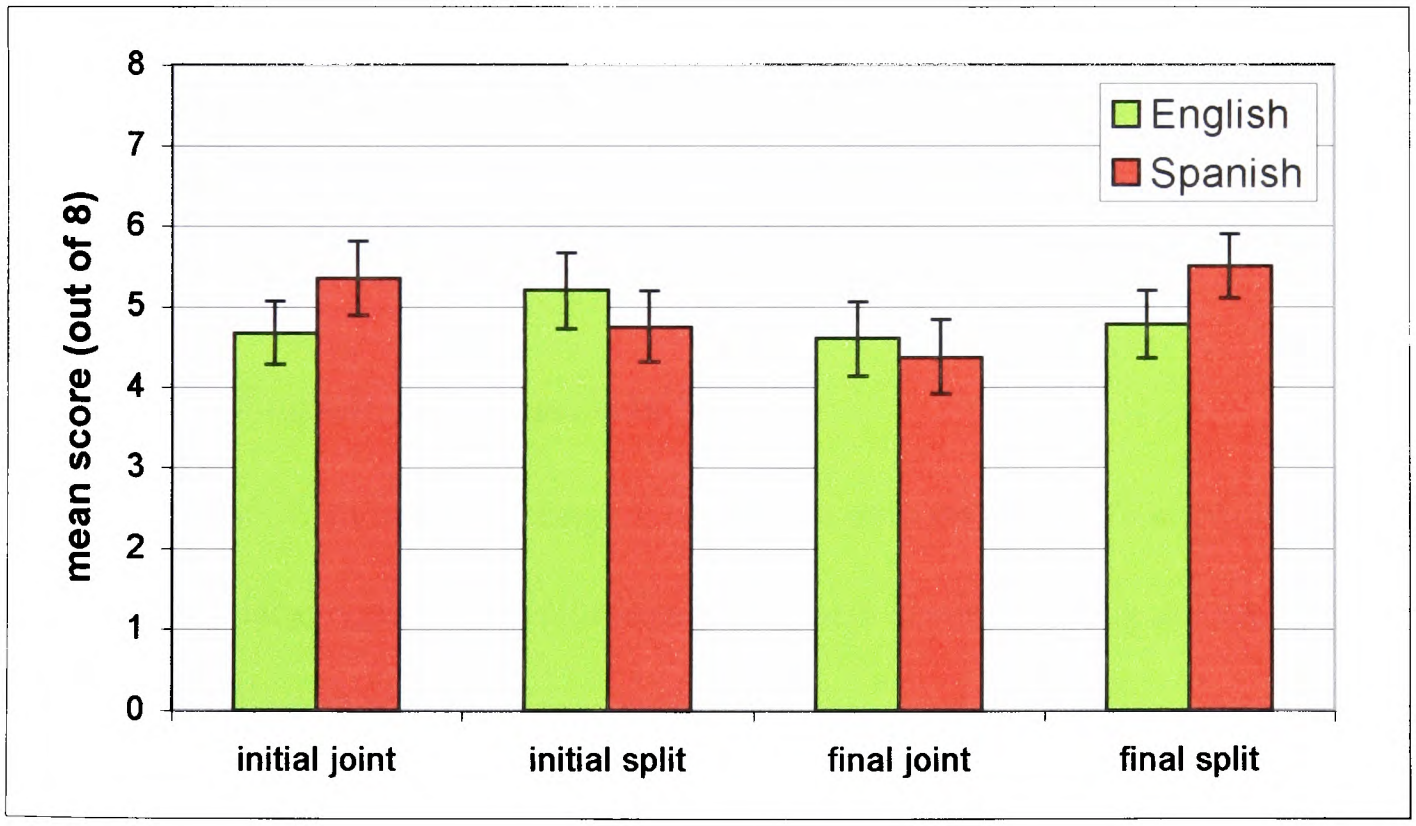
English monolinguals vs. Spanish monolingual

The mean scores for the English monolingual children and the Spanish monolingual children for each of the phonological tasks can be seen in Figure 9. 5. It had been predicted that the English children would find the 'initial' tasks easier than the 'final' tasks, whereas the Spanish children should find the 'initial-split' and 'final-joint' tasks easier than the 'initial-joint' and the 'final-split' tasks. It had been further predicted that there would be no difference in performance was expected between the two groups on the 'split' tasks, but that differences would occur on the 'joint' tasks (refer to Table 9. 3). However, as can be

seen in Figure 9. 5, the differences between the groups and between the different tasks are quite small.

The results were analysed by means of a three-way ANOVA with Shared Consonant Position (initial, final) and Syllabification (joint, split) as the within subjects factors, and Group (English monolingual, Spanish monolingual) as the between subjects factor. There were no main effects of Shared Consonant Position ($F[1,76] = 1.587$; $p < 0.212$), Syllabification ($F[1,76] = 2.704$; $p < 0.104$), or Group ($F[1,76] = 1.32$; $p < 0.291$). There were interactions of Syllabification by Shared Consonant Position ($F[1,76] = 4.550$; $p < 0.036$) and Shared Consonant Position by Syllabification by Group ($F[1,76] = 13.153$; $p < 0.001$).

Figure 9. 5: Mean phonological awareness task scores for the English and Spanish monolinguals



A post-hoc Newman Keul's test showed that the Shared Consonant Position by Syllabification by Group interaction was caused by the Spanish children performing better on the 'split' than the 'joint' task in 'final' conditions ($p < 0.05$), whereas this difference

was not significant for the English children. The post hoc-test also showed that the Spanish children were better at the 'initial-joint' than at the 'final-joint' task ($p < 0.05$).

The results for the Spanish children are not as predicted. If children are using syllable boundaries to help them with the task, then the opposite result would have been predicted. The 'initial-joint' task required the children to distinguish the second consonant of a cluster onset. The 'final-split' task required them to distinguish the coda of the first syllable. The 'final-joint' task required them to distinguish the first consonant of a cluster onset. The 'final-joint' task had been expected to be the easiest, but instead turned out to be the hardest. The finding suggests either that children are not using their knowledge of syllable boundaries to help them do the task, or that Spanish children are more aware of coda consonants and second consonants of cluster onsets than they are of first consonants of cluster onsets. Possible explanations of this finding will be discussed in Section 9.4.

No significant differences between any of the tasks were found for the English children. This finding was not as predicted, and suggests that syllabification does not play a role in double-consonant awareness for these children.

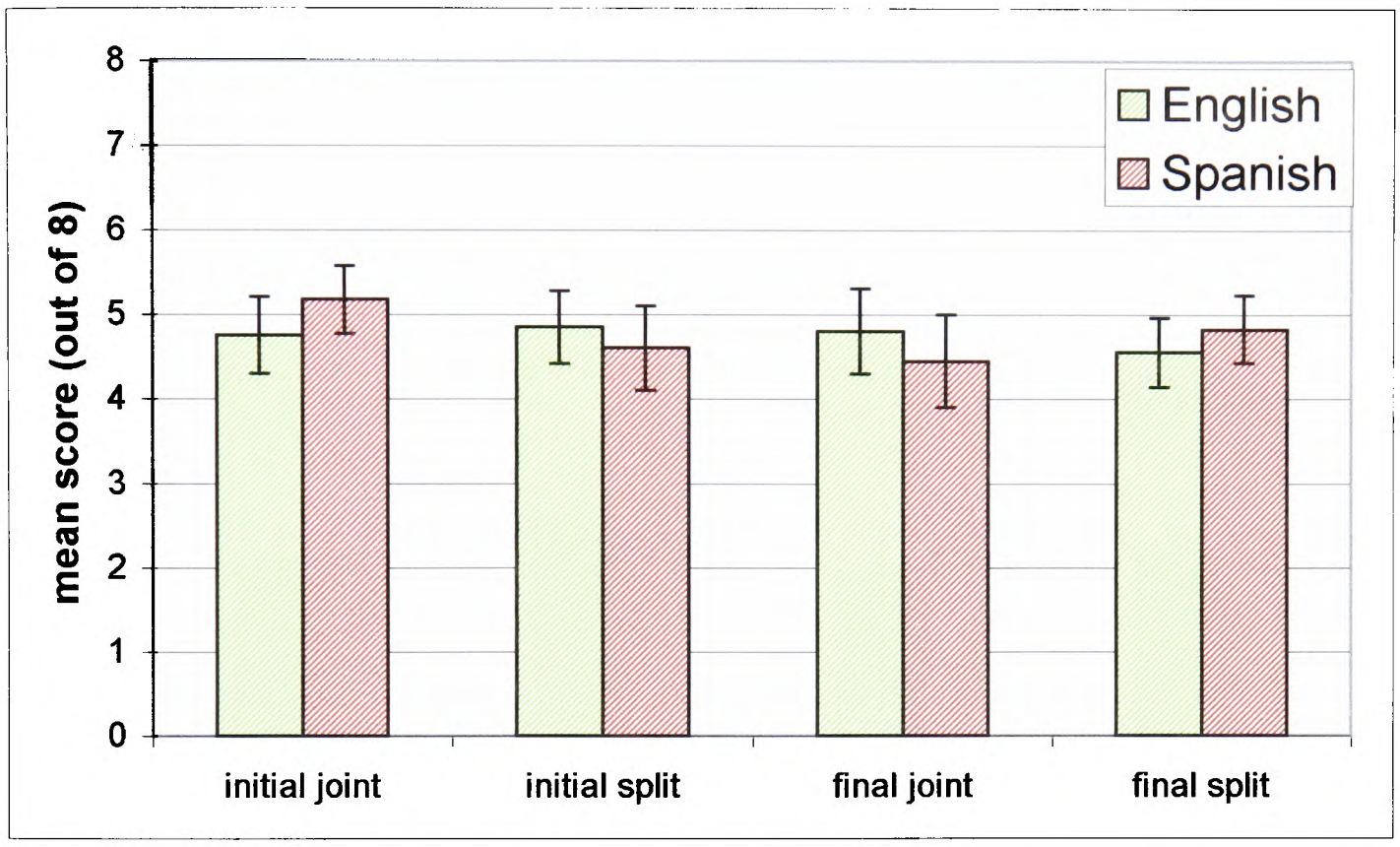
Bilinguals in English vs. bilinguals in Spanish

Figure 9. 6 shows the bilingual children's performance on the phonological tasks in each of their languages. The children performed similarly both across tests and across languages. Given that the children syllabified the words in the same way in English and Spanish, no cross-linguistic differences were expected. However, a difference in performance between the tests in both languages had been anticipated (refer to Table 9. 3).

The results were analysed by means of a three-way repeated measures ANOVA with Shared Consonant Position, Syllabification and Language (English, Spanish) as within subjects variables. There was no main effect of Shared Consonant Position ($F[1,39] =$

1.216; $p < 0.277$), Syllabification ($F[1,39] = 0.256$; $p < 0.616$) or Language ($F[1,39] = 0.019$; $p < 0.892$). However, there was an interaction of Syllabification by Shared Consonant Position by Language ($F[1,39] = 7.481$; $p < 0.009$).

Figure 9. 6: Mean phonological awareness task scores for the bilinguals in English and Spanish



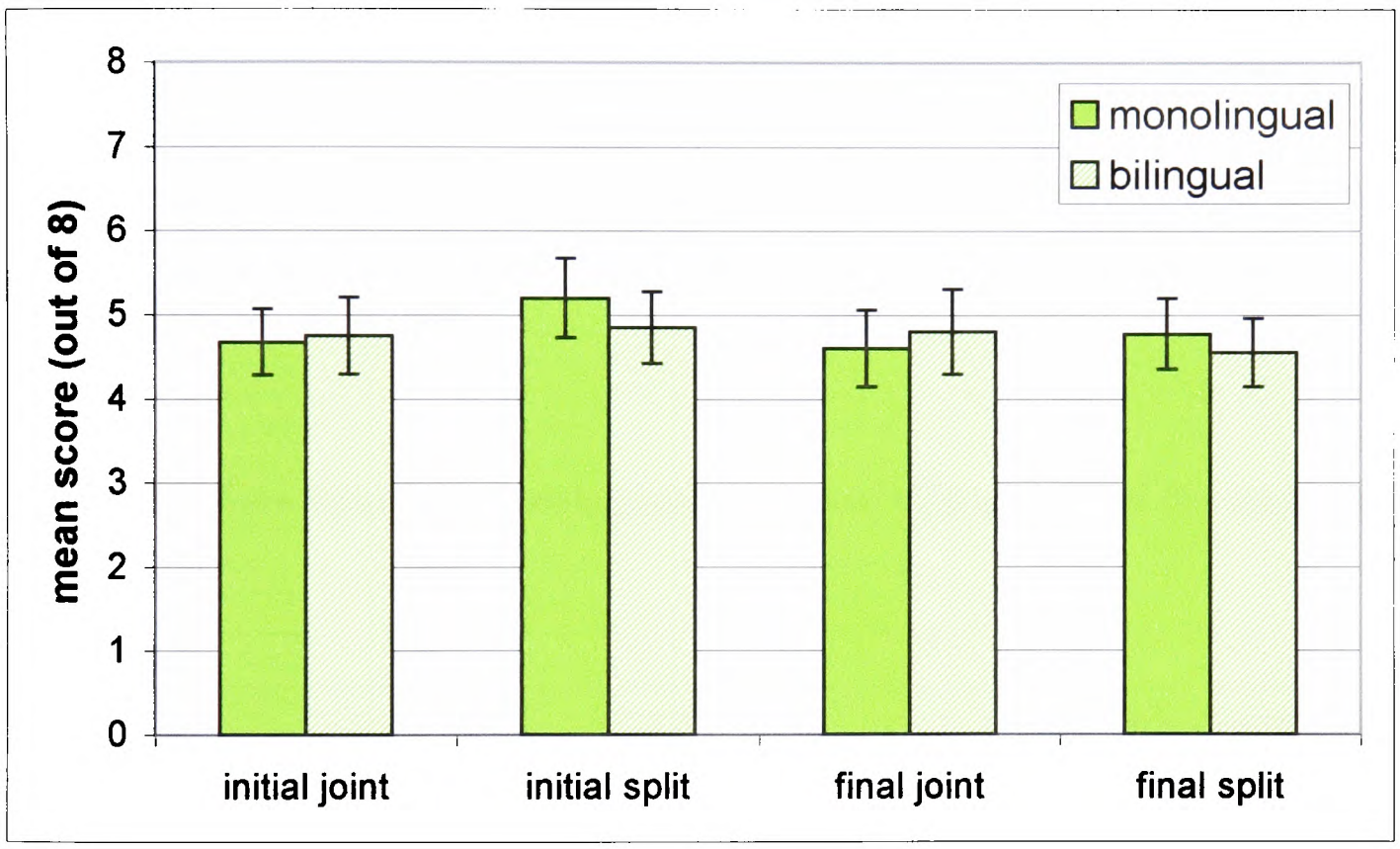
A post-hoc Newman Keul's test showed no informative significant differences that could have caused this interaction. Contrary to our prediction, the bilingual children's awareness of the individual consonants of word-medial double-consonants was not significantly affected by their knowledge of syllable boundaries. This was true in both English and Spanish.

English monolinguals vs. bilinguals in English

Figure 9. 7 shows the mean scores of the English monolingual children and the bilingual children on the English phonological awareness tasks. It had been predicted that the groups would perform differently on the 'joint' tasks due to the differences in

syllabification strategy. It had been further anticipated that the monolingual children would perform better on the 'initial' than on the 'final' tasks, and that the bilingual children would perform better on the 'initial split' and 'final joint' than on the 'final split' and 'initial joint' tasks (refer to Table 9. 3). However, Figure 9. 7 shows that the differences between the groups and across the tasks were very small.

Figure 9. 7: Mean English phonological awareness task scores for the monolinguals and bilinguals



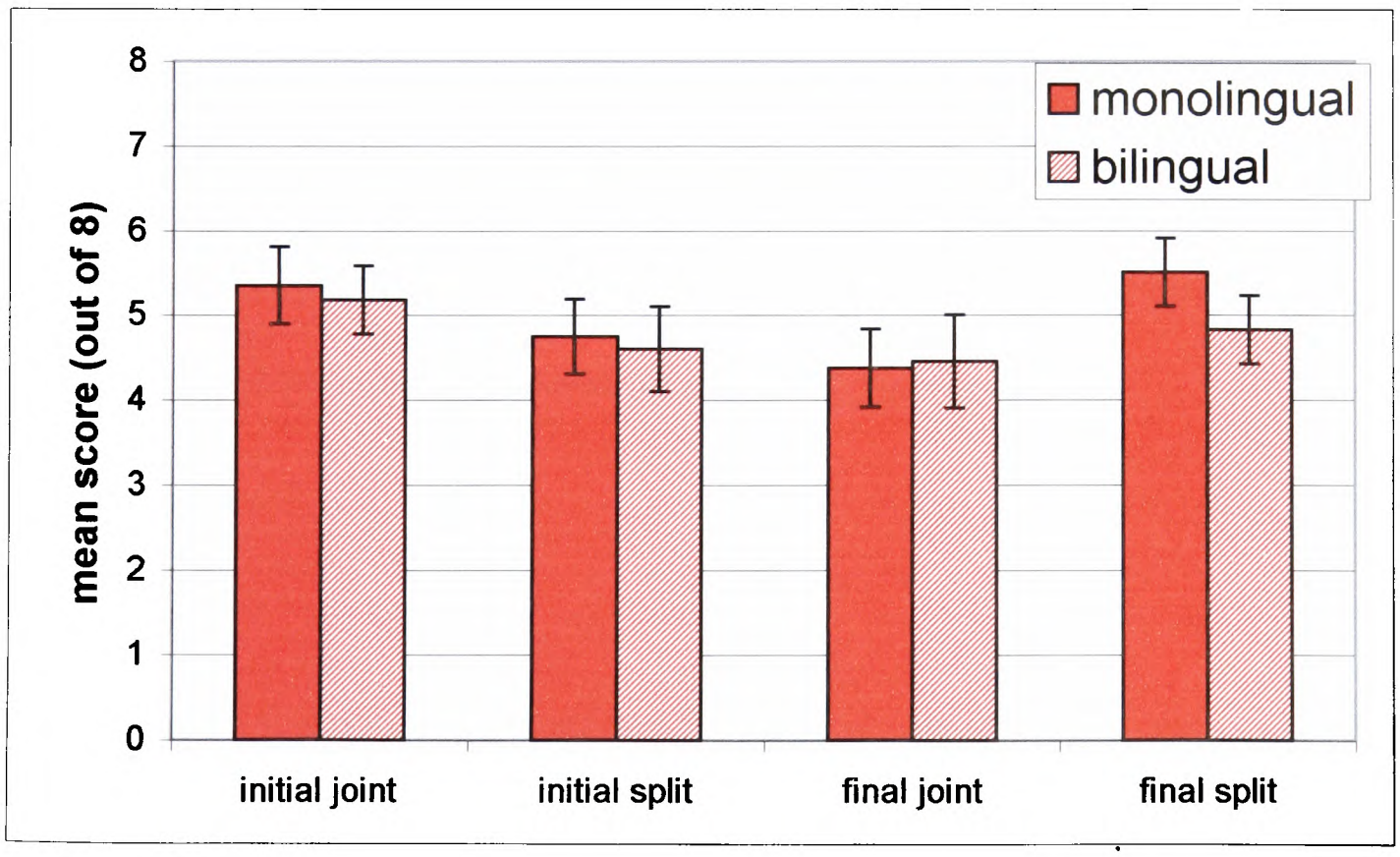
The results were analysed by means of a three-way ANOVA with Shared Consonant Position and Syllabification as the within subjects factors, and Group as the between subjects factor. There were no main effects of Shared Consonant Position ($F[1,76] = 2.044$; $p < 0.157$) or Syllabification ($F[1,76] = 0.609$; $p < 0.438$) or Group ($F[1,76] = 0.172$; $p < 0.679$). The children performed similarly on each of the phonological tasks. Furthermore, there were no significant differences between the performance of the two groups on any of the tasks. It would appear that syllable boundaries do not influence

either group's ability to distinguish the individual consonants of word-medial double-consonants.

Spanish monolinguals vs. bilinguals in Spanish

The results for the monolingual and the bilingual children on the Spanish phonological awareness tasks are shown in Figure 9. 8. There were very few differences in performance on each of the phonological tasks between the groups. This had been anticipated, since both groups of children syllabify words in the same way. However, there were also no large differences between the performance of each individual task for either group. It had been anticipated that certain tasks would be easier than others. In particular, we had predicted that those tasks involving the discrimination of singleton onsets or first consonants of cluster onsets would be particularly easy (refer to Table 9. 3).

Figure 9. 8: Mean Spanish phonological awareness task scores for the monolinguals and bilinguals



The data were analysed by means of a three-way ANOVA with Shared Consonant Position and Syllabification as the within subjects factors, Group as the between subjects

factor. There were no main effects of Shared Consonant Position ($F[1,78] = 0.224$; $p < 0.638$), Syllabification ($F[1,78] = 1.19$; $p < 0.279$) or Group ($F[1,78] = 2.032$; $p < 0.158$). However, there was an interaction of Shared Consonant Position by Syllabification ($F[1,78] = 18.303$; $p < 0.000$). A post-hoc Newman Keul's test showed that this interaction was caused by the 'final-split' task being easier than the 'final-joint' task, whereas the 'initial-joint' task was easier than the 'initial-split' task. The 'initial-joint' task was also easier than the 'final-joint' task, whereas there was no difference in performance on the 'initial-' and 'final-split' tasks (all $p < 0.05$).

Since it is known how these children were syllabifying the words, the results may be interpreted in the following manner. It was easier to detect the second consonant of a second syllable cluster onset than it was to detect both the first consonant of the cluster or a second syllable singleton onset. It was also easier to detect the coda of the first syllable than to detect the first consonant of a second syllable cluster onset. These results were not as predicted. We shall interpret them in Section 9.4.

9.3.vii The relationship between phonological awareness and reading ability

Previous research has shown that phonemic awareness and reading ability are correlated (see Chapter 3.1.i.c and 3.2.ii.b). Hence we predicted that reading ability would be correlated with phonological scores for each of the groups.

Monolinguals

Table 9. 4 shows the correlation between the phonological awareness tasks and standardised reading ability for the English and Spanish children. None of the phonological tasks was significantly correlated with reading ability for either the English or

the Spanish children. This suggests that the awareness of the consonants in word-medial double-consonants is not related to reading ability for English and Spanish children.

Table 9. 4: Spearman's rank correlations of the phonological tests with reading ability for the monolingual children

Phonological task	Initial-joint	Initial-split	Final-joint	Final-split
Standardised reading				
English	-0.019	-0.028	0.015	-0.012
Spanish	0.068	0.106	0.231	-0.130

Bilinguals in English and Spanish

Table 9. 5: Spearman's rank correlations of the phonological tests with reading ability for the bilingual children

	Standardised reading	English	Spanish
	Phonological test		
English	initial-joint	0.133	0.44
	initial-split	0.016	0.117
	final-joint	0.003	-0.140
	final-split	-0.016	-0.154
Spanish	initial-joint	0.122	-0.168
	initial-split	0.370*	0.305
	final-joint	0.146	0.289
	final-split	0.329*	0.233

* Correlation is significant at the 0.05 level

Table 9. 5 shows how the phonological tasks and standardised reading abilities in each of the bilingual children's languages are correlated. Reading ability and phonological tasks are not correlated in Spanish or in English. However, awareness of singleton onsets and codas in Spanish (initial-split and final-split, respectively) is correlated with reading ability in English. In Experiment 3 we found the same relationship between onset awareness and reading ability but not between coda awareness and reading ability.

9.3.viii The relationship between phonological awareness and spelling ability

Previous research has shown that phonemic awareness and spelling ability are correlated (see Chapter 4.1.i.a and 4.2.ii and 4.2.iii). Hence we predicted that spelling ability would be correlated with phonological scores for each of the groups.

Monolinguals

Table 9. 6 shows the correlation between the phonological awareness tasks and standardised spelling ability for the English and Spanish children.

Table 9. 6: Spearman's rank correlations of the phonological test with spelling ability for the monolingual children

Phonological test	Initial-joint	Initial-split	Final-joint	Final-split
Standardised reading				
English	0.064	-0.016	0.275	-0.160
Spanish	-0.132	0.369*	-0.375*	-0.122

* Correlation is significant at the 0.05 level

None of the phonological tasks was significantly correlated with spelling ability for the English children. This suggests that the awareness of the consonants in word-medial

double-consonants is not related to standardised spelling ability for English children. The Spanish children showed a positive correlation between 'initial-split' (singleton onset) awareness and spelling, but a negative correlation between 'final-joint' (first consonant of cluster onset) awareness and spelling. This finding is difficult to interpret.

Bilinguals in English and Spanish

Table 9. 7 shows how the phonological tasks and standardised spelling abilities in each of the bilingual children's languages are correlated. Spelling ability and phonological tasks were not correlated in Spanish or in English. However, awareness of singleton codas in Spanish (final-split) was correlated with spelling ability in English.

Table 9. 7: Spearman's rank correlations of the phonological tests with spelling ability for the bilingual children

	Standardised spelling	English	Spanish
	Phonological test		
English	**initial-joint**	-0.272	0.052
	initial-split	0.072	0.101
	final-joint	-0.172	0.220
	final-split	0.012	0.066
Spanish	**initial-joint**	0.242	-0.230
	initial-split	0.292	-0.238
	final-joint	0.035	0.155
	final-split	0.359*	-0.153

* Correlation is significant at the 0.05 level

9.4 DISCUSSION

This experiment aimed to determine whether awareness of the constituent consonants of word-medial double-consonants is affected by the way in which a word is syllabified. English monolinguals, Spanish monolinguals and Spanish-English bilinguals were asked to syllabify the words that were used in the phonological task, in order to determine in which way the three groups' syllabification strategies differed. It was found that the Spanish-speaking children adhered to the clear-cut syllable boundaries of Spanish. Furthermore, the bilingual children used the same method of syllabification in English and Spanish. The English monolingual children, on the other hand, syllabified the vast majority of words so that each consonant of the double-consonant belonged to a different syllable.

The English monolingual children were expected to perform better on the 'initial' than the 'final' tasks. This was because, according to their method of syllabification, the 'initial' tasks required the children to discriminate between singleton onset consonants, whereas the 'final' tasks required them to discriminate between singleton coda consonants. For the Spanish monolinguals, on the other hand, we tentatively speculated that they would find those tasks involving discriminating singleton onsets ('initial-split') or the first consonant of cluster onsets ('final-joint') easier than those involving the awareness of codas ('final-split') or the second consonant of clusters ('initial-joint').

We also predicted that the differing syllabification strategies would result in differences between the English and Spanish monolinguals for those words which they syllabified differently: the 'joint' words. The same results were expected for those words that were syllabified in the same way by the two groups: the 'split' words.

Regarding the bilingual children, it was also predicted that, if differences exist between the monolingual speakers' awareness of word-medial double-consonants as a

consequence of the differences in their syllabification strategies, then bilingual children would transfer awareness across languages.

Both monolingual and bilingual Spanish-speaking children were found to be more aware of second consonants of onset clusters (initial-joint) than first consonants of clusters (final-joint). This finding was not as predicted. However, a possible explanation might be that when pronouncing the cluster onset of the second syllable, the first consonant tends to get 'swallowed'. It is not dropped entirely, but it may well be less audible than the consonant that follows it, the second consonant of the cluster.

Furthermore, Spanish monolinguals were found to be more aware of coda consonants (final-split) than both singleton onset consonants (initial-split) and first consonants of cluster onsets (final-joint). This finding was also surprising, since it had been anticipated that onsets would be easier to detect than codas. However, as was alluded to in the introduction, the original predictions may have been misguided. If, as was hypothesised in Chapter 2.2.i.b, the syllable's internal structure is at the body-plus-coda level in Spanish, then Spanish-speakers should be more aware of codas than of onsets. The present finding thus lends support to the theory that Spanish-speakers phonologically underpin the syllable at the body/coda level.

Hence, there is evidence that how children syllabify words affects their ability to distinguish the individual consonants of word-medial double-consonants in Spanish.

The bilingual children showed no difference in performance on any of the English versions of the tasks. This was not as we predicted. However, it is an interesting result since it suggests that the same method of gaining phonological awareness is not being used in English and Spanish for bilingual speakers. Whereas in Spanish, knowledge of syllables may play a role, in English this does not appear to be the case, despite the fact that the children appeared to be using the same syllabification strategy across languages.

The English monolingual children also showed equal awareness of each consonant of word-medial double-consonants regardless of the task. This was not in line with our prediction. It suggests that English children do not use their awareness of syllables to increase their sensitivity to consonants found in the middle of words. However, this finding is not entirely contrary to the original prediction. In English, syllable boundaries are not clear: there are often various alternative ways of syllabifying a word. Although when children are forced to syllabify a word, as in the syllabification task, they will give some answer, this does not necessarily mean that they would always syllabify the word in this way. For English children it seems more likely that syllables have less 'psychological reality' than they do for Spanish children, precisely because of the differences in structure of the two languages.

From these results it would appear that Spanish-speakers do use their knowledge of syllable boundaries to help them analyse word-medial consonant clusters, whereas English-speakers do not. However, the question of real interest is whether using syllable knowledge can increase the ability to analyse double-consonants, and hence be more aware of the individual consonants that constitute them. In other words, does the different approach to phonological analysis that English and Spanish-speakers take result in different degrees of awareness between them? To determine whether or not this is the case, the children's performance was compared across languages.

Contrary to the predictions no differences in the awareness of word-medial double-consonants were found between the English monolingual and the Spanish monolingual children. This finding implies that using knowledge of syllable boundaries does not lead to an advantage in awareness of word-medial consonants.

Since no advantage was found for either of the monolingual groups, transfer of awareness should not be expected for the bilingual children. Instead, their performance

would be expected to be similar to that of their monolingual counterparts in each language. This is precisely what was found.

9.4.i Summary

Although there were no significant differences between the groups' abilities in analysing double-consonants, some cross-linguistic differences were found. Spanish-speakers are influenced both by the way in which they syllabify words and by the hierarchical organisation of the Spanish syllable. English-speakers, on the other hand, use neither their knowledge of syllable boundaries, nor their knowledge of the internal organisation of the English syllable to help them analyse word-medial double-consonants.

CHAPTER 10

EXPERIMENT 4, PART II: READING AND SPELLING DOUBLE-CONSONANTS

10.1 INTRODUCTION

In Chapter 9 it was seen that Spanish-speakers' ability to analyse word-medial double-consonants into their constituent consonants was affected by their knowledge of syllable boundaries. English-speakers, on the other hand, were not affected by their awareness of syllables. However, it was also found that English and Spanish monolinguals and bilingual-speakers all showed similar sensitivity to the individual consonants of double-consonants.

The study not only investigated whether children from the three different linguistic backgrounds are aware of the two consonants of word-medial double-consonants. Another concern was their ability to read and spell these double-consonants. The fourth and fifth aims of Experiment 4 were, thus, to determine whether syllabification strategy affects the ability to read and spell each consonant of word-medial double-consonants. The same predictions for the phonological tasks apply to reading and spelling. It was expected that the way in which children syllabify words would affect their ability to read and spell each of the consonants of the double-consonant.

Since the English monolingual children syllabified the vast majority of words in exactly the same way, we predicted that their performance on the 'joint' and 'split' words would be the same. They were expected to represent the second consonant of the double-consonant more often than the first consonant. This is because the second consonant, on syllabifying the word, becomes a singleton onset (e.g. *mactan* → *ma<u>c</u>-<u>t</u>an*); the first consonant becomes a singleton coda (e.g. *mactan* → *ma<u>c</u>-tan*).

For the Spanish monolingual children, and the bilingual children in both English and Spanish, the same results were expected as for the English monolingual children for the 'split' words. In other words, they were expected to be more able to represent the second than the first consonant of the double-consonant. This is because all of the groups syllabified 'split' words in exactly the same manner. For the 'joint' words, on the other hand, the opposite result was expected: we predicted that the second consonant of the double-consonant would be represented less often than the first consonant. This is because for the 'joint' words, on syllabification, the first consonant becomes the first consonant of a cluster onset (e.g. *mablan* → *ma-**b**lan*), whereas the second consonant becomes the second consonant of a cluster onset (e.g. *mablan* → *ma-**bl**an*).

Finally, English and Spanish monolingual children were expected to differ in their ability to read and spell the consonants of those words they syllabify differently: the 'joint' words. Differences were also anticipated between the English monolingual and the bilingual children's ability to read and spell the medial consonants of 'joint' words. This is because the bilingual children placed syllable boundaries of the 'joint' words in the same place as the Spanish-speakers. The English monolingual children, on the other hand, syllabified the vast majority of 'joint' words as if they were 'split'. By contrast, no differences in reading and spelling were expected between those groups that place syllable boundaries in the same place. Specifically, no differences were expected between the Spanish monolingual children and the bilinguals in Spanish, and no differences were expected between the bilinguals in Spanish and English.

In order to determine whether knowledge of syllable boundaries affects the ability to represent each consonant of a word-medial double-consonant, each group of children was asked to read and to spell two thirds of the experimental materials used in the oddity task.

The final aim of this experiment was to determine the relationship between children's ability to 'hear' phonemic differences between words that either share or do not share consonants of word-medial double-consonants, and their ability to read and spell those same double-consonants. This would enable us to further understand the nature of the relationship between the processing of sounds and the ability to represent them graphically (in spelling) and orally (in reading). If a direct relationship exists between awareness of a sound and the ability to read and spell it, then correlations would be expected between the children's phonological awareness scores and their double-consonant non-word reading and spelling scores. In particular, the study aimed to investigate whether there would be a direct correspondence between the awareness of each of the consonants of double-consonants and the ability to spell and read that particular consonant. For example, does the awareness of the first consonant of a 'split' double-consonant lead to a greater ability to read and spell it?

10.2 METHOD

10.2.i Participants

The participants of this study were the same children as those described in Experiment 4, Chapter 9.2.i.

10.2.ii Tasks and procedure

The procedure is described in Chapter 9.2.iii.

10.2.ii.a Non-word reading task

The non-words used were 64 of the 96 non-words that had been used in the phonological awareness task. Half of these were 'joint' words and half were 'split' words. Each child was encouraged to read as quickly as possible but without making any mistakes. The answers given were written down on the spot by the experimenter and also tape recorded and later transcribed. It should be noted that the bilingual children were asked to read the same set of non-words on two separate occasions, once in English and once in Spanish. The experimenter emphasised in which language the child was supposed to read them in.

Only errors in the reading of the double-consonants were of interest in this experiment. Hence the answers were marked according to whether the first or second consonant was omitted on the joint and split words. One point was given for each consonant omitted.

10.2.ii.b Non-word spelling task

The non-words used were 64 of the 96 non-words used in the phonological awareness task. Half of these were 'joint' words and half were 'split' words. The spelling test was conducted in the classroom with the teacher present. The children were told that they had to write down some words that they would not have heard before. They were encouraged to listen carefully to the sounds in the words. Each word was then read twice and the children had to write it down.

It should be noted that the bilingual children were asked to spell the same set of non-words twice, once in English and once in Spanish.

Only errors in the spelling of the double-consonants were of interest in this experiment. Hence the answers were marked according to whether the first or second consonant was omitted on the joint and split words. One point was given for each consonant omitted.

10.3 RESULTS

10.3.i Non-word reading: double-consonant omission errors

The non-word reading data were analysed in terms of omission errors made on reading the word-medial double-consonants. Only omission errors were examined, rather than all error types, on the assumption that if a child omits a consonant it is because she or he does not know how to put two consonants together to form a double-consonant. Other errors, such as adding an extra consonant or substituting one consonant for another, could be due to a variety of factors. Since the predictions were based on the children's ability to represent consonants as a function of their awareness of them, the only errors that are relevant are omission errors.

The only relevant distinction between the non-words was the 'joint'/'split' distinction. The 'initial' and 'final' distinction was not relevant because the children were reading each non-word individually, rather than comparing them (as they had been doing in the phonological tasks). Hence, for each double-consonant error, the type of non-word ('joint' or 'split') was noted along with whether it was the first or second consonant that had been omitted. Hence, there were four possible types of error: joint first consonant, joint second consonant, split first consonant and split second consonant.

It was predicted that all children should perform the same on the 'split' words. They were all expected to omit the first consonant (a singleton coda) more often than the second consonant (a singleton onset). The English children were expected to behave differently from the other groups on the 'joint' tasks because they syllabified these words differently from the other groups. They were expected to make the same pattern of errors as for the 'split' tasks. The Spanish monolingual children and the bilingual children in both English and Spanish were expected to omit the second consonant (second consonant of a

cluster onset) more often than the first consonant (first consonant of a cluster onset) on the 'joint' words.

Comparisons were first made across languages (i.e. English-speaking vs. Spanish-speaking) and the groups within languages were then compared (i.e. monolingual vs. bilingual).

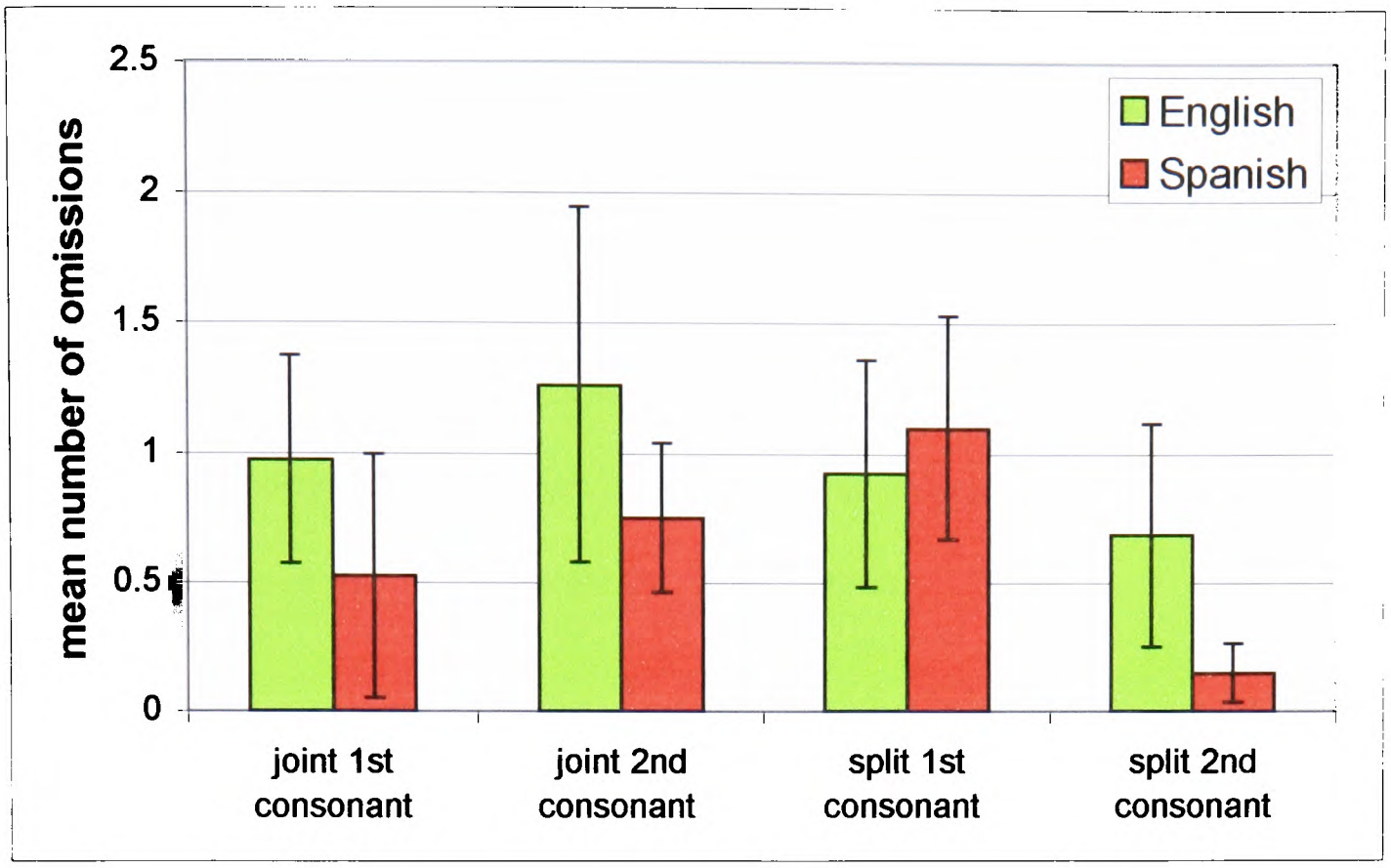
Our data violate the assumptions of normality and homogeneity of variance that analysis of variance makes. However, using non-parametric tests would not allow us to look at within-group differences and interactions. Nor would it allow us to compare the bilingual children across languages. Furthermore, there are good reasons to believe that our analysis is robust to violations of the assumptions. See Appendix 5 for a full explanation.

English monolinguals vs. Spanish monolinguals

Figure 10. 1 shows the English monolingual and the Spanish monolingual children's omission errors for each of the consonants for each of the phonological tasks. The Spanish children made fewer errors than the English children on all of the tasks apart from the first consonant of 'split' non-words.

Moreover, the Spanish children show the pattern of results predicted for them. They were more likely to omit the second consonant of a 'joint' word than they were to omit the first consonant, and they were also more likely to omit the first consonant of a 'split' word than they were the second consonant. The English monolingual children also performed as was predicted for the 'split' words: they omitted the first consonant more often than the second consonant, but, they performed in the opposite way to that predicted for the 'joint' words. They omitted the second consonant of 'joint' words more often than the first consonant.

Figure 10. 1: Mean non-word reading omission errors for the English and Spanish monolinguals



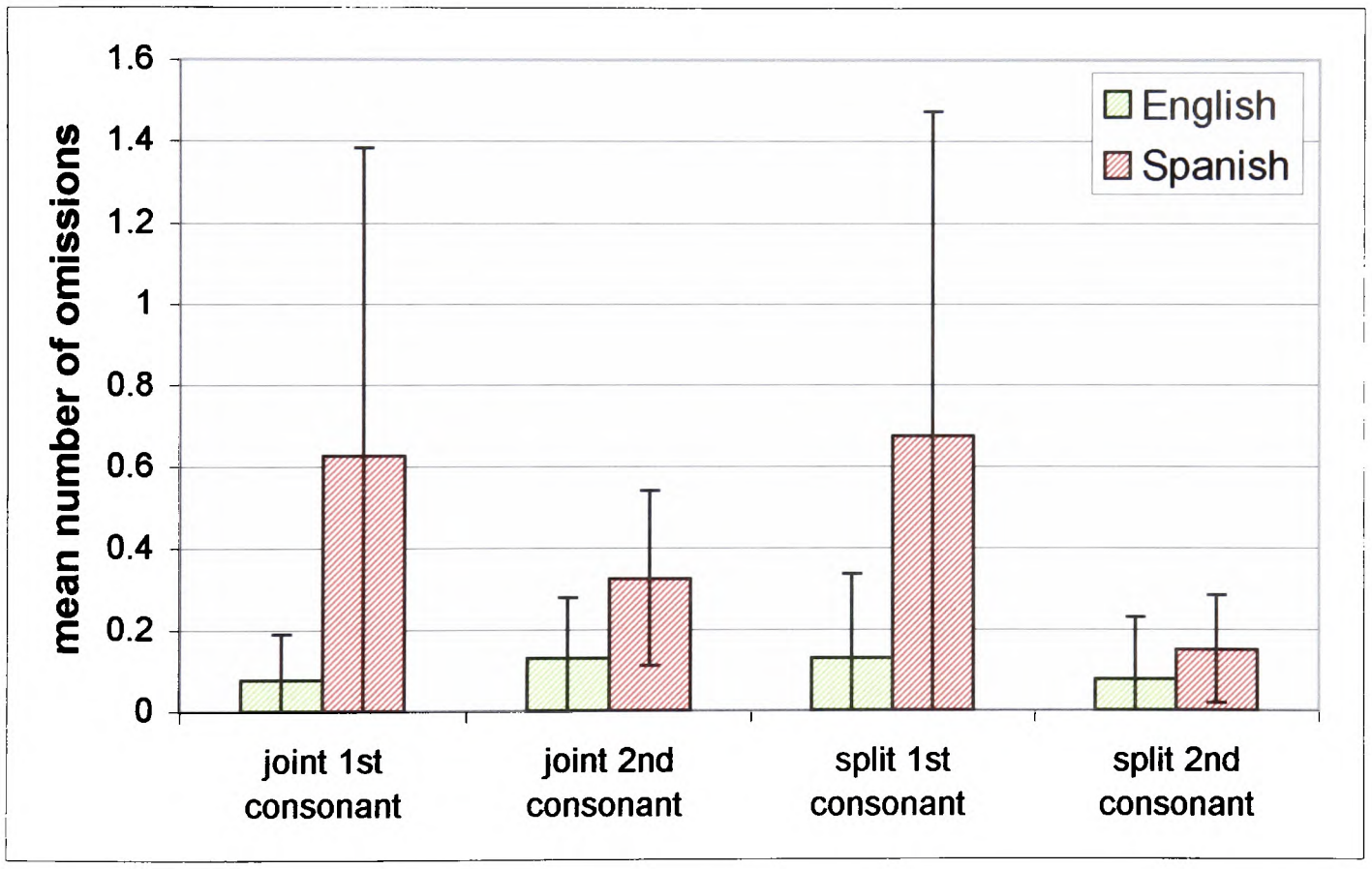
The data were analysed by means of a three-way ANOVA with Syllabification (joint, split) and Consonant (first, second) as the within subjects variables, and Group as the between subjects factor. There were no main effects of Syllabification ($F[1,74] = 2.551$; $p < 0.115$), Consonant ($F[1,74] = 2.623$; $p < 0.110$) or Group ($F[1,74] = 0.673$; $p < 0.415$). However there was an interaction of Syllabification by Consonant ($F[1,74] = 2.927$; $p < 0.003$).

A post-hoc Newman Keul's test showed that this was caused by the children omitting the second consonant of 'split' words less than the first consonant of 'split' words ($p < 0.05$), whereas there was no significant difference in the number of first and second consonants omitted in 'joint' words. The post-hoc analysis also showed that more second consonants were omitted in 'joint' than in 'split' words ($p < 0.05$). This result was as predicted for both the Spanish and the English children for the 'split' words. However, it was not the result predicted for either group for the 'joint' words. This point shall be returned to in the Discussion Section.

Bilinguals in English vs. bilinguals in Spanish

Figure 10. 2 shows the omission errors committed by the bilingual children in each of their languages. The children made fewer errors when they were reading in English than when they were reading in Spanish. This finding suggests that they found double-consonants easier to read in English than they did in Spanish. Furthermore, the number of omission errors on the English non-words was very low for all consonants. When reading the same non-words but in Spanish, the pattern was as predicted for the 'split' words, but was the opposite of that predicted for the 'joint' words.

Figure 10. 2: Mean non-word reading omission errors for the bilinguals in English and Spanish



The results were analysed by means of a three-way repeated measures ANOVA with Syllabification, Consonant and Language (English, Spanish) as the within subjects factors. There were no main effects of Syllabification ($F[1,38] = 0.378$; $p < 0.542$) or Consonant ($F[1,38] = 1.086$; $p < 0.304$), but there was a main effect of Language ($F[1,38] = 4.497$; $p < 0.041$). The children made more omission errors in Spanish than they did in

English. This English advantage is surprising since the Spanish orthography is more transparent and hence reading using GPCs alone would seem to be more practicable in Spanish than in English.

The lack of any other main effects or interactions suggests that syllabification does not have a great effect on bilingual children's ability to read word-medial double-consonants.

English monolinguals vs. bilinguals in English

Figure 10. 3: Mean English non-word reading omission errors for the monolinguals and bilinguals

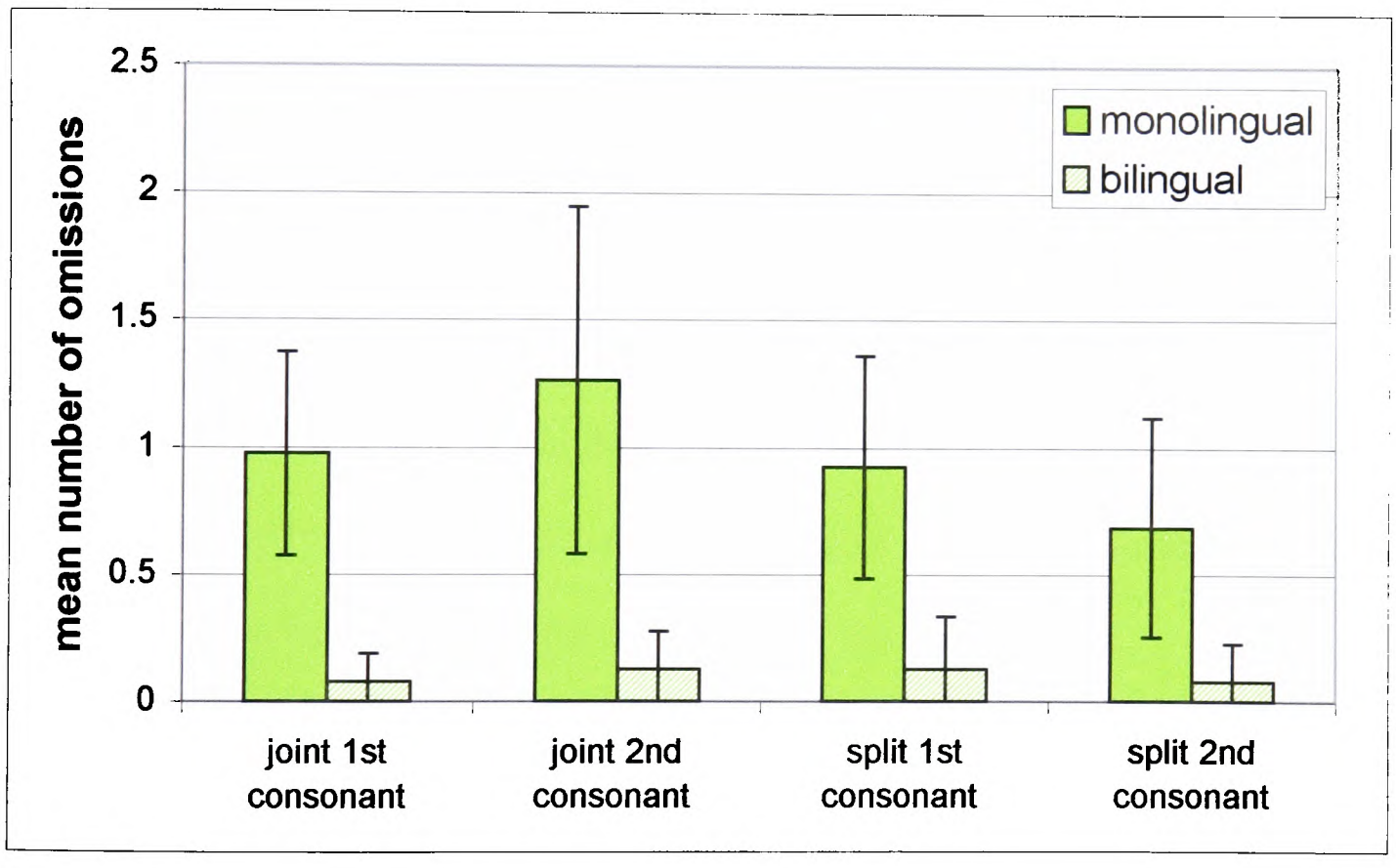


Figure 10. 3 shows how the English monolingual and the bilingual children compared on double-consonant omission errors on the English non-word-reading task. The bilingual children made fewer errors than their monolingual counterparts. The bilinguals' overall error rate was extremely low, making it difficult to tell whether they followed the pattern of results predicted for them. The monolinguals, on the other hand, showed the

pattern expected for the 'split' words, but showed the opposite pattern to that predicted for the 'joint' words.

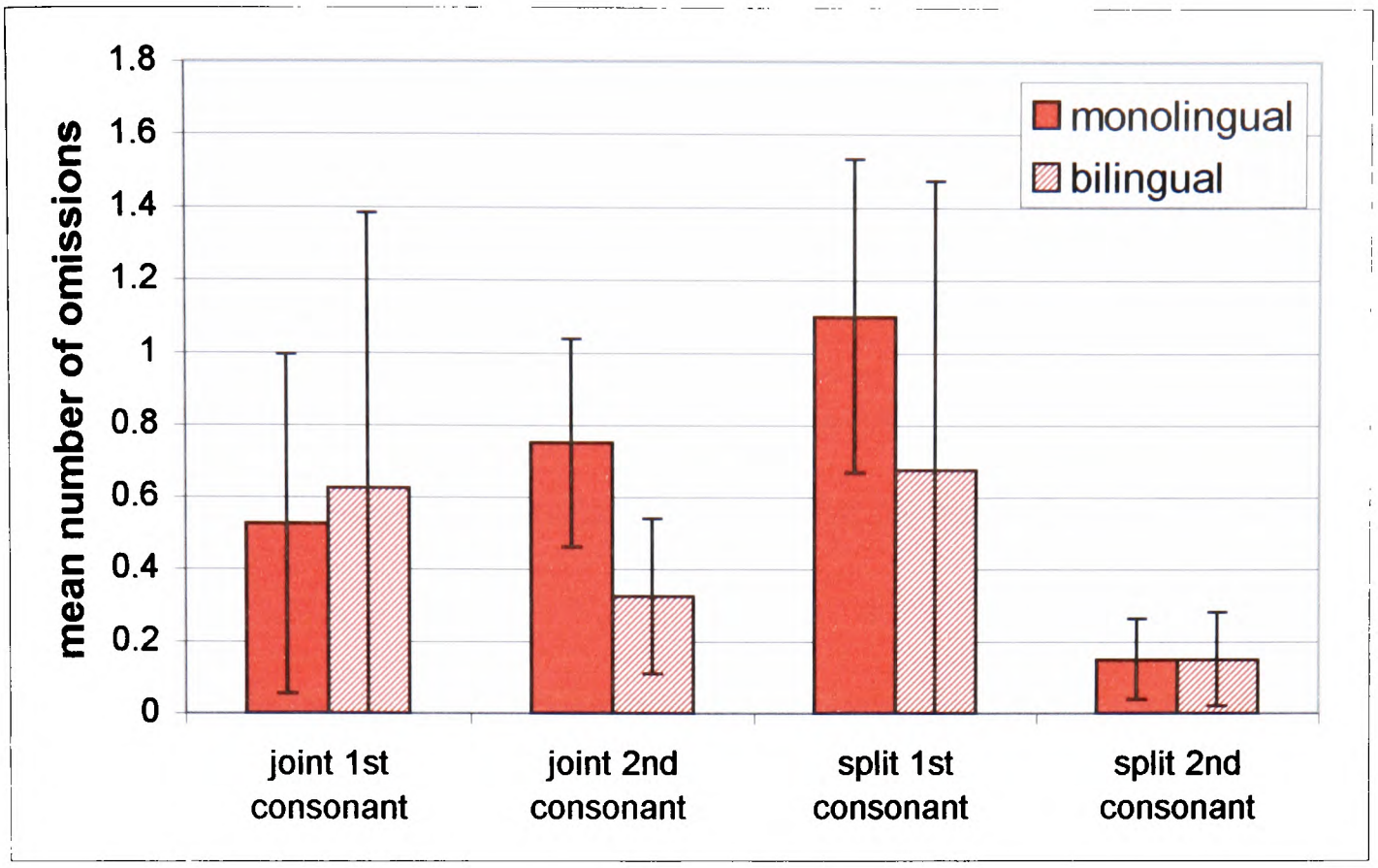
A three-way ANOVA with Syllabification and Consonant as the within subjects variables, and Group as the between subjects factor was carried out. There were no main effects of Syllabification ($F[1,73] = 3.337$; $p < 0.072$) or Consonant ($F[1,73] = 0.169$; $p < 0.682$), but there was a main effect of Group ($F[1,73] = 20.303$; $p < 0.000$). This was caused by the bilingual children making fewer errors overall than their monolingual counterparts. The lack of other effects suggests that, contrary to our predictions, syllable boundaries do not have an effect on the ability to read word medial double-consonants for either group.

Spanish monolinguals vs. bilinguals in Spanish

Figure 10. 4 shows the double-consonant omission errors committed by the monolingual children and bilingual children on the non-word-reading task. Contrary to our prediction, the two groups of children did not perform in the same way. The Spanish monolinguals performed as predicted. The bilingual children performed as predicted for the 'split' words, but opposite to our prediction for the 'joint' words.

The data were analysed by means of a three-way ANOVA with Syllabification and Consonant as the between subjects variables and Group as the between subjects variable. There were no main effects of Syllabification ($F[1,78] = 0.252$; $p < 0.617$), Consonant ($F[1,78] = 3.719$; $p < 0.057$) or Group ($F[1,78] = 0.575$; $p < 0.451$). However, there were interactions of Syllabification by Consonant ($F[1,78] = 14.238$; $p < 0.000$) and Syllabification by Consonant by Group ($F[1,78] = 6.556$; $p < 0.012$).

Figure 10. 4: Mean Spanish non-word reading omission errors for the monolinguals and bilinguals



A post-hoc Newman Keul's test showed the Syllabification by Consonant by Group interaction was caused by the monolingual children making significantly more first consonant than second consonant omissions on the 'split' words ($p < 0.05$), whereas this difference did not exist for the bilingual children. In other words, the monolinguals were more likely to omit the singleton coda of the first syllable than they were the singleton onset of the second syllable. The post-hoc test also revealed that the monolinguals were more likely to omit the second consonant of 'joint' words than were the bilingual children ($p < 0.05$). In other words, they were more likely to omit the second consonant of a cluster onset than bilingual children. Possible explanations of these results will be returned to in the Discussion Section. No other interesting differences were found.

10.3.ii The relationship between phonological awareness and reading omission errors

The non-word reading and the phonological awareness tasks focussed on the same non-word double-consonants. It was therefore expected that if phonological awareness and

reading ability are directly related, there should be a correlation between the awareness of each consonant of word medial double-consonants and the ability to read that same consonant. These correlations are highlighted in blue in the tables below.

English monolinguals

Table 10. 1 shows the correlations between the phonological awareness tasks and the non-word double-consonants omission errors for the English monolingual children.

Table 10. 1: Spearman's rank correlations for the phonological tasks with non-word reading double-consonant omission errors for the English monolinguals

Phonological task	Initial-joint	Initial-split	Final-joint	Final-split
Reading omissions				
Joint 1st consonant	-0.021	0.196	0.161	0.056
Joint 2nd consonant	-0.033	-0.362*	-0.068	-0.030
Split 1st consonant	-0.108	0.000	-0.144	0.125
Split 2nd consonant	0.104	-0.175	-0.119	0.140

* Correlation is significant at the 0.05 level

The only significant correlation was between the 'initial-split' phonological tasks and omissions of the second consonant on joint tasks. This was as predicted: if children were aware of (singleton) onsets, they were less likely to omit that sound when reading. However, this was the only significant correlation found. Hence, it would appear that awareness of consonants within double-consonants is not very closely related to the ability to read them.

Spanish monolinguals

Table 10. 2 shows the correlations between the phonological awareness tasks and the non-word double-consonants omission errors for the Spanish monolingual children. The awareness of each consonant in double-consonants was not related to the ability to read the same consonant. However, there was some correlation between the awareness of consonants and the ability to read double-consonants.

Table 10. 2: Spearman's rank correlations for the phonological tasks with non-word reading double-consonant omission errors for the Spanish monolinguals

Phonological task	Initial-joint	Initial-split	Final-joint	Final-split
Reading omissions				
Joint 1st consonant	0.032	0.168	-0.196	-0.275
Joint 2nd consonant	-0.041	0.332*	-0.312*	-0.334*
Split 1st consonant	-0.335*	0.091	-0.239	0.175
Split 2nd consonant	-0.046	0.112	-0.253	0.032

* Correlation is significant at the 0.05 level

Bilinguals in English

Table 10. 3 shows the correlations between the phonological awareness tasks and the non-word double-consonants omission errors for bilingual children on the English tasks. The awareness of the consonants in word-medial double-consonants was not related to the ability to read these consonants in the bilingual children in English.

Table 10. 3: Spearman's rank correlations for the phonological tasks with non-word reading double-consonant omission errors for the bilinguals in English

Phonological task	Initial-joint	Initial-split	Final-joint	Final-split
Reading omissions				
Joint 1st consonant	-0.272	-0.252	0.103	0.117
Joint 2nd consonant	0.253	0.053	-0.101	0.009
Split 1st consonant	-0.087	-0.072	-0.020	0.003
Split 2nd consonant	-0.272	-0.125	0.147	0.081

Bilinguals in Spanish

Table 10. 4 shows the correlations between the phonological awareness tasks and the non-word double-consonants omission errors for bilingual children on the Spanish tasks.

Table 10. 4: Spearman's rank correlations for the phonological tasks with non-word reading double-consonant omission errors for the bilinguals in Spanish

Phonological task	Initial-joint	Initial-split	Final-joint	Final-split
Reading omissions				
Joint 1st consonant	-0.96	-0.243	-0.183	-0.278
Joint 2nd consonant	-0.002	-0.231	-0.189	0.087
Split 1st consonant	-0.062	-0.025	-0.143	-0.001
Split 2nd consonant	-0.061	-0.042	0.026	-0.118

The awareness of the consonants in word-medial double-consonants was not related to the ability to read these consonants for the bilingual children in Spanish.

Bilinguals in English and Spanish

Table 10. 5 shows the correlations between the phonological awareness tasks and the non-word double-consonant omission errors for bilingual children on both the English and the Spanish tasks. The children's phonological awareness of double-consonants in each language was not related to their ability to read the consonants of the double-consonant in their other language. In other words, they did not appear to be transferring their awareness of the phonology of the double-consonants in language A to help them read these same double-consonants in language B.

Table 10. 5: Spearman's rank correlations for the phonological tasks with non-word reading double-consonant omission errors for the bilinguals in English and Spanish

		English phonological task				English reading omission errors			
		Initial Joint	Initial Split	Final Joint	Final Split	Joint 1st C	Joint 2nd C	Split 1st C	Split 2nd C
Spanish phono-logical tasks	Initial Joint					0.02	0.05	-0.04	-0.19
	Initial Split					-0.18	-0.16	-0.01	-0.07
	Final Joint					0.08	-0.26	-0.00	0.06
	Final Split					0.03	0.22	-0.18	-0.13
Spanish reading omission errors	Joint 1st C	0.04	-0.07	-0.05	0.06	0.27	0.63**	0.60**	0.44**
	Joint 2nd C	-0.00	-0.12	-0.20	0.01	0.44**	0.58**	0.49**	0.34*
	Split 1st C	-0.13	-0.06	-0.10	-0.06	0.52**	0.38*	0.54**	0.39*
	Split 2nd C	-0.20	-0.09	-0.18	-0.03	0.26	0.21	0.26	0.41**

* Correlation is significant at the 0.05 level; ** Correlation is significant at the 0.01 level

However, the table also shows that the ability to read both consonants in double-consonants in one language was related to their ability to read both consonants in double-consonants in the other language. If the child was likely to omit a consonant from the double-consonant in English, then she or he was also likely to omit that same consonant in Spanish. This was true for all consonants apart from for the first consonants of joint words (first consonant of cluster onset).

These findings indicate that a similar process is involved when reading in English and Spanish, yet this process does not appear to involve the use of the knowledge of phonology in each language to help read in the other language. This is yet further indication that bilingual children's approach to reading is similar in both English and Spanish, and yet this approach differs from that of either of their monolingual counterparts.

10.3.iii Non-word spelling: double-consonant omission errors

It was predicted that the way in which children syllabify words would affect their ability to spell word-medial double-consonants.

Just as for the non-word reading task, the 'initial'/'final' distinction was not relevant since the children simply had to write down each word individually, without drawing any comparisons across sets of words. Furthermore, just as with the non-word reading task, only omission errors were studied since it was not possible to be certain why the other types of error were being committed. Omissions, on the other hand, seem to be almost certainly due to the child not realising that two letters should be there.

The same predictions were made for the non-word spelling as for the non-word reading. All of the groups were expected to omit the first consonant of split words more often than the second consonant. The English children were expected to make this same pattern of errors on joint words as well. The Spanish monolinguals and the bilinguals in

both English and Spanish were expected to omit the second consonant of 'joint' words more often than the first.

The groups were first compared across languages, and then they were compared within languages.

English monolinguals vs. Spanish monolinguals

Figure 10. 5: Mean non-word spelling omission errors for the English and Spanish monolinguals

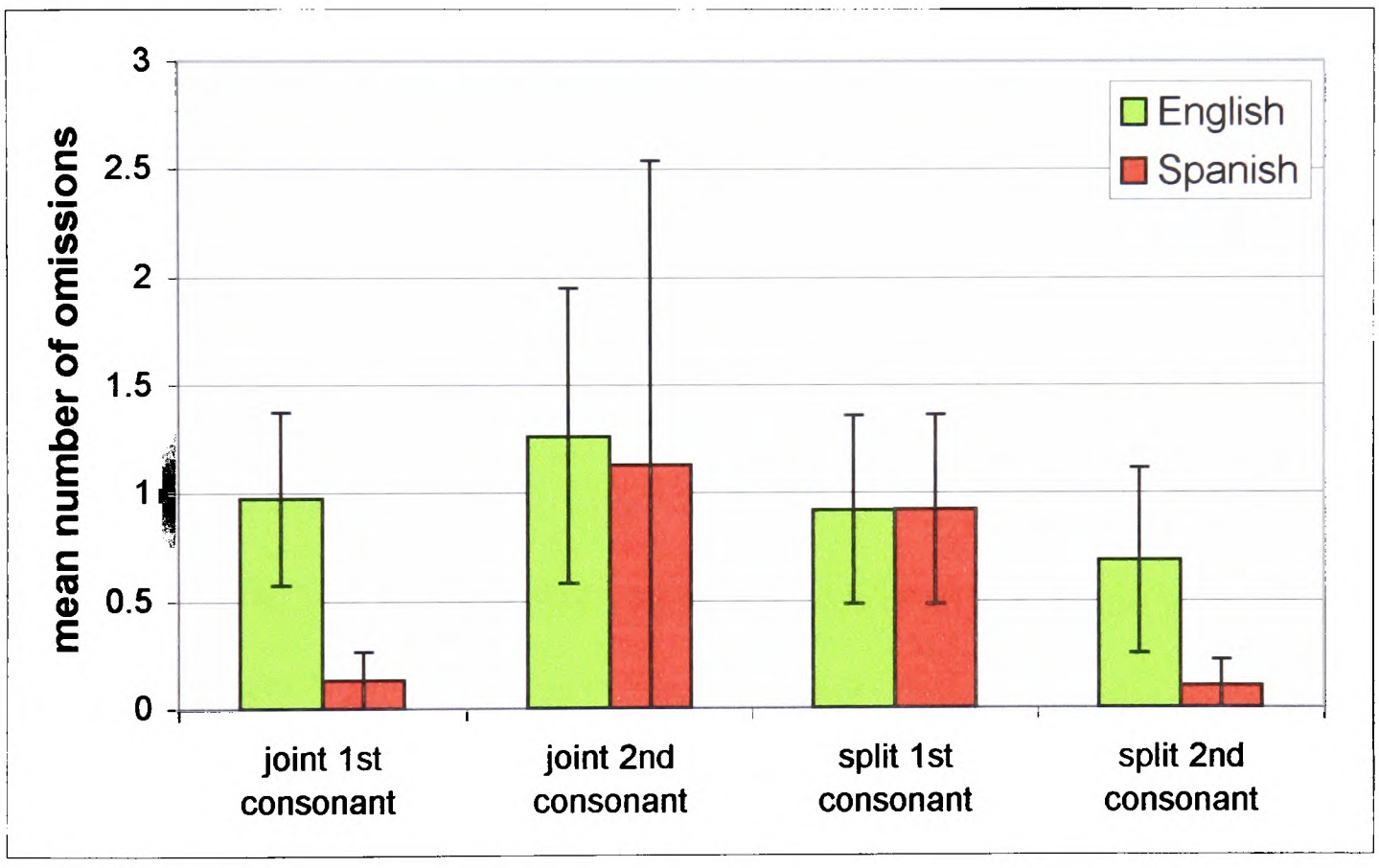


Figure 10. 5 shows that the Spanish children made fewer errors overall than the English monolingual children. Since all groups place syllable boundaries of 'split' words in the same place, no differences were expected between the groups on these words. It was anticipated that both groups would omit the first consonant more often than the second on these words. However, since the English monolingual children syllabify 'joint' words differently from Spanish-speakers, it was predicted that there would be a difference between the groups in their ability to spell the consonants of these 'joint' words. The

English children were expected to omit the first consonant more often than the second consonant and the Spanish children were expected to omit the second consonant more often than the first consonant. However, the pattern of errors turned out to be very similar for both groups.

A three-way ANOVA was carried out with Syllabification (joint, split) and Consonant (first, second) as the within subjects variables and Group as the between subjects variable in order to see if there were any significant differences. There were no main effects of Syllabification ($F[1,75] = 0.734$; $p < 0.394$) or Consonant ($F[1,75] = 0.274$; $p < 0.602$), but there was a main effect of Group ($[1,75] = 7.487$; $p < 0.008$). There was also an interaction of Syllabification by Consonant ($F[1,75] = 17.122$; $p < 0.000$).

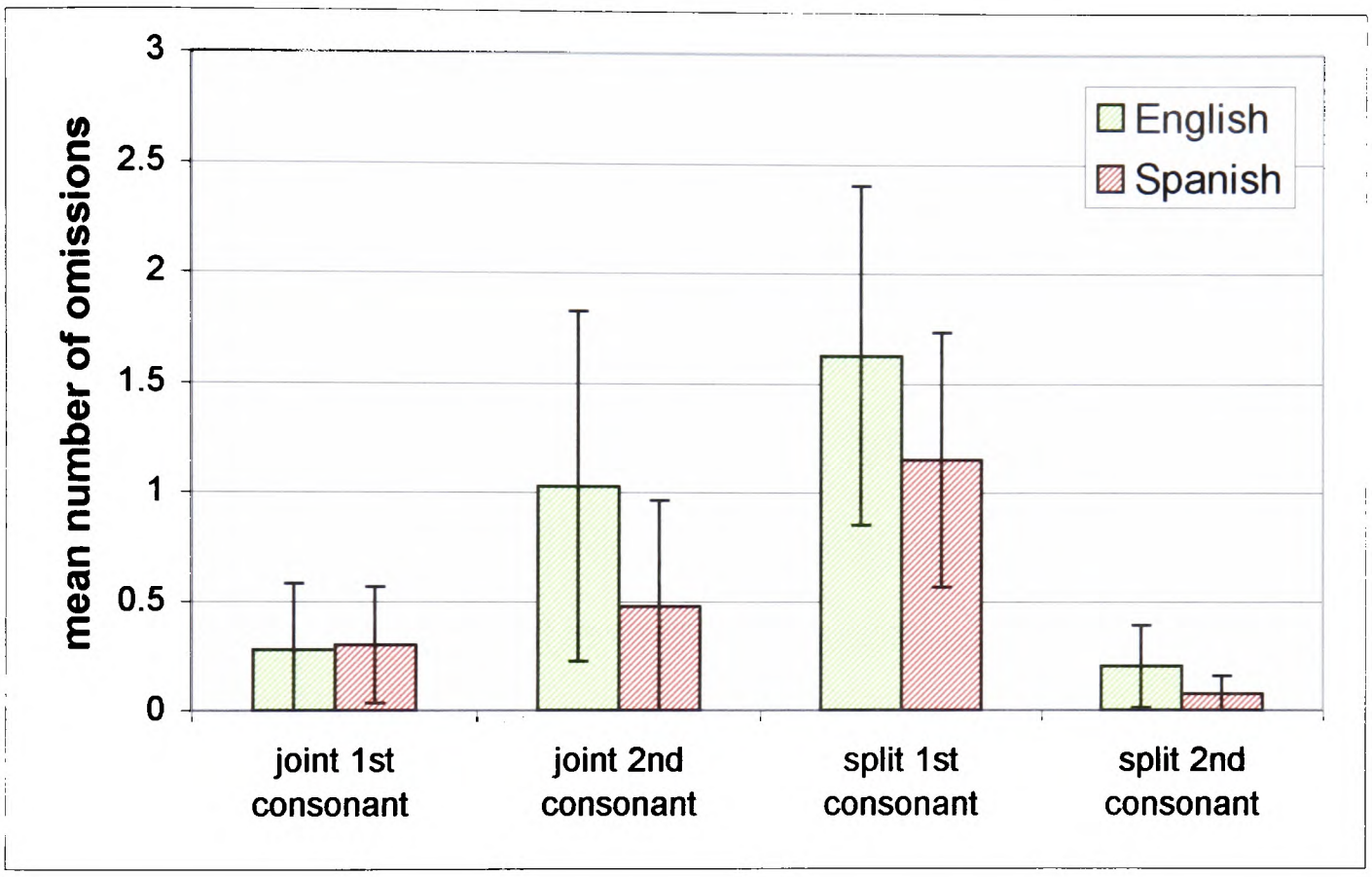
The main effect of Group was caused by the Spanish children making fewer omission errors overall. A post-hoc Newman Keul's test showed the Syllabification by Consonant interaction was caused by the children making more first than second consonant omissions on the 'split' tasks but more second than first consonant omissions on the 'joint' task (both $p < 0.05$). This pattern of results was as predicted for both groups on the 'split' words. The children were more likely to omit a coda (first consonant 'split') than an onset (second consonant 'split'). The results for the Spanish group were also as predicted on the 'joint' words. They omitted the second consonant of a cluster onset (second 'joint') more often than they omitted the first consonant of a cluster onset (first 'joint'). However, we had not expected to find a difference in the English group's performance on the 'split' and 'joint' tasks.

Bilinguals in English vs. bilinguals in Spanish

Figure 10. 6 shows the omission errors made on the double-consonants by the bilingual children in both English and Spanish. The children made fewer errors in Spanish

than they did in English, but, as predicted, the pattern of errors was similar in both languages. The pattern of errors was also that predicted. More errors were made on first than second consonants of 'split' words, but more errors were made on the second than on the first consonants of 'joint' words.

Figure 10. 6: Mean non-word spelling omission errors for the bilinguals in English and Spanish



A three-way repeated measures ANOVA was carried out with Syllabification, Consonant and Language (English, Spanish) as the within subjects variables. There was no main effect of Syllabification ($F[1,36] = 0.952$; $p < 0.336$), but there were main effects of Consonant ($F[1,36] = 5.095$; $p < 0.030$) and Language ($F[1,36] = 5.449$; $p < 0.025$). There were also interactions of Syllabification by Consonant ($F[1,36] = 19.4322$; $p < 0.000$) and of Syllabification by Consonant by Language ($F[1,36] = 7.850$; $p < 0.008$).

The main effect of Language was caused by the children making fewer omissions in Spanish than in English. The main effect of Consonant was caused by the children omitting the first consonant more often than the second consonant overall.

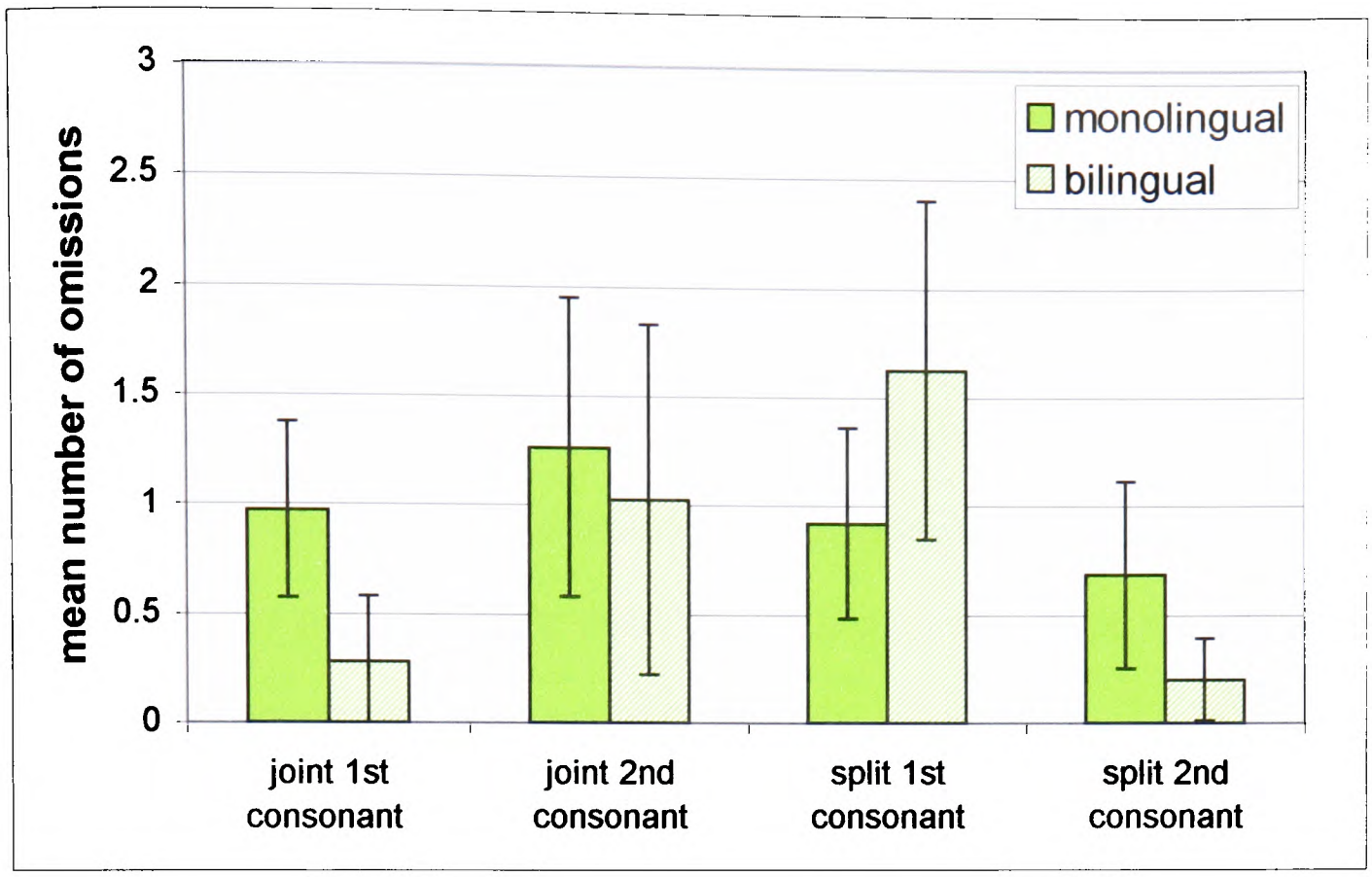
A post-hoc Newman Keul's test showed that the Syllabification by Consonant interaction was caused by children making significantly more first consonant than second consonant omissions on the 'split' words ($p < 0.05$), whereas they made similar numbers of first and second consonant errors on 'joint' words. In other words, just as predicted, they would more often omit the coda of the first syllable (first split) than the onset of the second syllable (second split). The post-hoc test also showed that more first consonant errors were made on 'split' than on 'joint' words ($p < 0.05$). This was also as predicted: the first consonant of a 'split' word is a coda, the first consonant of a 'joint' word is part of an onset.

A post-hoc Newman Keul's test showed the Syllabification by Consonant by Language interaction to be caused by the children omitting more second consonants on joint words than on split words in Spanish ($p < 0.05$), whereas they omitted more first consonants on split words than on joint words in English ($p < 0.05$). The post-hoc test also revealed that the children omitted more first than second consonants on split words in both languages (both $p < 0.05$). Thus, in Spanish the children found second consonants of cluster onsets (second joint) harder than singleton onsets (second split). In English, they omitted more codas (first split) than first consonants of cluster onsets (first joint). Both groups omitted more codas (first split) than onsets (second split).

English monolinguals vs. bilinguals in English

Figure 10. 7 shows the monolingual and bilingual children's mean omission errors on the double-consonants in the non-word-spelling task. Contrary to the prediction, the pattern of errors was similar for both groups. The pattern was that expected for both groups for the 'split' words. It was also as predicted for the 'joint' words for the bilingual group, but the opposite of that expected for the monolingual children.

Figure 10. 7: Mean English non-word spelling omission errors for the monolinguals and bilinguals



A three-way ANOVA was carried out with Syllabification and Consonant as the within subjects factors and Group as the between subjects factor. There were no main effects of Syllabification ($F[1,73] = 0.009$; $p < 0.925$), or Consonant ($F[1,73] = 0.309$; $p < 0.580$), but there was a main effect of Group ($F[1,73] = 4.250$; $p < 0.043$). There was also an interaction of Syllabification by Consonant ($F[1,73] = 25.422$; $p < 0.000$).

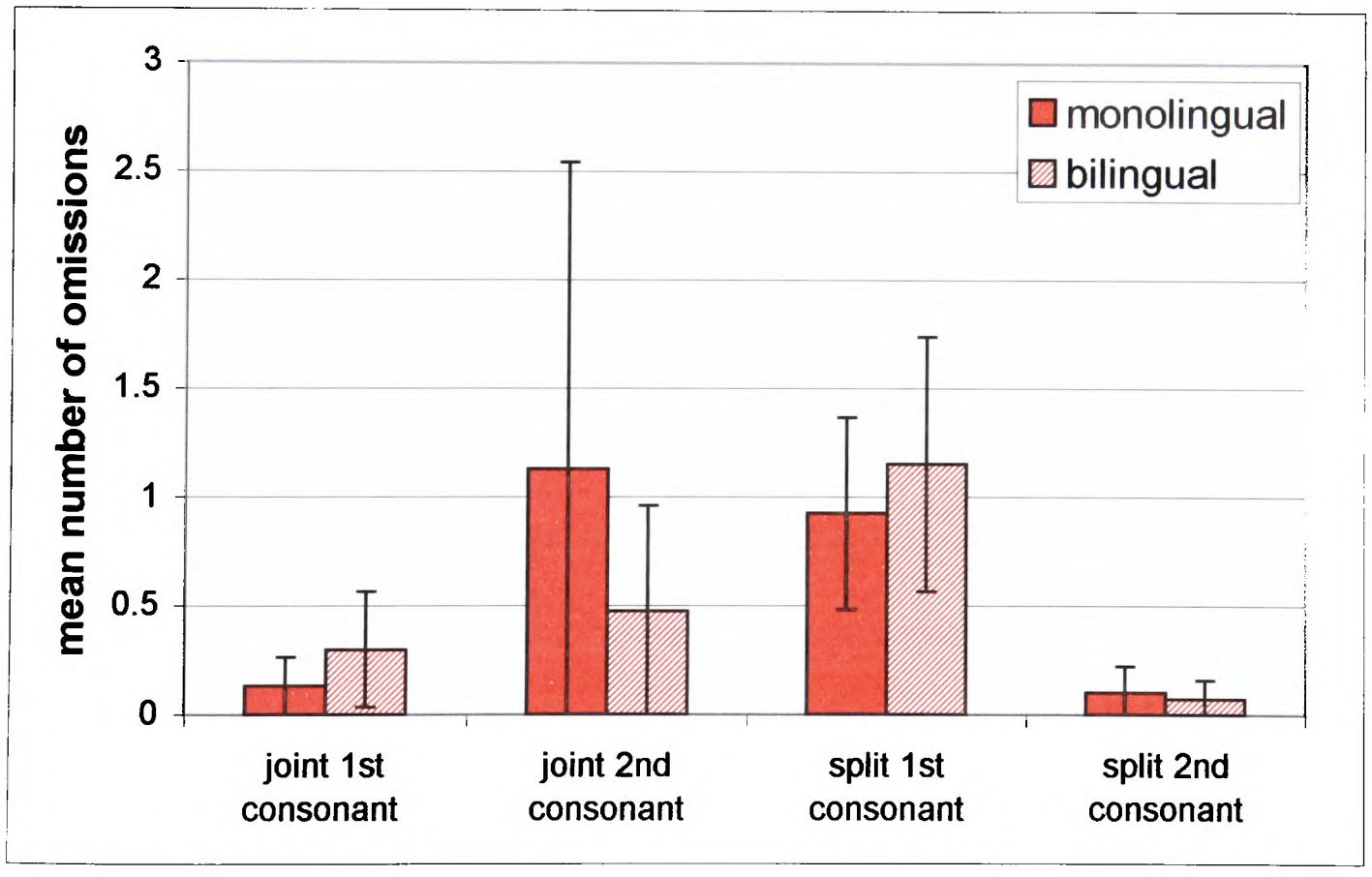
The main effect of Group was caused by the bilinguals making fewer omission errors overall. A post-hoc Newman Keul's test showed the Syllabification by Consonant interaction was caused by the children making more first consonant omission errors than second consonant omission errors on the 'split' words, but more second than first consonant errors on the 'joint' words (both $p < 0.05$). These results were as predicted for both groups for the 'split' words. They were more likely to omit a coda (1st consonant 'split') than an onset (2nd consonant 'split'). The results were also those predicted for the 'joint' words for the bilingual children. They omitted the second consonant of a cluster onset (second 'joint') more often than they omitted the first consonant of a cluster onset

(first 'joint'). However, the difference in the English monolingual group's performance on the 'split' and 'joint' tasks was not expected. There were no other interesting findings.

Spanish monolinguals vs. bilinguals in Spanish

Figure 10. 8 shows how the monolingual and bilingual children compared on word medial double-consonant omission errors. As expected, the two groups performed similarly. Furthermore, their performance was as predicted. More errors were made on those consonants that were either codas ('split' first consonant) or second consonants of double-consonant onsets ('joint' second consonant).

Figure 10. 8: Mean Spanish non-word spelling omission errors for the monolinguals and bilinguals



The data were analysed by a three-way ANOVA with Syllabification and Consonant as the within subject variables and Group as the between subjects variable. There were no main effects of Syllabification ($F[1,77] = 0.058$; $p < 0.810$), Consonant

(F[1,77] = 0.879; p < 0.351), or Group (F[1,77] = 0.088; p < 0.767). There was an interaction of Syllabification by Consonant (F[1,77] = 12.857; p < 0.001).

A post-hoc Newman Keul's test showed that the interaction was caused by the children making more first than second consonant omission errors on 'split' words (p < 0.05), but making similar numbers of first and second consonant errors on the 'joint' words. These results were as predicted for 'split' words. They were more likely to omit a coda (1st consonant 'split') than an onset (2nd consonant 'split'). However, a difference had also been expected in the number of first and second consonant omission errors on 'joint' words. The post-hoc test also revealed that more omissions were made on the consonants in cluster onsets (first and second 'joint') than singleton onsets (second 'split') (p < 0.05). This finding was also as predicted.

10.3.iv The relationship between phonological awareness and spelling omission errors

It was predicted that the awareness of each of the constituents of double-consonants would be directly related to the ability to spell each of these consonants for each of the groups, but particularly for the Spanish-speakers. This was because Spanish-speakers were expected to rely more heavily on GPCs than English-speakers. Below we look at whether or not this is the case for each group. The correlations highlighted in blue are those that indicate a direct mapping between awareness of a consonant and the ability to spell it.

English monolinguals

Table 10. 6 shows that English children's awareness of consonants in word-medial double-consonants was not strongly related to their ability to spell them. The only significant correlation was between omitting the second consonant of joint words, and awareness of the second consonant of split words.

Table 10. 6: Spearman's rank correlations for the phonological tasks with non-word spelling double-consonant omission errors for the English monolinguals

Phonological task	initial joint	initial split	final joint	final split
Spelling omissions				
joint 1st consonant	-.021	-.196	.161	.056
joint 2nd consonant	-.033	-.362*	-.068	-.030
split 1st consonant	-.108	.000	-.144	.125
split 2nd consonant	.104	-.175	-.119	.140

* Correlation is significant at the .05 level (2-tailed).

Spanish monolinguals

Table 10. 7: Spearman's rank correlations for the phonological awareness tasks with non-word spelling omission errors for the Spanish monolinguals

Phonological task	initial joint	initial split	final joint	final split
Spelling omissions				
joint 1st consonant	-.107	-.255	.064	.260
joint 2nd consonant	.006	-.044	-.029	-.002
split 1st consonant	-.076	.111	-.077	.238
split 2nd consonant	.134	.081	-.360*	-.127

* Correlation is significant at the .05 level (2-tailed).

Table 10. 7 shows that awareness of each consonant of a double-consonant was not directly related to the ability to spell these consonants for the Spanish children.

Bilinguals in English

Table 10. 8 shows that the ability to spell each consonant of a double-consonant was not related to the awareness of these consonants for the bilingual children in English. The only exception to this was the ability to spell singleton codas which correlated with the awareness of singleton codas.

Table 10. 8: Spearman's rank correlations for the phonological awareness tasks with non-word spelling omission errors for the bilinguals in English

Phonological task	initial joint	initial split	final joint	final split
Spelling omissions				
joint 1st consonant	.027	.032	.046	.053
joint 2nd consonant	.073	-.063	-.021	-.106
split 1st consonant	-.164	-.134	-.165	-.389*
split 2nd consonant	.056	-.195	-.097	-.022

* Correlation is significant at the .01 level (2-tailed).

Bilinguals in Spanish

Table 10. 9: Spearman's rank correlations for the phonological awareness tasks with non-word spelling omission errors for the bilinguals in Spanish

Phonological task	Initial joint	initial split	final joint	final split
Spelling omissions				
joint 1st consonant	.016	-.072	.300	-.155
joint 2nd consonant	-.001	-.284	-.050	-.069
split 1st consonant	.047	-.247	-.085	-.136
split 2nd consonant	-.047	.092	.142	.178

Table 10. 9 shows that the ability to spell the consonants of a double-consonant bore no relation to awareness of them for the bilingual children in Spanish.

Bilinguals in Spanish and English

Table 10. 10: Spearman's rank correlations for the phonological awareness tasks with non-word spelling omission errors for the bilinguals in English and Spanish

English phonological task	initial joint	initial split	final joint	final split
Spanish spelling omissions				
joint 1st consonant	-.127	-.044	.030	-.210
joint 2nd consonant	.046	-.002	-.027	.057
split 1st consonant	.026	-.002	.073	-.057
split 2nd consonant	.059	-.194	-.189	-.059

Spanish phonological task	initial joint	initial split	final joint	final split
English spelling omissions				
joint 1st consonant	.067	-.108	.112	-.087
joint 2nd consonant	-.012	-.122	-.130	-.247
split 1st consonant	-.166	-.233	.094	-.200
split 2nd consonant	.123	.143	-.021	-.163

Table 10. 10 shows that the awareness of each consonant within a double-consonant in English was not related to the ability to spell these consonants in Spanish. Likewise, the awareness of each consonant within a double-consonant in Spanish was not related to the

ability to spell these consonants in English. Given the poor correlations between phonological awareness and spelling of double-consonants within languages for the bilingual children, this finding is not surprising.

10.4 DISCUSSION

It was predicted that the way in which children syllabify words may affect their ability to read and spell consonants in the middle of words. It is known that English monolingual children place syllable boundaries differently from Spanish monolingual children and from bilingual children in English. Hence, differences were expected in the ability to represent word-medial double-consonants between these groups. Spanish monolingual children, on the other hand, syllabify words in the same way that bilingual children do in both of their languages. Differences were not, therefore, expected in these groups' abilities to represent word-medial double-consonants.

The results of the reading data show little evidence for syllabification playing a role in the ability to read word-medial double-consonants. Looking at each group individually, it appears that the English monolingual children made similar numbers of omission errors of first and second consonants. A larger number of first consonant omissions than second consonant omissions had been predicted. This was because, if syllable boundaries are taken into consideration during reading, the first consonant is the coda of the first syllable (e.g. *mactan* → *ma**c**-tan*), whereas the second consonant becomes the onset of the second syllable (e.g. *mactan* → *ma**c**-**t**an*). It would seem that English children do not use their knowledge of syllable boundaries to help them read consonants found in the middle of words.

The Spanish monolingual children did show some evidence that syllabification strategy affected their ability to read word-medial double-consonants. They made more first than second consonant omissions in 'split' words. In other words, they omitted more codas than onsets in those words in which the word-medial double-consonant was broken up such that each consonant belonged to a different syllable. This suggests that they use their knowledge of syllables to help them read these words. However, they made similar numbers of first and second consonant omission errors in 'joint' words. If they were taking

syllable boundaries into account one would have expected them to omit the second consonant more often than the first. This is because the second consonant is the second consonant of a cluster onset (e.g. *mablan* → *ma-<u>bl</u>an*), whereas the first consonant is the first consonant of the cluster onset (e.g. *mablan* → *ma-<u>bl</u>an*). However, the evidence concerning the omission of consonants in cluster onsets in Spanish is not conclusive (see Chapter 3.3). Hence, this finding may be quite in keeping with the prediction that Spanish children use syllable boundaries in order to help them read double-consonants.

The bilingual children's ability to read word-medial consonants was not affected by their knowledge of syllable boundaries in either language. This suggests that, contrary to the predictions, bilingual children do not use their knowledge of syllable boundaries to aid the task of reading double-consonants found in the middle of words. Interestingly, this is the same pattern of behaviour as displayed by the English monolingual children.

The study was not only concerned with whether syllable boundaries affect the ability to read word-medial double-consonants for each group individually. It had also been predicted that, if syllable boundaries do play a role, then we should find differences between the groups' performances on the different types of words. The English monolingual children, had been expected to perform in the same manner as the Spanish monolingual and the bilingual children for the 'split' words, since these words were syllabified in the same way by all three groups of children. This was indeed found. However, it had also been predicted that they would behave differently on the 'joint' words, because they syllabified these differently. In fact, no differences were found between the groups' ability to represent these consonants in reading. It would appear that knowledge of syllable boundaries is of little importance when it comes to reading word-medial consonants.

The bilingual children had been expected to perform similarly in each language, and to also perform similarly to the Spanish monolingual children, since words are syllabified

in the same manner for each group. Indeed, no differences were found between the different groups.

For the spelling omissions, all groups performed as predicted for the 'split' words. They all omitted the first consonant more often than the second consonant. In other words, they were more likely to omit a singleton coda than a singleton onset consonant. This suggests that all of the children were using their knowledge of syllable boundaries to help them spell these consonants.

The Spanish monolingual children also showed a difference in their ability to spell each consonant of 'joint' words. They were more able to spell the first consonant of a cluster onset (first 'joint') than the second consonant of a cluster onset (second 'joint'). Both the monolingual and bilingual children were better at spelling singleton onset consonants than consonants of onset clusters. These results add further support to the theory that Spanish children use their knowledge of syllable boundaries to help them spell words.

The English monolingual children had been predicted to perform in the same manner on the 'joint' and 'split' words because they syllabify both types of word in the same manner. In fact they performed in the opposite way, omitting more second than first consonants of 'joint' words and more first than second consonants of 'split' words. This was the pattern that had been predicted for children syllabifying the words in the Spanish manner.

However, there is a possible explanation for the lack of similarity in performance across 'joint' and 'split' words that the English children displayed. As well as syllabification having an impact on the ability to represent both consonants of a double-consonant in spelling, the type of consonants that create the double-consonant may also have an influence. All of the 'split' words contained double-consonants consisting of two obstruent consonants. The 'joint' words, on the other hand, had double-consonants

consisting of an obstruent+liquid consonant. It is possible that liquid consonants are particularly difficult to represent because they tend to bind to the proceeding vowel (Hooper, 1976). If this is the case, then despite the fact the liquid is an onset consonant, its linguistic properties might make it harder to spell and hence mask any effect that knowledge of syllable boundaries may have on spelling ability. Indeed, the English monolingual children performed worse overall on the 'joint' words than on the 'split' words (although not significantly so). This lends further support to the suggestion that it is consonant type that was affecting the ability to spell the double-consonant.

One interesting result was the finding that Spanish-speakers and bilingual children in English made fewer spelling omission errors overall than the English monolingual children. This finding is interesting for two reasons. Firstly, it suggests that Spanish children are more used to applying PGCs in spelling and are hence less likely to miss out a letter when spelling than are English children. Secondly, it suggests that bilingual children transfer spelling strategies across languages. From spelling in Spanish they may become accustomed to applying PGCs, and this is a strategy that they can employ in English, causing enhanced consonant spelling ability.

Finally, awareness of the consonants of word-medial consonants was not strongly related to the ability to read or spell these consonants, as shown by the lack of correlations between the children's phonological scores and the number of reading and spelling omissions. This finding was unexpected. It suggests that children do not use their sound awareness of word-medial consonants in order to help them read or spell these sounds. One possible explanation of this finding is that children may employ a different strategy based on units larger than individual phonemes when attempting to represent double-consonants.

However, there are two possible alternative explanations that do not preclude the hypothesis that children use their awareness of word-medial consonants directly when

attempting to read and spell them. Firstly, all of the children performed at near ceiling levels on the reading and spelling tasks. Hence there may not have been enough variance for correlations to be significant.

The second alternative is that the phonological test employed in this study was not tapping into the appropriate level of phonological awareness needed for reading and spelling word-medial double-consonants. It is feasible that the ability to distinguish phonemes in a sound task does not require the same type of knowledge as that required in order to be able to represent these sounds either orally, as in reading, or orthographically, as in spelling. It seems possible that the phonological task employed here (the oddity task) was not the most appropriate.

CHAPTER 11

CONCLUSIONS AND IMPLICATIONS

In order to discuss the conclusions and implications of the work presented in this thesis, the main questions posed and the predictions made will be briefly repeated. The extent to which these were answered will be reviewed and a theory that explains the findings will be put forward. Finally, the limitations of the work will be discussed and suggestions for future research will be considered.

11.1 THE QUESTIONS RAISED

The first main question raised in this thesis was whether there are any cross-language differences in awareness of phonology dependent upon the differences in structure of different languages. The second main question was whether bilingual children can transfer awareness across languages of those phonological units that are made relatively more salient in one language than in the other. The third main question was whether phonological awareness holds a different relationship with literacy according to both the phonology(ies) and orthography(ies) to which children are exposed.

11.2 THE FIRST QUESTION: DO DIFFERENCES IN LANGUAGE STRUCTURE AFFECT PHONOLOGICAL AWARENESS?

As shown in Chapter 2.2, different languages have different structures. As a consequence of this it was predicted that exposure to different languages may result in differences in phonological awareness. Those units made relatively salient by the language(s) to which you are exposed should be those to which you show relatively more

sensitivity. In this thesis we focussed on three main linguistic differences between English and Spanish: syllabic differences, intra-syllabic differences and phonemic differences.

11.2.i Syllables

Beginning with syllables, English and Spanish have quite different syllabic structures. Spanish has clear-cut syllable boundaries. There is one and only one possible way of placing syllable boundaries in this language. In English, on the other hand, there are various alternative ways of syllabifying a word, all of which are equally acceptable.

The differences in syllabic structure between languages imply that Spanish children may be more aware of syllables than English children. It makes sense to postulate that a clearly defined phonological unit (such as the Spanish syllable) will be easier to identify than a unit with non-specific boundaries (such as the English syllable). Experiment 1 looked at whether this was the case.

Contrary to our prediction, we found that English-speakers are more aware of syllables than Spanish-speakers. It was suggested that this difference may be caused by the ability of English children to compare alternative ways of syllabifying words. They can compare the three alternatives '*bu*'-'*tter*', '*but*'-'*ter*' and '*butt*'-'*er*' as alternative syllabifications of '*butter*'. Because Spanish children can syllabify each word in only one way, it was argued that they might not focus their attention on the syllable unit as much as English children do.

Experiment 4 looked at whether differences in syllable structure affect the awareness of word-medial consonants. If a child is aware of where one syllable ends and the next begins, she or he may be able to focus on these endings and beginnings, which, in effect, requires focusing on the phonemes found in the middle of words. It was predicted that Spanish children may be particularly apt at this since they have clear syllable

boundaries with which to work. English children, on the other hand, may be at a disadvantage because 'murky' syllable boundaries might not encourage the use of their knowledge of syllables to help them focus on word-medial phonemes.

However, we found no differences between English- and Spanish-speakers' awareness of word-medial phonemes. Nevertheless, Spanish-speaking children's awareness of word-medial phonemes is affected by syllable boundaries. When the word-medial double-consonant is split between syllables (e.g. *mactan* → *mac* – *tan*), the first consonant (a singleton coda) is more readily detected than the second consonant (a singleton onset). English-speaking children's word-medial phoneme awareness, however, is not affected by their knowledge of syllable boundaries. This indicates that, even though the differences in syllable structure may not cause any cross-linguistic differences in phonemic awareness, children from different language backgrounds appear to be analysing their language in different ways.

11.2.ii Onset and rime

We saw in Chapter 2 that, at the intra-syllabic level, there is no definitive answer as to how English and Spanish differ. Treiman's work, reviewed in Chapter 2.1.i.a, indicated that in English onset and rime are the hierarchical components of the syllable. From the little evidence available, and from looking at the structure of Spanish syllables, we posited that the onset/rime distinction may play a less important role in Spanish. Firstly, most Spanish syllables are 'open'. That is, they have a CV or VC rather than a CVC structure. The rime of a CV syllable corresponds to the vowel sound, and hence is a single phoneme. The rime in a VC syllable corresponds to the vowel and the proceeding consonant and hence corresponds to the entire syllable. Therefore, from a linguistic perspective alone, it appears unlikely that the rime would be a phonological unit worthy of psychological

underpinning in Spanish. What is more, the evidence available points to the syllable being underpinned at the 'body+coda' level in Spanish. For example, we saw in Chapter 2.2.i.a and 2.2.i.b that children seem less willing to break apart the onset from its proceeding vowel (e.g. *mal* → */m/ - /al/*) than they do the vowel from its proceeding consonant (e.g. *mal* → */ma/ - /l/*). Nevertheless, viewing the syllable as having a 'body+coda' hierarchy in Spanish falls under the same criticism as viewing it as having an 'onset+rime' hierarchy. In a VC syllable, the body and coda correspond to individual phonemes (the vowel and the consonant, respectively). In a CV syllable the body corresponds to the entire syllable and there is no coda. Therefore, most intra-syllabic units correspond either to individual phonemes or to entire syllables.

Hence, in Spanish, because of the nature of the syllable's structure, we anticipated that Spanish-speakers would have relatively little awareness of intra-syllabic units. In English, however, we already know that the onset and rime have a psychological reality. Hence it was predicted that English-speakers should be more aware of rimes than Spanish-speakers. Experiment 1 looked at this.

Contrary to our prediction, we found that Spanish-speakers are more aware of rimes than English-speakers. It was thought that this might be for two reasons. Firstly, VC rimes are relatively rare in Spanish. Hence, children may notice when a syllable ends with a consonant, precisely because it does not happen very often. In English, on the other hand, since virtually all syllables end with consonants, the rime unit may be less salient. Secondly, Spanish word-final VC rimes are often morphemes. Hence Spanish-speaking children may have used their morphological awareness to help them with the task. Both of these factors may have contributed to the Spanish children's greater rime awareness.

The result also highlights the possibility that rime in English is not as salient a unit as the literature claims. As discussed in Chapter 2.1.ii, investigations into rime awareness in English have used mono-syllables. In words with just one syllable, rhyme and rime are

confounded. Brady's (unpublished) study reviewed in Chapter 2.1.ii found that rhyme, not rime, is the constant phonological unit for children. In Experiment 1 we found a similar result. Rhyme was more salient than rime. Furthermore, we also found that word position may influence the availability of rime to children. We had anticipated that rimes containing the stressed vowel would be more salient than rimes containing the unstressed vowel. However, although we found stress to play a role in syllable and vowel awareness, it did not affect rime awareness. Instead, it may have been word position that affected the awareness of rime. First-syllable rimes, which were stressed, were in the middle of the word. Final-syllable rimes, which were not stressed, were at the end of the word. Children may have greater difficulty in analysing sounds that are embedded in words (e.g. /s**ʌn**dei/) than sounds that are not (e.g. /menʃ**ʌn**/).

Hence, despite the vast quantity of research positing rime as a psychologically salient unit in English, it may be premature to draw such conclusions. Further research is needed to examine the role that stress and word position may play in the awareness of rimes in English.

11.2.iii Phonemes

In Chapters 2 and 8 we saw that consonant sounds are similar in both English and Spanish. English contains 24 consonants whereas Spanish has only 20. Generally, there are very few acoustic/phonetic differences between the corresponding consonants in each language; the vast majority of consonants take up the same space in each language's sound system and have the same contrasting minimal pairs. Most distinctions that are relevant in one language are equally relevant in the other. Chapters 2 and 6 indicated that the same is not true for vowel sounds. Spanish and English differ markedly in terms of vowel systems. Whereas there are up to 21 different English vowel sounds, there are only five in Spanish.

As a consequence, there are contrasts made in English that do not exist in Spanish. This entails that English-speakers will 'hear' differences between sounds that are 'heard' as being the same sound by Spanish-speakers. Since English has so many different vowel sounds, and because these sounds are less acoustically and phonetically stable than Spanish vowel sounds, it is likely that vowels are less 'psychologically real' to English-speakers than they are to Spanish-speakers.

Therefore, in terms of consonant awareness, few differences were expected between speakers of English and Spanish. Experiment 3 examined this. However, Spanish-speakers were expected to show greater sensitivity to vowel sounds than English-speakers, as a reflection of the linguistic differences between the vowel systems of each language. It was predicted that a smaller number of clearly defined sounds were more likely to invoke awareness than a large number of ill-specified or non-specific sounds. Experiments 1, 2 and 3 looked at this.

In accordance with our predictions, we found that Spanish-speakers are more aware of vowel sounds but not of consonant sounds than English-mnolingual-speakers. This result points to the conclusion that vowels are particularly salient units in Spanish.

However, Experiment 3 also allowed us to determine the relative salience of vowel and consonant sounds within languages. We found that, whilst Spanish children are similarly aware of vowels and consonants, monolingual English children are more aware of consonants than vowels. Hence, it is not necessarily that vowels are particularly salient in Spanish, rather, it might be that vowels are particularly non-salient in English. Why do English children show insensitivity to vowel sounds?

One possibility is the complexity of the English vowel system. There are two factors that contribute to this complexity. Firstly, English vowel sounds are highly variable. Each vowel phoneme has a range of possible phonetic realizations. This is not true to nearly the same extent for Spanish vowels, or for English consonants. The

pronunciation of English vowels changes from accent to accent, person to person and even from word to word. The same is not as true for consonant sounds, which are acoustically far more uniform and stable. Different accents are not reflected in differences in consonant pronunciation (Stanley-Whitley, 1986, p.21). As a consequence, the mental representations of English vowel phonemes may be less sharply distinguished from one another because of their variability (Coleman, 2000, personal communication). In Spanish, on the other hand, the pronunciation of vowels is far more constant across accents, people and words. Differences in accents are generally reflected in differences in the pronunciation of consonants (Stanley-Whitley, p.21).

The second, related, reason the English vowel system is hard to fathom has to do with 'phonetic features'. Phonemes, as acoustic units, are defined in terms of sets of features. With English vowels many of these features overlap, whereas in consonant sounds this happens less frequently. There are a great number of vowels that are defined by two or more features and certain vowels may differ only in the prominence of different interacting features (Ewen, 1995, pp.573-4). For example, /e/ and /ɛ/ are both constructed from a mixing of the features [sonorant][1] and [front][2] (/a/ and /i/). However, /e/, is more front than sonorant (contains more of /i/ than /a/), and /ɛ/ is more sonorant than front (contains more /a/ than /i/). In other words, the majority of English vowels overlap portions of the vowel space; the phonemes do not partition the vowel space into discrete regions. Spanish vowels, on the other hand, rely on either single features (/a i u/) or two features (/e o/); they partition the vowel space into separate (or more separate) regions (Coleman, personal communication).

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[1] Sonority refers to a sounds loudness relative to that of other sounds with the same length, stress and pitch. The vowel /a/ is the most sonorant of all vowels, (Ladefoged, 1975).

[2] Front refers to the fact that the highest point of the tongue is in the front of the mouth in the articulation of the vowel sound. The most front vowel is /i/, (Ladefoged, 1975).

11.2.iv Conclusions regarding the first question

In answer to the first main question, our results show that the awareness a child has of phonology is determined, at least in part, by the nature of the language to which she or he is exposed. Although English- and Spanish-speakers' phonological awareness shows the same pattern of development, the degree of awareness of each unit at any point in time differs across languages. Where there is a difference in the structure of units between languages, there is a relative difference in awareness of that unit in English and Spanish-speakers. These findings point to the conclusion that children analyse their spoken language in ways appropriate to its structure. Different languages, having different structures, call for different forms of analysis. It appears that, in general, where there is the opportunity to contrast alternative forms of the same phonological unit (e.g. syllables in English, rimes and vowels in Spanish) this unit becomes salient. If there is too much variability within a unit (e.g. vowels in English) or none at all (e.g. syllables in Spanish), then the child does not focus on the unit. From our results, therefore, it might tentatively be suggested that what makes a unit salient is some sort of middle ground. It has to be neither too consistent nor too variable.

11.3 THE SECOND QUESTION: CAN BILINGUAL CHILDREN TRANSFER PHONOLOGICAL AWARENESS ACROSS LANGUAGES?

The second main question that the thesis raised concerned bilingual children. The evidence discussed in Chapter 2.4 suggests that bilingual children do not analyse language in the same way as monolingual children. Bilinguals are exposed to a richer language environment than monolinguals and as a consequence of this they may be more prone to analysing their linguistic environment and picking out the differences that exist between languages.

It was hypothesised that this would be necessary in order to prevent 'language mixing'. 'Language mixing' refers to the scenario in which children inappropriately use the phonology of one language in the production and comprehension of speech in the other language. In order to avoid this, it must be essential to pick out those sounds, or more importantly, those contrasts that are relevant or irrelevant in each language. For example, where a minimal pair exists in one language but not the other, a child will be aware of this contrast. His or her attention is then brought to focus on this phonological unit. Monolingual children need never carry out this analysis because they are only required to work within a single sound system.

For example, English makes a distinction between /i/ and /I/. Spanish makes no such contrast even though these two sounds may both exist phonetically as allophones of the same phoneme. The bilingual child needs to be aware of, and make use of, this contrasting minimal pair in one language (English) but not in the other (Spanish). Because of this, his or her attention might be drawn towards noting when and where different sounds need to be perceived as different sounds, and where they may be treated as the same sound. Bialystok (1992) argues that this requirement to analyse speech sounds in bilingual children, which does not exist for monolingual children, may increase their 'meta' awareness of speech sounds as compared to their monolingual counterparts. However, the evidence reviewed in Chapter 2 does not tell us whether the amount of awareness is different in monolinguals and bilinguals. Instead, it simply indicates that the quality of awareness is richer.

We hypothesised that, in terms of phonological awareness, children exposed to two languages would not act as two monolinguals in one body. It was predicted that bilingual children may use their knowledge of the differences in sounds between languages to help them improve their awareness of sounds in each language, giving rise to quantitative differences between monolinguals and bilinguals. There were two alternative ways in

which this might occur. The first possibility was through transfer of awareness across languages. If a particular unit is made relatively more salient in Language A than in Language B as a consequence of the structure of each language, bilingual children may be able to transfer their awareness from Language A to Language B. Bilingual-speakers would consequently have a greater awareness of this unit in Language B than monolingual-speakers of Language B. For example, if vowels are particularly salient in Spanish as compared with English, bilingual children could transfer, or use their awareness of Spanish vowels in English. This would consequently make them more aware of vowels in English than are English monolingual-speakers.

The second possibility is that bilingual children would be better at analysing languages at a more general level. This argument stems from Bialystok's theory (discussed in Chapter 2.4 and Chapter 3.4) that bilinguals are better at analysing knowledge. This would predict that bilingual children should show enhanced phonological awareness when compared to monolinguals not only of the units that are made relatively salient in L1/2 as compared to L2/1, but of all units.

Which theoretical position is supported by our findings? Our results suggest that neither pure transfer, nor a general increase in analytical capacity occur. Instead, a hybrid hypothesis is supported.

In order to explain this hybrid hypothesis it is easiest to look at the evidence that contradicts each theory in its pure form. The first hypothesis argues that children simply transfer knowledge of one language's phonology and use it in the other language. In Experiment 1 we found that bilinguals were more aware of Spanish syllables than Spanish monolinguals. This result neither confirms nor refutes the transfer hypothesis. We did not control for the possibility that many of the Spanish syllables used in the experimental materials could also have been English syllables. Hence, we do not know whether the bilingual children were using their knowledge of English syllables in the Spanish task (as

the transfer hypothesis would claim), or whether they were analysing syllables differently from Spanish monolinguals (as the 'enhanced analysis' hypothesis would claim). However, we do have evidence from Experiment 2's results that bilingual children do not only transfer awareness. We found that bilingual children were more aware of vowels than English monolinguals. This vowel advantage did not only occur for vowels existing in both Spanish and English, namely, tense vowels. It also extended to vowel sounds that exist only in English, namely, lax vowels. Since these vowels do not exist in Spanish, the findings suggest that bilingual children are analysing the vowel system more closely than are monolingual (English) children.

However, we also found evidence refuting the 'enhanced analysis' hypothesis. In Experiment 2 we found that bilingual children are more aware of tense vowels, that exist in both languages, than they are of lax vowels, which exist only in English. English children do not show a tense vowel advantage. Hence, it would appear that there is some direct transfer of phonological knowledge from one language to the other.

Furthermore, if bilingual children were more able to analyse their languages, then we should have found a consonant as well as a vowel advantage. Experiment 3 showed that where phonological systems do not differ markedly between languages, bilingual children show similar levels of phonological sensitivity to monolingual children in both English and Spanish.

11.3.i Conclusions regarding the second question

We may tentatively suggest that bilingual children analyse language differently from their monolingual counterparts. When differences are found between the phonological structures of their languages, bilingual children focus on these contrasts. They are able both to transfer their awareness of L1/2 directly to L2/1 and to analyse these

structures so as not to get confused between languages. Where the structure of each of their languages is similar, this enhanced analysis does not occur.

11.4 THE THIRD QUESTION: HOW IS PHONOLOGICAL AWARENESS RELATED TO LITERACY FOR EACH OF THE GROUPS?

The final question this thesis posed concerned the relationship between phonological awareness and literacy. This question came in three parts. We firstly asked how phonological awareness and reading are related for each group at a general level. The second question concerned whether a more direct mapping between phoneme awareness and phoneme reading and spelling exists. Finally, we asked how bilingual children's phonological awareness of each language is related to their literacy skills in each language; is their approach to literacy different from that of monolingual children?

11.4.i The relationship between phonological awareness and reading

11.4.i.a English and Spanish monolingual children's reading

As discussed in Chapter 3.1.iii, the English orthography is most regular or consistent at the level of the onset/rime division. However, there is on-going debate as to which level of phonological awareness is most highly correlated with reading ability and how this might change as reading skill develops. From the research reviewed in Chapter 3.1 we can identify two main schools of thought. Bryant and colleagues have argued that at the beginning stages of literacy acquisition English children rely on their knowledge of onsets and rimes, and later, phonemic awareness also plays a role. However, research conducted by Muter *et al.* and Duncan *et al.* suggests that phonemic awareness plays a role at the earliest stages of reading and rime is not related to reading until a later stage.

Experiments 1 and 3 looked at early reading. We found that the awareness of rhymes, syllables and consonants is correlated with reading for English monolingual children. The awareness of vowels, however, is not related to reading ability. Experiments 2 and 4 looked at the relationship between phoneme awareness and reading at later stages of reading. We found in Experiment 2 that vowel awareness is related to reading ability. However, Experiment 4 found that consonant awareness was not related to reading ability.

These findings fit nicely with Bryant and colleagues' argument. Rhyme is related to early reading, and vowel awareness is related to later reading. The finding that consonant awareness is also related to early reading does not necessarily contradict the theory. Firstly, half of the consonants in Experiment 3 were onsets, so this finding fits in with the theory that intra-syllabic units are related to early reading. Secondly, the children in Experiment 3 had started to read and hence it is possible that they had begun to develop phonemic awareness. Interestingly, vowel awareness was not correlated with reading until a later stage. This may be a reflection of the relatively more complex mapping that exists between vowel sounds and their orthographic representations than between consonant sounds and their orthographic representations. Children need to learn vowel awareness through learning to read. This may take longer than it does for consonant awareness because the orthographic representations of vowel sounds are more varied and complex, as are the vowel sounds themselves. We will return to this point in Section 11.4.iii.

The findings are not entirely contrary to Muter *et al.* and Duncan *et al.*'s theory. Consonant awareness is related to early reading, as their theories would predict. However the finding that rhyme awareness is also related to reading at the early stages and that consonant awareness at the later stages of reading is not related to reading ability goes against their theories. One possible reason for this discrepancy in findings is that Muter *et al.* and Duncan *et al.* tested for the awareness of consonants in word-

initial or word-final positions. The present study looked at the awareness of consonants in the middle of words.

Research into the relationship between phonological awareness and literacy has not been as extensive or conclusive in Spanish. The Spanish orthography's regularity lies at the grapheme-phoneme level. On the whole, using GPCs works. The evidence discussed in Chapter 3.2.ii suggested that Spanish children rely on their knowledge of phonemes in reading (and spelling) from the earliest stages. However, using GPCs can be a relatively cumbersome way of reading and spelling. Indeed, research indicates that Spanish children also use their syllable knowledge in literacy acquisition (Chapter 3.2.i). However, the research has generally failed to look systematically at which phonological units are most important, and at whether the relationship between phonological awareness and reading changes over time. The experiments conducted here enabled us to look at whether other phonological units were related to reading in Spanish, and at how phoneme awareness is related to reading at different stages of ability.

In Experiments 1 and 3 we saw that for Spanish monolingual children, the awareness of syllables, rimes, vowels (Experiment 1 but not 3) and consonants is related to reading at the early stages. Since the Spanish orthography reflects the spoken language rather accurately, it could be argued that phonological-to-orthographic consistency lies at every level. Our findings suggest not only that children employ their phonological awareness from the very earliest stages of reading, but moreover, all types of phonological awareness are useful. These results are in accord with the majority of Spanish research indicating a role for syllable and phoneme awareness in literacy. However, they also suggest that the Spanish research needs to expand to encompass the possibility that other phonological units are implicated in Spanish literacy ability. We shall return to this point in Section 11.5.ii.

We found, in Experiments 2 and 4, that at the later stages of reading neither consonant nor vowel awareness are related to reading ability for Spanish children. This is contrary to the findings of González, Valle Arroyo, and Jiménez (discussed in Chapter 3.2.i and 3.2.ii) who argue the case for phoneme knowledge playing a role in Spanish reading. However, it supports the claim of Domínguez Martínez and Cuetos Vega that children increasingly rely on the lexical route for reading.

11.4.i.b Comparing English and Spanish children's approach to reading

Just as it was hypothesised that differences in linguistic background would affect phonological awareness, it was also speculated that differences in orthographic structure between languages would require and/or further the knowledge of different phonological units.

We found that the relationship between reading and phonological awareness differed between the groups. Given the limited amount of data available, we may only speculate as to how English- and Spanish-speakers differ in their acquisition of reading skill. It would appear that Spanish children rely more heavily on phonological awareness at the early stages of reading, but phonological awareness continues to have an impact on reading for English children beyond that at which it has for Spanish children.

This may be for several reasons. Firstly, correlations between phonological awareness and reading can only be found for those units of which the child is aware. As we saw in Experiment 2, vowel awareness comes late to English children. Spanish children, on the other hand, are aware of vowel sounds from an early(ier) age. Hence, whilst Spanish children are able to apply this knowledge to reading acquisition from the

very first stages of literacy, any relation between vowel awareness and reading for English children will not appear until later.

Secondly, the mapping between phonological and orthographic systems in English is far more complex than it is in Spanish. Consequently, it may be speculated that the specific relationship between phonology and orthography will take longer to master in English. It is relatively easy for Spanish children, on the other hand, to work out how phonology and orthography are related to one another. Hence, these children can move onto more 'visual' or 'orthographic' strategies sooner than English children.

11.4.i.c Bilingual children's reading

In Chapter 3.4 it was postulated that bilingual children may approach reading differently from their monolingual counterparts as a direct consequence of their exposure to two differing phonological and two differing orthographic systems. Firstly it was argued that their phonological advantage may allow them to draw correspondences between phonology and orthography that their monolingual counterparts could not. Secondly, it was argued that exposure to two orthographic systems could begin by confusing the children. However, at later stages of reading it may enable them to analyse the level at which phonology is represented in each orthography.

In each of our experiments, the bilingual children never showed a deficit in reading ability in either language. It could be argued that this result is surprising. In English, the bilingual children's receptive vocabularies were significantly worse than their monolingual counterparts (data not presented). Hence, it might be assumed that the bilingual children were unfamiliar with some of the words they were being asked to read. In Spanish the bilingual children spent far less time undergoing literacy training than their Spanish monolingual counterparts.

We have to ask why the bilingual children appear to have this facility for reading when, on the face of it, they seem to be at a disadvantage when it comes to reading in both of their languages. One possible explanation for their good literacy abilities could lie in the differences in phonological awareness between the groups.

However, one finding that is notable throughout the experiments is that correlations between reading and phonological awareness are fewer for bilingual children than for monolingual children, even though, if anything, they have greater phonological awareness than monolingual children. It is not clear why this occurs. One possibility is that bilingual children have too much phonological knowledge and consequently find it hard to map this knowledge onto orthographic systems.

This may be exacerbated by the fact that mapping between phonology and orthography in English and Spanish is different. Hence, bilingual children may choose to be conservative in their approach to mapping phonology and orthography. They may focus on those units where the most consistent mappings occur in each language. Indeed, in Experiments 1 and 3 we saw that at the early stages of reading, the bilingual children only showed significant correlations between those units that are most consistently represented in each orthography and reading skill in each language: the onset and rime in English, and syllable, vowel and onset units in Spanish.

Nevertheless, our findings also suggest that at the later stages of reading, (Experiments 2 and 4), bilingual children do not focus on the representative nature of orthographic systems. In Experiments 2 and 4 neither vowel nor consonant awareness was related to reading ability in English for the bilingual children. Nor was consonant awareness related to reading for the bilingual children in Spanish, although the awareness of vowels was.

However, it is possible that we were looking at the wrong level of awareness at inappropriate times in development. Since the children were reading relatively fluently

in both languages at this age, they may have moved from phonological methods of reading to an approach based around 'visual' or 'orthographic' reading. Alternatively, the type of phonological task employed might not have been tapping into the level of phonology that may have been being utilised in reading. We do not have enough data on which to base any strong conclusions about how phonological awareness and reading are related at the different stages of literacy acquisition in bilingual children. We will return to the discussion of the possible reading strategies of bilingual children in Section 11.4.v.b.

11.4.ii Direct mapping

The second main question concerning literacy and phonological awareness was whether phonemic awareness is directly applied to the reading of phonemes for each of the groups. From the research literature reviewed in Chapters 3.1.i.c, 3.2.ii and 4.1.i.a, 4.2.ii we know that phoneme awareness is a good predictor of reading and spelling skill in English and Spanish, and there is strong evidence that training children in phoneme awareness enhances literacy ability (Chapters 3.2.ii.c and 4.2.iii for Spanish, Chapter 3.1.ii for English). However, this research does not tell us how knowledge of phonemes is employed in reading and spelling. By making children read and spell those phonemes for which we had already tested awareness, we had a more direct measure of the influence that awareness has on literacy. If a child uses her or his awareness of sounds directly in reading and spelling, we would expect to find a good correlation between the ability to distinguish a sound and the ability to read or spell it.

11.4.ii.a Reading

In Experiments 2 and 4 we looked at the relationship between the awareness of

non-words containing vowel and word-medial consonant sounds, respectively, and the ability to read these same phonemes. Only the English monolingual children showed significant correlations between reading vowels and awareness of them. We found that none of the children showed good correlations between the ability to hear a medial consonant sound and the ability to read that sound.

There are various possible alternative explanations of these findings. Firstly, in contrast to our predictions, the results suggest that at this stage in literacy acquisition none of the children directly map between (word-medial) consonant phonemes and their corresponding graphemes, and only monolingual English children directly map between vowel sounds and their orthographic representations. This implies that children at this stage in reading do not apply GPCs, since vowels in Spanish, and consonants in both languages, are virtually always represented with single graphemes. English vowels, however, are the only phonemes that are frequently represented by more than one grapheme. The result thus supports the work of Sebastian Gallés and Parreño Vacchiano (in Spanish) and Bryant and colleagues (in English) in providing a case for phonological-to-orthographic mappings occurring for units larger than the phoneme.

The second possible explanation is that we did not use an appropriate awareness task. As reviewed in Chapter 3.i.vi, a certain body of researchers in both English and Spanish argue that 'epi-linguistic' awareness, which is the type of awareness the oddity task tests for, is not sufficient for reading. Rather, it is 'meta-linguistic' awareness that counts. It is possible that if GPCs are to be used a child needs to have explicit representations of the phoneme, the grapheme(s) and of the relationship between these two. However, this seems unlikely as an explanation for our results because the only correlations found were between English vowel awareness and English vowel reading. Of all the groups, the English children were both the least aware of vowels and the least able to read them. It is doubtful that either their phonemic or their orthographic representations

of vowels were more sophisticated, or higher level, than that of the other groups.

The final possibility is that high reading scores were masking any direct relationship between phoneme awareness and reading ability. The English monolingual children's vowel reading scores were the lowest phoneme reading scores of all the groups. Hence, they may have shown enough variability for a correlation to be significant.

11.4.ii.b Spelling

Experiments 2 and 4 also examined the relationship between the ability to spell vowels and word-medial consonants and awareness of them. We found that none of the groups directly drew links between individual word-medial consonant sounds and their orthographic representations, but that vowel awareness was related to spelling for all of the groups apart from the bilinguals in English.

The results may indicate that no children apply PGCs for consonants at this stage of spelling development. All children, apart from bilingual children in English, however, draw vowel phoneme-to-grapheme-correspondences. There are two questions that these results raise. Firstly, why did we find correlations for vowels but not for consonants? And secondly, why do the bilingual children not show the same pattern of results for vowel sounds as the other groups?

With respect to the first question, the high consonant spelling performance from all the groups may have masked any potential correlations. However, this seems an unlikely explanation since the Spanish-speakers, at least, also scored highly on the vowel spelling tasks, yet correlations were found between vowel awareness and vowel spelling.

An alternative possibility is that, since only the spelling of word-medial consonants was examined here we should not extrapolate and argue that PGCs are never applied for consonants. It is possible that GPCs are made for consonants in word-initial and/or word-

final positions. The reason they are not made for word-medial consonants may be because these are viewed as intrinsic parts of larger phonological units, across which phonological-to-orthographic mappings may be made. This argument would support the work of Goswami (for English) and Sebastian Gallés and Parreño Vacchiano (for Spanish) reviewed in Chapter 3.1.iii and 3.2.iii. The direct relationship between phonology and orthography for vowels, on the other hand, might be better understood in Spanish because vowels are often not embedded in the middle of words, and in English, because the phoneme-to-grapheme correspondence is often quite complex. Good vowel awareness may encourage a better understanding of how different vowels are represented orthographically, and good knowledge of the orthography may encourage a better awareness of the many subtly different English vowel sounds.

With respect to the second question, the lack of relationship between vowel awareness and vowel spelling for the bilingual children in English may be indicative of poor orthographic representations of English vowel sounds. The bilingual children found digraph vowel spellings particularly hard. This may have been because of an over-reliance on the single grapheme Spanish orthographic representation of vowel phonemes. Hence, although bilingual children may show high levels of English vowel awareness as a consequence of being exposed to two languages, they do not realise that vowel sounds are orthographically represented differently in English and Spanish.

However, there is an alternative possible explanation. Watson (1991) argues that the processes involved in the perception and production of speech, whilst intimately linked in the monolingual, may be more separate in bilinguals. He claims that that there "...seem[s] to be a disparity between the production and perception habits of bilinguals which is not found in monolinguals." (p.44). If it is accepted that bilingual children might not be able to produce all of the distinctions that they can perceive, it is possible that they could do well on an auditory discrimination task whilst performing poorly on a

production task. This is what we found. The bilingual children's performance on the oddity task was good, and yet the majority of them had perceptible Spanish accents.

Therefore, even though they display greater vowel awareness, it is likely that they are not able to accurately reproduce sounds when it comes to spelling. Presumably, the phonemic representations to which we refer to help us spell are those found in the production rather than the perceptual system. It is possible that they were searching for the orthographic representation of an incorrectly remembered sound. This possibility was probably heightened by the fact that non-words were used in the spelling task. The fact that these words had no entry in the mental lexicon, makes it even more possible that the bilinguals were not entirely phonologically accurate in their recall.

11.4.ii.c Conclusions regarding question three, part two

With respect to the second question concerning literacy acquisition, our findings do not provide a definitive answer. On the surface it would appear that the only children to map directly between phoneme awareness and reading are English monolingual children, and only then for vowel sounds. However, it seems more likely that high vowel and consonant reading scores from the other groups may have masked any correlations.

For spelling, it was argued that children may map between individual consonants and their corresponding graphemes, but not when these consonants are embedded in the middle of words. It was further concluded that direct phonological-to-orthographic-mappings occur for vowels, but that bilingual children are impeded from doing this accurately in English by their knowledge of the Spanish orthography.

The results of Experiments 2 and 4 also bring out an important point. The lack of direct correlations between phonemic awareness and literacy in our studies suggest that

when a correlation is found between phonemic awareness and literacy ability we should not draw the conclusion that children are directly using their knowledge of phonemes to help them read. Instead, any correlation may simply be an indication that, the more sophisticated your knowledge of phonology, the more able you will be to find links between the spoken and written systems.

11.4.iii The complexity of the phonology and orthography

In Experiment 2, we looked at the ability to read and spell vowels. We found that English-speakers had particular difficulties in both reading and spelling those vowel sounds that are represented with two graphemes (e.g. 'ee', 'oo', 'ar' and so on). We also saw how English-speakers were not as good as Spanish-speakers at reading and spelling vowels that were represented with either one or two graphemes. These results suggest that it is not only the lack of consistency of the English orthography (see Chapter 3.1.iv) that makes vowel literacy so difficult to achieve in English. Rather, it may be more productive to also think about the complexity of the phonological system, and how this interacts with the orthographic system.

Firstly, English vowels are phonetically complex. For children to read or spell a vowel accurately they must have a good phonological representation of it. Spanish vowels are phonetically much simpler. Hence it is easier for Spanish children to acquire phonological representations of them. We saw that this was the case in Experiment 2.

Secondly, there are only five vowel graphemes in the Roman alphabet. Whereas Spanish has five vowel sounds that need to be mapped onto these, English has up to 21 vowel phonemes that need to be mapped onto the same five vowel graphemes. Hence, English children need to learn both a larger number, and a more complex set, of vowel grapheme-to-vowel-phoneme-correspondences than do Spanish children. This might

explain why it is so much harder for English children to learn how to read and spell vowels.

11.4.iv Reading and spelling: how closely related are they?

Our data suggest some interesting conclusions regarding the relationship between reading and spelling. The suggestion is that the relationship is different for monolingual and bilingual children.

For monolingual children it appears that when a phonological unit has a complex orthographic representation, reading and spelling are related. For example, the mapping between English vowel sounds and their orthographic representations is complex. We found in Experiment 2, that vowel reading and spelling were related to one another. Where a phonological unit has a simple orthographic representation, reading and spelling are treated differently. Consonant sounds have relatively simple GPCs in both English and Spanish. Vowel sounds also have simple GPCs in Spanish. We found, in Experiment 4, that consonant reading and spelling were not related for either language, and Experiment 2 showed us that vowel reading and spelling were not related in Spanish.

Bilingual children appear to take the opposite approach. Where complex orthographic representations exist, reading and spelling are separated, and this is true for both languages, even if the complex orthographic representations only occur in one of them. Where simple orthographic representations exist, reading and spelling are brought together. Experiment 2 showed that vowel reading and spelling are not correlated with one another in either language. Experiment 4, on the other hand, showed that the reading and spelling of consonants was related.

However, we should bear in mind that the number of vowel and consonant reading and spelling errors was not particularly high for any group. This, along with the fact that

our experiments were not specifically designed to tease apart any differences in approach to reading and spelling for each of the groups, make our suggestions only tentative. Future research should examine further under what conditions reading and spelling are viewed as two sides of the same coin, and how these conditions differ for children reading in different orthographies. One way of determining whether or not this hypothesis is correct will be discussed in Section 11.2.3 below.

11.4.v Do bilingual children approach literacy acquisition differently from monolinguals?

The final question concerning literacy that this thesis posed was whether bilingual children approach literacy differently from monolinguals.

11.4.v.a Do bilingual children use the phonology of L1/2 in L2/1 reading and spelling?

One way in which bilingual children could differ from monolinguals in their approach to reading is by using the phonology of each language to help them read in the other language. The research discussed in Chapter 3.4 suggests that children do do this. We aimed to replicate these findings and extend them in Experiments 1-4 by looking at the relationship between the awareness of different phonological units and reading across languages. Overall we found few correlations between L1/2 awareness and L2/1 reading. Bilingual children do not appear to use their knowledge of English phonology to help them read in Spanish or of their Spanish phonology to help them read in English. This suggests that they mainly rely on the phonological system of L1/2 when trying to draw correspondences between phonology and orthography in L1/2.

Does this imply that they approach learning to read in English and Spanish independently of one another? The results could be interpreted as an indication that

bilingual children do not appreciate that the processes involved in reading alphabetic scripts are similar, regardless of the language in which you are trying to read. Indeed, given that the bilingual children showed relatively low numbers of correlations between reading and phonological awareness overall, it may be that the exposure to two orthographies confuses them at the early stages of reading and prevents them from realising that orthographies represent phonologic units at some level. However, we would not wish to adopt this interpretation in its strong form. We saw in Section 11.4.i.c of this Chapter that bilingual children focus on those units at which phonological-to-orthographic consistency is greatest in each language.

We have at least two alternative explanations for our findings. Firstly, it may be that phonological knowledge of English/Spanish is not particularly useful for reading in Spanish/English. Since the languages' phonological and orthographic structures differ, the level of phonology that is represented in each orthography may not correspond to phonological units that are salient in the other language. To give an example, Spanish syllables are mainly open (CV or VC), whereas English syllables are usually closed (CVC). Hence, knowledge of Spanish syllables will not be of great help in reading in English because most English syllables are represented orthographically as CVC.

This theory is supported by the fact that, where correlations were found between English/Spanish awareness and reading ability in Spanish/English it occurred for phonemic awareness. In Experiment 2 we found that Spanish vowel awareness was related to English reading skill. In Experiments 1 and 2 we found that the awareness of English vowels was related to Spanish reading ability. In Experiments 3 and 4 we found that Spanish consonant awareness was related to English reading ability. In Experiment 3 we found that English consonant awareness was related to Spanish reading.

We should also bear in mind that these correlations cannot tell us anything about

the causal links between phonological awareness and reading skill. We do not know whether it is the reading of English/Spanish that promotes phonemic awareness in Spanish/English, or vice versa, that phonemic awareness in English/Spanish enhances Spanish/English reading skill. A third possibility is that the relationship between phonological awareness in English/Spanish and reading in Spanish/English is mediated by a third skill, such as phonological awareness in Spanish/English. Hence, any correlations found between phonological awareness in L1/2 and reading ability in L2/1 does not necessarily mean that the two are directly related.

Our findings suggest that, instead of using their knowledge of L1/2's phonology directly in reading L2/1, bilingual children use their knowledge of L1/2's phonology to enhance their knowledge of L2/1's phonology. This enhanced phonological awareness in L1/2 may then be used to aid in phonological to orthographic mappings in L1/2.

A second alternative explanation of our findings is that the 'oddity task' may have measured the wrong 'level' of phonological awareness. It might be that more 'explicit' forms of phonological awareness would be more highly correlated with reading skill for bilingual children. This is a point we shall return to below.

11.4.v.b How do bilingual children acquire literacy?

In Section 11.3 above we argued that bilingual children show some transfer of phonological awareness across languages and some enhanced phonological analysis. However, this does not appear to feed into reading. Not only do bilingual children show fewer correlations between phonological awareness and reading ability than monolingual children, but they also do not appear to use their phonological awareness of English/Spanish to help them in Spanish/English. However, this is not harming their reading skill. Experiments 1-4 showed that bilingual children's reading ability in both

languages was equivalent to or even better than that of monolingual children of the same age. So how do bilingual children acquire literacy?

The dearth of experimental evidence in this field makes the question very hard to answer without resorting to speculation and theoretical issues. We would argue that bilingual children do not approach literacy acquisition in the same way as monolingual children. They are not merely the sum of two monolinguals. Support for this theory comes from two sources.

Firstly, our research indicates that instead of concentrating solely on the language or the level of phonology employed in reading by bilingual children, it might be more fruitful to look at the potential strategies used. Phonological knowledge might not be the only aspect of knowledge that transfers across languages. Reading strategies may also be transferred. Experiments 2 and 4 provide evidence of this occurring. Bilingual children were more accurate in their reading of non-word vowels and consonants than were English monolingual children. This finding is similar to that found by da Fantoura and Siegel (1995), discussed in Chapter 3.4, for Portuguese-English bilinguals. The typically Spanish reading strategy of applying GPCs might have transferred to English to help in the non-word reading tasks. Further support for this hypothesis is that reading ability (Experiments 1, 3 and 4) and reading omissions (Experiments 2 and 4) were correlated across languages, indicating that a similar strategy was being employed in both languages. This indicates that bilingual children use strategies that are unavailable to monolinguals.

The second source of evidence suggesting that bilinguals are not merely the sum of two monolinguals comes from the finding that correlations between phonological awareness and reading skill were not the same in monolinguals and bilinguals. This supports Bialystok's (1985, 1987, 1991, 2000; Chapter 3.4) idea that bilingual children have a greater comprehension of the symbolic nature of orthographic systems. The research of Durgunoğlu *et al.* (1993), discussed in Chapter 3.4, points to a similar

conclusion. They found that Spanish-English bilingual children were good at reading things that should be read differently in English and Spanish. The implication is that exposure to two orthographies enables bilinguals to gain a deeper understanding of how phonology is represented in each. Our work points to a similar conclusion.

Bialystok's argument is that bilinguals read well in both languages because they are better able to analyse their knowledge. In terms of literacy acquisition, this analysis manifests itself in two important ways. Firstly, it enhances phonological knowledge: "Becoming literate in a second language...forces the language learner to examine the structure of the second language through the process of analysis so that the language is represented as a formal system." (Bialystok, 1991, p.130). We found that bilingual children's phonological awareness was enhanced.

Secondly, bilinguals are more able to control processing or direct attention to the relevant information in order to solve a task. In literacy, this translates as the ability to focus on the relevant aspects of language to solve the literacy acquisition problem. We also found evidence of this. Although there were few correlations between reading ability and phonological awareness in both English and Spanish, the correlations that existed were between those phonological units that are most consistently represented in each orthography and reading skill in each language.

However, although Bialystok provides a good theoretical framework within which to work, we are not entirely content with either aspect of her theory.

The first proposition, that bilinguals show greater levels of phonological awareness, refers to a qualitative, as opposed to a quantitative, advantage for the bilinguals. The claim is that only high levels of awareness, or meta-awareness, are related to reading skill. Menyuk (1984) makes a similar point. She argues that reading depends not just on how much one knows, but on the degree of knowledge of any particular structure. The degree would reflect the extent of analysis. In other words, for awareness of phonology to be

useful in literacy it must have reached a level at which the child understands that a phonological unit is an entity that may be symbolised orthographically.

We have one theoretical and one empirical reason for disputing this proposition. Firstly, to talk of 'levels of awareness' is vague. What does this term mean? Bialystok (1985) herself argues that levels of awareness lie on a continuum with all the gradations being viable representational forms. "Development, then, is the emergence of the more analysed forms through the increasing ability to structure and classify knowledge." (p.233). However, this fails to tell us precisely how structured and well-classified knowledge needs to be to influence reading ability.

Other researchers (Gombert, 1992; Chomsky, 1979) argue that consciousness is what distinguishes different levels of awareness. For example, Gombert claims "...a command of reading and writing *necessitates* the conscious knowledge and intentional control of numerous aspects of language." (p.190, his italics). Invoking consciousness as the key criterion does not help. 'Consciousness' is an equally vague and ill-specified term as 'awareness'. Hence, from a theoretical standpoint, the terms used lack clear definition.

An alternative way of defining what constitutes a sufficiently high level of awareness is by reference to different phonological tasks. It is generally argued that the oddity task, used throughout this thesis, is a measure of epi-linguistic awareness. However, according to Bialystok, it is meta-linguistic awareness that is implicated in reading. This leads to our second point of contention. We found evidence for a relationship between phonological awareness and reading even though we used the oddity task. Hence, even low levels of phonological analysis are involved in reading. Nevertheless, we acknowledge that it remains to be seen whether more analytical representations will yield stronger correlations between phonological knowledge and reading skill (see Section 11.5.i).

The second part of Bialystok's theory is that bilingual children have better control over attention; they are better at attending to the appropriate aspects of language in order to solve a predicament. The problem is that this tells us little as to how they might do this. Bialystok's point is, in large, entirely theoretical. We know nothing about what it is that bilingual children choose to focus on, or how this choice might be made. How do they know when different strategies are applicable? To what extent do they organise their reading skills separately in each language, to what extent are they functionally the same system?

We wish to argue that the general idea might be correct. The implication of our work and the work of others is that bilingual children employ strategies that monolingual children do not have access to as a consequence of experiencing only one orthographic system. However, what is of real interest is what exactly it is that children do when they read. We concede that the theory tells us little about this. Future research may elucidate what the bilingual approach entails (see Section 11.5).

11.4.v.c Spelling

To our knowledge, no research has been conducted on whether bilingual children employ L1/2 phonology in L2/1 spelling. Experiments 2 and 4 indicate that they do not, at least for vowels and word-medial consonants. However, just as was argued for bilingual reading, rather than looking at the level or language of phonology employed, we should maybe concentrate on the possible strategies used. Spelling was highly correlated in English and Spanish suggesting that similar methods are employed in both languages. Experiment 2 provided evidence, for example, that in spelling English vowels bilingual children tend to choose Spanish orthographic vowel representations. Not only were they worse at vowel spelling overall than monolingual children, but this was particularly true

for vowels that require two graphemes, which is something that never occurs in Spanish. Experiment 4 provides further evidence for the use of PGC strategy in both languages. The children were better at spelling non-word consonants than their monolingual counterparts in English. Non-words are thought to promote the use of PGCs in spelling (Bryant and Bradley, 1980). This suggests that they transfer strategy use across languages, in this instance the application of PGCs, rather than using their phonological awareness of one language to help them spell in the other language.

11.5 FUTURE RESEARCH

Given the dearth of research into bilingual literacy, it is hard to know where to begin with future research. Virtually all the research conducted into monolingual literacy acquisition could be repeated for bilingual children. This would be just a start. There is also huge scope for research that concentrates on those cognitive or metalinguistic advantages that apply specifically to bilinguals. We will attempt to discuss potential studies that have arisen directly as a result of the findings of this thesis.

11.5.i 'Epi-' vs. 'meta-' linguistic awareness

We generally found few correlations between reading skill and phonological awareness for the Spanish and the bilingual children. Moreover, we found virtually no correlation between the ability to hear a vowel or consonant sound and the ability to read that same sound. This is in contrast to the majority of research in Spanish that has found phonological awareness, and phonemic awareness in particular, to be a strong predictor of reading ability. One possibility for the discrepancy between our findings and those of other researchers is the type of tests employed. The oddity task is classified as an 'epi-linguistic' task. We chose to use this task in our experiments for

two main reasons. Firstly, we wanted to be consistent throughout the experiments in task type so that we could directly compare the awareness of the various phonological units with one another. As pointed out in Chapter 3.1.vi, the results of many studies are difficult to interpret because they have used different types of tasks to test for different phonological units, so that it is impossible to tell whether differences in awareness between units are truly a consequence of differences in phonological awareness, or whether the differences are an artefact of the different cognitive demands of the various tasks employed.

The second reason for using the oddity task was that most Spanish research has used 'meta-linguistic' phonological tasks. We wanted to know whether children's 'epi-linguistic' awareness is enough, or whether, in Spanish, meta-linguistic awareness is required.

From our results we might argue that epi-linguistic knowledge of one's phonology does play some role in reading skill. However, a future study might use meta-linguistic tasks to ascertain whether Spanish-speaking children and bilingual children have greater meta-linguistic understanding of their phonology than English-monolingual-speakers, and whether they use this in reading. An experiment could be conducted similar to that of Experiment 1. Children could be tested for their awareness of different phonological units through the use of a meta-linguistic task such as the deletion task.

Since learning to read and spell is achieved sooner in Spanish than in English, we speculate that Spanish children will be more able to directly manipulate the sounds of their language than English-speakers. This would be particularly true of phonemes. We also anticipate that this increased knowledge would arise directly as a result of experience with the Spanish orthography.

If bilingual children are more able to analyse their knowledge than are monolinguals, we would expect these children to perform better than their monolingual counterparts on meta-linguistic tasks. Furthermore, they might be able to perform successfully on meta-linguistic tasks before they have started to read. This is because, if exposure to two languages forces children to attend to the differences between the sound systems of each, they will presumably gain a deeper understanding of phonology and will hence be more capable of directly manipulating sounds. Exposure to two orthographies may further enhance this ability.

11.5.ii The role of body awareness in reading

One topic that should be examined in future research is the role of the body in phonological awareness and literacy. In Experiment 3 we saw that Spanish monolingual children are less aware of onsets than are English monolinguals. In Experiment 4 we saw that codas were more salient than onsets for Spanish monolingual children. Both of these results suggest that the Spanish syllable's hierarchical internal structure is not based around the onset/rime divide, but rather around the body/coda divide. In Chapter 2 we argued that the body unit might be more salient to Spanish-speaking children than it is to English-speakers. Furthermore, we argued that the body might be important in reading and spelling in Spanish.

One way of determining this is to look at the correlation between body (and coda) awareness and reading ability at different reading stages. However, this would not tell us whether body awareness is used directly in reading. One way in which it might be used is in drawing analogies across words with the same body. Goswami (1986) has shown that, in English, children from an early age are able to spontaneously draw analogies across CV units, though they find it easier for rimes. We would predict

that Spanish children would show the opposite pattern of results. They would be more able to draw analogies across body than rime units. This hypothesis could be tested by teaching children to read 'clue' words and then testing their ability to read new words that share either the rime or the body with the 'clue' word.

11.5.iii The transfer of reading strategies in bilingual children

It was suggested in Section 11.4.v.b that bilingual children might transfer reading strategies across languages. One way of examining this would be to teach children a reading strategy in L1 and then look at whether they spontaneously employ it in L2. One candidate would be the use of analogy, since it is a strategy that is effective in both English and Spanish.

Children could be taught to draw analogies across, say, the rime unit in English. Once they had learned to do this, they could be presented with Spanish words that they had previously been unable to read, but that could be read via rime analogy with words that they already knew in Spanish. If reading strategies are transferred across languages, the children should be able to read the target Spanish word.

Another group of children could be given analogy training in Spanish and then tested on their ability to draw analogies in English. Such a 'double-sided' study would determine whether the language in which the original skill is taught is of importance, or whether strategies may be transferred as easily from L1 to L2 as from L2 to L1.

The children could also be asked to read target words that shared a phonological unit in common with a word that they could already read. However, in this instance, the phonological unit could be one across which they had not been taught to draw analogies. If they could read this target word it would suggest that they had learned a new skill rather than a rule that, for example, words that end in the same way are read in the same way.

They would have learned to generalise the analogy strategy to encompass units other than that in which they were originally trained.

According to Bialystok's theory, bilingual children should be more able to draw analogies than monolingual children. This is because of their increased analysis of their representation of phonology and their enhanced ability to focus on the relevant aspects of the task in hand. Furthermore, if it is true that bilingual children are cognitively more flexible than monolinguals (Peal and Lambert, 1962), from teaching them to draw analogies across one level of phonology they might extrapolate. They should be more adept than monolinguals at ascertaining on which occasions or under which circumstances different types of analogy are most appropriate in each language.

11.5.iv Analogies and word length

One further issue that lacks research is the ability to draw analogies in words of more than one syllable. In Experiment 1 we found that for English children, although the correlation between reading and rime awareness almost reached significance, the relationship between rhyme and reading was much stronger. This finding throws into question the conclusions concerning the importance of rime in reading drawn by the majority of research on English literacy acquisition. These studies have always confounded rhyme and rime in the experimental materials. For example, in Chapter 3.1.iii we reviewed strong evidence that children draw analogies across the rime unit. One area that requires investigating is whether children are able to draw analogies across rimes in the middle of the words.

An experiment could be conducted in which children are taught to read a 'clue' word (e.g. mountain). They could then be presented with target words to read that shared either the first syllable rime (e.g. pouncing), the second syllable rime (e.g.

bargain), or the rhyme (e.g. fountain), with the clue word. Control words could share the same number of common letters with the clue word as the target word, but these letters would be in a different orthographic sequence. Evidence for the importance of rhyme, rather than rime, would be provided if children could draw analogies across the rhyme but not across the rime units.

Similar experiments could also be conducted that manipulated stress and word position of the rimes to see how these two factors influence the ability to draw analogies across rime units. For example, would it be easier to draw an analogy across a second syllable rime if it is stressed (e.g. saloon, baboon), than if it was not stressed (e.g. gerbil, pencil).

11.5.v Orthographic complexity and reading and spelling

In Section 11.1.iii.d above, we tentatively speculated that the relationship between reading and spelling is mediated by orthographic complexity and that complexity affects bilingual and monolingual children differently. One way of examining this would be to ask children to read and spell non-words containing both simple and complex orthographic sequences. According to the hypothesis proposed we should expect monolingual children's ability to read simple orthographic sequences not to be related to their ability to spell them, whereas their ability to read complex sequences should be related to their ability to spell them. Bilingual children should demonstrate the opposite pattern of results. The reading and spelling of simple orthographic sequences should be correlated in each language, whereas those of complex orthographic representations should not.

11.5.vi L1/2 awareness and L2/1 reading

The evidence from Experiments 1-4 seems to indicate that Spanish/English phonological awareness is of limited use in English/Spanish reading. Instead, we argued in Section 11.4.v.a above that rather than phonological knowledge of one language being used directly to aid the reading of the other language, phonological awareness in one language increases your awareness of the other language. It is this knowledge that can then be employed in reading.

However, we may be wrong in this speculation. After all, we found few correlations between those units that bilingual children had transferred across languages and the ability to read in this language. One way of determining whether children employ their phonological awareness of both languages in reading, or whether they restrict themselves to the use of the phonological knowledge of the language in which they are reading, is to conduct a predictive study.

By looking at reading and phonological awareness in both languages you could determine how much the phonological awareness of each contributes to the reading of each. In other words, you could see how much of L1's reading variance is accounted for by phonological awareness of L2 and L1. Likewise, you could see how much L2's reading variance is accounted for by the phonological awareness of L2 and L1. The only problem with such a study is that it tells us nothing about what is causing what. It could be that good reading in L1 promotes L1 phonological awareness, which in turn promotes good L2 phonological awareness. Therefore, any correlation between L2 awareness and L1 reading would not be causal, rather it would be mediated by L1 awareness.

An alternative might be to conduct a longitudinal training study. One group of children could be trained in phonemic awareness in L1. A control group could receive no training. Phonological awareness and reading tests in each language should be

carried out both directly before and directly after training, and again maybe six months and one year later. You could then examine whether the experimental group's phonological awareness and reading ability improve in L2. If you find that only reading ability improves, then it could be argued that phonological awareness in L1 has a direct impact on reading in L2. If both reading and phonological awareness improve in L2, then the longitudinal element of the study allows you to determine the causation of the improvement. There are various possible outcomes: improvement in L2 phonological awareness is found before improvement in L2 reading. This would suggest that improvement in L2 phonological awareness was caused by the training in L1 phonology. The increased L2 phonological awareness, in turn, causes the improvement in L2 reading. Alternatively, L2 reading could improve before L2 phonological awareness improves. This would suggest that L1 training directly affects L2 reading, and L2 reading, in turn, increases L2 phonological awareness. Finally, if both L2 phonological awareness and L2 reading improve simultaneously, no strong conclusion can be drawn. L2 reading could have improved directly because of an increase in L1 phonological awareness, whilst the increase in phonological awareness in L2 could have resulted either from the improvement in L2 reading or the increase in L1 phonological awareness, or both. Alternatively, L2 reading could have improved because of the improvement of L2 phonological awareness.

11.5.vii Literacy and education in bilingual children

The work presented here has shown that bilingual children do not approach learning in the same manner as monolingual children. This is true for areas which have always been viewed as requiring low levels of cognition, or at least implicit forms of learning, such as the acquisition of your language's phonology, as well as areas that

may be cognitively more demanding, or at least require more explicit forms of learning, such as the acquisition of literacy. If bilingual children do not learn in the same manner as monolingual children, we should presumably not teach them in the same way.

Future research should look at the individual differences between bilingual children's learning strategies. If we are able to pinpoint the strategies that work in literacy, then we may be able to work out ways of encouraging all children to adopt these strategies. In order to do this, we first need to understand how they develop their phonological awareness in each language, and to what extent this knowledge has been analysed; what sort of representations these children have of each phonology. Once we know this, we can begin to devise methods that encourage children to use this awareness in literacy.

We also need to devise methods that use their exposure to two orthographies to help them understand that literacy acquisition is largely about learning to map a phonological system on to an orthographic one appropriately. Once more, this will be easier to achieve once we understand how successful bilingual readers and spellers tackle the task of literacy acquisition.

It is also important not to neglect other aspects of reading such as the role morphological and semantic knowledge may play.

11.5.viii Education and cognition in bilingual children

A final area for future research concerns the development of cognition in bilingual children, and how it can be best exploited in order to help improve educational outcomes. One important consideration that is not restricted to literacy acquisition but affects education in a broader sense, is the possibility that the transfer of ability might depend on the language in which you originally teach the skill. We need to understand

further the extent to which cognition and language interact. Can children use knowledge from one language to aid in attaining knowledge in the other? For example, is it sufficient to teach children something in one language for the same cognitive structures to appear in the other? Does this depend on whether the children are originally taught in their stronger or weaker language? To what extent is cognition independent of language? All of these questions require research. Bilingual children provide an ideal opportunity to examine the relationship between language and cognition.

Once these areas are better understood, it will be easier to structure bilingual education programs that are more fitting to bilingual children's methods of learning. Ultimately, future research needs to reinvent education for these children.

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Appendix 1

Experiment 1 materials

English materials:

RHYME

Example words

mummy	tummy	children
money	funny	spaceship

Test words

plenty	Friday	twenty
also	baby	maybe
toffee	coffee	hamster
bumping	hedgehog	jumping
railway	forty	naughty
telly	smelly	garden
lonely	icecream	only

SYLLABLE 1

Example words

fingers	island	postman
winter	window	martian

Test words

market	martian	spider
rainbow	welcome	raindrop
tractor	penknife	penguin
picnic	picture	seagull
painful	something	painter
blowing	panties	panda
somehow	sometimes	language
sunshine	gerbil	Sunday

SYLLABLE 2

Example words

eyebrow	woman	eyebrow
flower	dentist	artist

Test words

money	penny	gerbil
only	Tuesday	early
peanut	lorry	hairy
carpet	trumpet	rainbow
sixty	birthday	frosty
hungry	tortoise	cactus
mountain	captain	jigsaw
snowflake	weather	cornflake

RIME 1

Example words

blister	christmas	Friday
clumsy	hedgehog	jumper

Test words

Sunday	crunchy	tower
early	Monday	certain
public	twenty	mention
object	problem	hungry
fedup	monkey	bedtime
public	sandwich	handsome
number	somehow	candle
helmet	donkey	elbow

RIME 2

Example words

future	music	public
necklace	tortoise	farmyard

Test words

often	person	railway
something	also	doing
trousers	gerbil	candle
rainbow	scarecrow	hedgehog
hundred	biscuit	forward
highly	answer	doctor
jungle	pencil	mermaid
pumpkin	birthday	engine

VOWEL 1

Example words

biscuit	power	midday
elbow	pancake	hamster

Test words

simple	winter	birthday
problem	cherry	doctor
future	Monday	public
breakfast	hedgehog	mermaid
husband	quickly	trumpet
better	children	fifty
penguin	welcome	eyebrow
grandma	tortoise	blackbird

VOWEL 2

Example words

pancake	birthday	tiger
airplane	mermaid	seesaw

Test words

peanut	yumyum	eyebrow
painter	music	darling
always	Monday	fifty
wanting	future	public
grandad	blowing	cowpat
forward	something	butter
penguin	biscuit	mermaid
marmite	blowing	sunshine

Spanish materials:

RHYME

Example words

planta	manta	dulce
trucha	gente	ducha

Test words

gancho	plancho	firme
santa	hijo	planta
marcha	junto	punto
puente	fuente	carla
santo	dulce	tanto
orden	vista	lista
gusto	justo	firme
frente	cabo	gente

SYLLABLE 1

Example words

meses	cinco	cinta
angel	ancha	mocos

Test words

polvo	carta	carne
ante	ancho	pili
alma	gente	alto
gente	falda	falso
sangre	santa	dicho
algo	frente	alma
vista	hondo	once
boda	bobo	peces

SYLLABLE 2

Example words

verso	pati	oso
vista	once	dulce

Test words

triste	polvo	gente
débil	acto	gusto
esta	planta	circo
rostro	hija	dentro
firme	punto	alto
vista	carta	firme
alma	diente	forma
cerca	finca	justo

RIME 1

Example words

monte	hondo	sala
culpa	frío	dulce

Test words

jefe	misma	visto
contra	fondo	simple
rostro	ala	bosque
leche	santa	banco
busca	justo	firme
harto	nube	charla
hijo	sangre	planta
largo	carta	ese

RIME 2

Example words

locos	virgen	falten
hombres	dulces	cantan

Test words

pocas	débil	manchas
crimen	todos	palos
culos	pozos	mandan
llenan	mocos	faltan
gustos	firmen	beben
fácil	útil	orden
almas	virgen	todas
débil	gastan	compran

VOWEL 1

Example words

gesto	fácil	verde
lucha	bosque	torno

Test words

marcha	falso	duque
sangre	hijo	falta
leche	costa	fondo
simple	digno	carta
santa	cargo	débil
dulce	fama	curso
barba	gente	falso
solo	gente	cerca

VOWEL 2

Example words

cejas	compran	útil
cogen	fácil	meses

Test words

útil	jefes	carmen
mármol	nidos	beben
meses	lápiz	joven
fácil	orden	jueves
bosques	pueden	lápiz
hijos	pueden	árbol
útil	carmen	peces
césped	unten	árbol

Appendix 2

Experiment 2 materials

Phonological materials

First stressed syllable

Example words

Spanish:	l/i/ndil	p/i/ctod	t/a/lsun	English:	l/i/ndil	p/i/ctod	t/a/lsun
	m/o/lsar	b/o/mpil	s/e/nten		l/ɔ/ndel	p/ɔ/ctad	d/ʒ/lsun

Test words

Tense vs. tense vowel comparisons

f/u/ster	k/u/ncad	m/e/mpil
v/a/stir	g/a/ndod	l/o/mpes
d/o/lsal	k/o/ngen	f/i/ctis
d/i/ntal	g/i/lson	k/a/mpes
f/e/mpar	k/e/ndus	b/i/lton
s/u/ctor	p/u/ndan	p/o/lsud
l/o/ndel	p/o/ctad	d/e/lsun
p/i/cton	b/i/mpid	l/u/ngar
b/a/ngon	n/a/mpus	t/u/stel
d/e/stid	l/e/ncon	b/a/mpal

tense vs. lax comparisons

g/a/ndod	v/a/stir	n/*a*/mpus
b/i/mpid	p/i/cton	f/I/ndus
l/ɔ/mpes	k/ɔ/ngen	t/o/lsal
k/u/ngen	l/u/mpes	t/ʊ/ncad
l/o/ndel	p/o/ctad	d/ɔ/lsen
k/ʊ/ndus	t/ʊ/stel	s/u/ctor
f/ʒ/mpon	b/ʒ/ltad	k/e/mpes
l/I/ndil	p/I/ctod	d/i/ntus
p/e/lsud	b/e/mpal	s/ʒ/nten
t/*a*/lsun	k/*a*/stir	n/a/mpus

Lax vs. lax vowel comparisons

b/I/mpid	p/I/cton	l/ʊ/ngar
l/I/ndil	p/I/ctod	t/*a*/lsan
v/*a*/stir	g/*a*/ndod	l/ɔ/mpes
b/*a*/ngon	n/*a*/mpus	t/ʒ/stel
f/ʒ/ster	k/ʒ/ncad	m/ɔ/mpil
g/ʒ/lsad	f/ʒ/mpon	d/I/nter
b/ɔ/mpil	m/ɔ/lsar	s/I/nten
k/ʊ/ndus	f/ʊ/mpar	b/ʒ/lton
m/ɔ/lsar	b/ɔ/mpil	s/ʊ/nten
n/ʊ/ngan	p/ʊ/mpol	k/*a*/stir

Second stressed syllable

Example words

Spanish:	gand/e/s	bect/e/n	nuls/o/d	English:	gand/e/s	bect/e/n	nuls/o/d
	nost/u/s	fund/u/l	semp/a/n		fump/ɑ/d	bels/ɑ/l	muct/ɪ/n

Test words

tense vs. tense vowel comparisons

tist/a/n	gond/a/d	lemp/o/s
dant/i/l	gols/i/n	komp/u/s
poct/i/n	bimp/i/d	lung/a/s
lend/o/l	pact/o/d	dels/u/n
soct/u/s	pand/u/n	pals/e/d
fest/u/n	kanc/u/d	momp/a/l
famp/e/d	kund/e/s	bilt/o/n
bong/a/n	nump/a/s	tist/e/l
dist/e/d	lonc/e/n	bomp/i/l
dals/o/l	keng/o/n	fuct/i/s

tense vs. lax comparisons

gond/a/d	vist/a/n	nump/ɑ/s
bimp/i/d	poct/i/n	fand/ɪ/s
lemp/ɔ/s	king/ɔ/n	dals/o/l
kund/u/s	soct/u/n	test/ʊ/l
lend/o/l	pact/o/d	dels/ɔ/n
nang/ʊ/n	kanc/ʊ/d	fest/u/s
fest/ɜ/l	gals/ɜ/d	bong/e/n
lind/ɪ/l	poct/ɪ/d	dunt/i/s
puls/e/d	bamp/e/l	sent/ɜ/n
tals/ɑ/n	kist/ɑ/d	nump/a/s

lax vs. lax vowel comparisons

bimp/ɪ/d	poct/ɪ/n	lung/ɔ/s
lind/ɪ/l	pact/ɪ/d	tals/ɑ/n
puls/ɑ/d	tend/ɑ/l	kemp/ɔ/s
b/ɑ/ngon	n/ɑ/mpus	t/ʊ/stel
fest/ɜ/n	kanc/ɜ/d	mimp/ɑ/l
gals/ɜ/d	f/ɜ/mpos	dent/ɪ/n
dact/ɔ/s	keng/ɔ/n	fils/ʊ/l
dist/ʊ/s	lonc/ʊ/n	bomp/ɜ/l
gals/ɔ/l	tond/ɔ/s	duct/ɜ/d
nang/ʊ/l	pomp/ʊ/n	kist/ɪ/s

English non-word reading test:

bimpid	kongen	tistan	disters
picton	dolsal	gondad	loncern
tarslan	deental	pactid	tondors
garndod	geelson	lindil	galsorl
fooster	bulton	bimpeed	kancood
kooncad	gulsad	pocteen	festoon
lormpes	nerngan	filsul	gondard
korngen	fempar	festun	tistarn
vastir	kendus	lendol	palsed
gandod	permpol	pactod	disted

Spanish non-word reading test:

fuster	kuncad
vastir	gandod
kongen	dolsal
dintal	gilson
kendus	fempar
tistan	gondad
bimpid	poctin
lendol	pactod
kancud	festun
palsed	disted

English non-word spelling test:

/bImpId/	/talsən/
/fustə/	/lɔmpes/
/bʊltən/	/gandod/
/kongən/	/dintəl/
/n3ngən/	/kendʌs/
/tistan/	/lIndIl/
/poctin/	/fIlsʊl/
/lendol/	/gondad/
/lons3n/	/tondɔs/
/palsed/	/kancud/

(the stressed syllable is underlined)

Spanish non-word spelling test:

/fuster/

/gandod/

/kongen/

/dintal/

/kendus/

/tistan/

/poctin/

/lendol/

/palsed/

/kancud/

(the stressed syllable is underlined)

Appendix 3

English materials:

Onset			**Coda**		
Example words:			*Example words:*		
music	maiden	farmyard	music	headache	teapot
tortoise	volume	ticket	wizard	forehead	charcoal
Test words:			*Test words:*		
papers	college	pointed	basket	teapot	grandad
nation	ballet	basket	peanut	visit	mermaid
corner	volume	cactus	cornflake	private	music
tunnel	rubbish	tuesdays	forehead	taken	solid
picture	daily	diamond	spaceship	raindrop	trial
vaccuum	vending	patient	gerbil	cactus	always
service	second	railway	effort	chaos	crisis
series	seven	model	famous	action	tennis
comment	father	feeling	icecream	goldfish	toothbrush
forward	finish	level	chairman	tortoise	produce
cabbage	middle	mother	clockwork	penguin	station
notice	nature	candle	magnum	hairslide	victim
major	many	ballet	welcome	programme	finish
music	level	moment	saucepan	ticktock	golden
toffee	number	necklace	volume	fountain	pumpkin
lecture	minute	label	evil	colonel	bedtime
likely	longer	reason	somewhere	little	neighbour
window	reason	water	dancer	therefore	local
people	wasn't	wardrobe	spirit	charcoal	angel
record	middle	reason	seashell	windmill	carrot

Vowel in first syllable

Example words:

biscuit	power	midday
problem	cherry	doctor

Test words:

future	monday	public
husband	quickly	trumpet
better	children	fifty
penguin	welcome	eyebrow
grandma	tortoise	blackbird

Vowel in second syllable

Example words:

airplane	mermaid	seesaw
peanut	yumyum	eyebrow

Test words:

pattern	music	darling
pancake	always	hedgehog
grandad	blowing	cowpat
penguin	biscuit	mermaid
marmite	blowing	sunshine

Spanish materials:

Vowel in first syllable

Example words:

gesto	fácil	verde
lucha	bosque	torno

Test words:

leche	costa	fondo
simple	digno	carta
dulce	fama	curso
solo	gente	cerca
barba	gente	falso

Vowel in second syllable

Example words:

cejas	compran	útil
cogen	fácil	meses

Test words:

mármol	nidos	beben
meses	lápiz	joven
bosques	pueden	lápiz
hijos	pueden	árbol
césped	unten	árbol

Onset

Example words:

marcha	mueve	siglo
sirve	nudo	sala

Test words:

dulce	dicho	barca
pozo	piña	sube
taxi	dulce	torro
verde	cubo	vista
mueve	caña	kilos
nudo	firme	falta
fama	fuerte	nido
santa	jefe	solo
siglo	mueve	sana
liso	jefe	junta
nata	duque	nido
mundo	marcha	sirve
mismo	dulce	manta
vivo	nada	nene
cara	niño	nube
loco	leche	santa
rica	muelle	rostro
rombo	rara	gente
poco	leche	lana
libre	lucha	mono

Coda

Example words:

vivos	deben	charlan
tuyos	nenes	fácil

Test words:

útil	hablad	coged
bebed	cutis	tomad
juzgad	mentid	botón
vended	frontón	tocad
mandad	sufrid	coger
mundos	reyes	faltan
zorros	plumas	deben
teles	fácil	muchos
mienten	playas	focos
pocos	ramas	líder
llaman	vivos	pueden
mienten	pagan	bolsos
móvil	gastan	sufren
mandan	cutis	deben
tuyos	piden	charlan
futbol	quejen	dátil
bollos	útil	cárcel
vender	móvil	juzgar
fútbol	líder	pasar
mármol	sútil	deben

Appendix 4

Experiment 4 materials

Phonological awareness tasks

Initial tasks

Example words:

dostol	mustus	pacter
coblon	mubles	dabrar

Test words:

Initial-joint			**Initial-split**		
mablas	poblel	dibrun	donton	pangul	cintes
dibron	mablas	pebrul	pincal	sondos	cunder
cicran	decres	poclul	mender	sincos	pundan
cebrer	sibran	mublod	solsos	malsen	diltul
piblon	cebled	subras	saltal	pilsun	colted
sicros	cuclar	dacran	muntol	cangad	pentis
soblos	mibran	debrul	cincon	sundal	mendes
dibron	pablas	mebrur	saltol	diltin	pelsud

Final tasks

Example words:

cintes	dantan	poltor
meclon	piclir	dublas

Test words:

Final-joint			**Final-split**		
mablan	pobles	duclir	duntas	costol	misten
mablan	suplis	copler	puntus	celtor	dintal
micren	dogrol	sacrus	posten	diltur	caltas
cibran	sogrus	pegred	pasten	sustil	dontor
cacral	degrin	pogrus	mentel	distar	punton
poplor	suplen	ditlad	peltis	coctul	mactan
duplel	mablan	soplir	doctun	pictal	mestes
ciclen	muplur	doplas	dested	mistol	puntan

Non-word reading task

Joint-words			**Split-words**		
mablas	poblel	dibrun	donton	pangul	cintes
dibron	mablas	pebrul	pincal	sondos	cunder
cicran	decres	poclul	mender	sincos	pundan
cebrer	sibran	mublod	solsos	malsen	diltul
piblon	cebled	subras	saltal	pilsun	colted
sicros	cuclar	dacran	muntol	cangad	pentis
soblos	mibran	debrul	cincon	sundal	mendes
dibron	pablas	mebrur	saltol	diltin	pelsud
mablan	pobles	duclir	duntas	costol	misten
mablan	suplis	copler	puntus	celtor	dintal
micren	dogrol	sacrus	posten	diltur	caltas
cibran	sogrus	pegred	pasten	sustil	dontor
cacral	degrin	pogrus	mentel	distar	punton
poplor	suplen	ditlad	peltis	coctul	mactan
duplel	mablan	soplir	doctun	pictal	mestes
ciclen	muplur	doplas	dested	mistol	puntan

Non-word spelling task

Joint-words			**Split-words**		
mablas	poblel	suplis	donton	pangul	mentel
dibron	pebrul	dogrol	pincal	sondos	diltur
cicran	decres	duclir	mender	sincos	sustil
cebrer	sibran	sogrus	solsos	malsen	posten
piblon	cebled	micren	saltal	pilsun	pasten
sicros	cuclar	cibran	muntol	cangad	distar
soblos	mibran	degrin	cincon	sundal	caltas
dibron	pablas	cacral	saltol	diltin	pictal
mablan	poclul	suplen	duntas	costol	peltis
sacrus	soplir	doplas	puntus	celtor	doctun
muplur	ciclen		dested	mistol	

Appendix 5

Parametric tests were used to analyse the data reported in Chapters 7 and 10. The problem with using tests of this type is that they make assumptions about the nature of the underlying populations that may not be valid. The F-test of analysis of variance assumes independent random samples were drawn from normally distributed populations with the same variance. The data reported in Chapters 7 and 10 violates these assumptions: the variance was sometimes heterogeneous, and the data was often not normally distributed (see table below). Instead it was often 'skewed'.

However, there is evidence that the ordinary F test is immune to violation of assumptions, particularly if group sizes are equal (or differ little) and the number in each group is large (above 25-30) (Pearson, 1931; Bartlett, 1935; Welch, 1937; Daniels, 1938, Quensel; 1947; Gayen, 1950a, 1950b; David and Johnson, 1951; Horsnell, 1953; Box, 1953, 1954a, 1954b; Box and Anderson, 1955). Our data satisfies both of these conditions.

Norton (1951) conducted a study in which he obtained samples of F's by means of a random sampling procedure from distributions having the same mean but which violated the assumptions of normality and homogeneity of variance in predetermined fashions. His results showed that when sampling from populations having the same shape but different variances there was very little effect on the empirical percentage exceeding theoretical limits. Hence the lack of homogeneity of variance should not affect our results since the shape of the distributions was similar across groups.

The other assumption we violate is that of normality. Norton also found that when the samples came from the same population, the shape of the distribution had little effect on the percentage of F ratios exceeding the theoretical limit. He found that for an extremely skewed distribution, the null hypothesis was incorrectly rejected (Type I error) on 4.76% of instances. Hence, by violating the assumption of normality, an effect needs to

be stronger for the null hypothesis to be rejected than when the population is normally distributed.

One alternative to using analysis of variance to analyse this data would have been to conduct non-parametric tests, such as Pearson's Chi-square. However, there are good reasons for choosing a parametric test over a non-parametric test.

Firstly, non-parametric tests ignore the subtleties of the data. The way in which the data is grouped will affect the results. Further, as Boneau (1960) argues, "...tests which make no assumptions about the distribution from which one is sampling will tend not to reject the null hypothesis when it is actually false as often as will those tests which do make assumptions. This lack of power of non-parametric tests is a decided handicap" (p.49). Hence a parametric test was employed because of the higher degree of power that it confers when compared to distribution free tests.

Thirdly, we were not solely interested in making comparisons across groups (i.e. comparing independent samples). We were also interested in looking at within group differences (i.e. comparing dependent variables), and at the interactions between independent and dependent variables. Non-parametric tests would not allow us to do this.

Nevertheless, we carried out non-parametric Pearson's Chi-square analysis on our data to confirm that the two types of analysis did not give contradictory results. Since we found no differences between the two types of analysis we chose to present the analyses of variance since it allowed us to make within-group, as well as between-group comparisons.

Experiment 2

	English monolinguals		Bilinguals in English		Bilinguals in Spanish		Spanish monolinguals	
	skew	σ^2	skew	σ^2	skew	σ^2	skew	σ^2
Non-word reading:								
vowel 1	1.07	35.26	.77	9.10	1.78	.15	2.33	.22
vowel 2	.31	58.33	.38	6.9	4.00	.30	3.74	.26
vowel 1, 1 grapheme	1.91	104.7	.51	25.34				
vowel 1, 2 graphemes	1.12	510.5	.78	255.2				
vowel 2, 1 grapheme	1.39	205.7	.35	41.03				
vowel 2, 2 graphemes	.64	530.7	.33	207.8				
Non-word spelling:								
Tense vowel 1	1.31	298.5	-.47	283.1	6.33	10.00	4.30	19.49
Tense vowel 2	.39	348.7	-.65	264.4	6.33	10.00	6.33	10.00
Lax vowel 1	.09	631.8	-1.07	265.6				
lax vowel 2	.44	688.2	-.56	630.8				
Tense vowel, 1 grapheme	2.15	81.91	2.63	74.07				
Tense vowel, 2 graphemes	.54	1153	-.91	1024				
Lax vowel, 1 grapheme	.41	701.5	.36	359.0				
Lax vowel, 2 graphemes	.58	918.6	-.47	427.4				

Experiment 4

	English monolinguals		Bilinguals in English		Bilinguals in Spanish		Spanish monolinguals	
	skew	**σ^2**	**skew**	**σ^2**	**skew**	**σ^2**	**skew**	**σ^2**
Non-word reading:								
Joint 1st consonant	1.41	1.59	4.92	.13	5.52	5.97	4.80	2.31
Joint 2nd consonant	2.54	4.63	3.68	.22	2.37	.48	1.14	.86
Split 1st consonant	1.38	1.19	5.76	.43	5.70	6.64	1.73	1.94
Split 2nd consonant	3.28	1.84	6.25	.23	3.01	.18	2.04	.13
Non-word spelling:								
Joint 1st consonant	1.41	1.59	3.45	.97	3.27	.73	3.38	.17
Joint 2nd consonant	2.54	4.63	3.70	6.69	4.56	2.46	5.89	20.27
Split 1st consonant	1.38	1.19	2.91	6.29	2.20	3.57	1.95	1.97
Split 2nd consonant	3.28	1.84	3.49	0.37	3.35	0.07	4.05	.15