

**DYSLEXIA VERSUS ENGLISH-AS-AN-
ADDITIONAL LANGUAGE: LITERACY AND
PHONOLOGICAL SKILLS**

by
Styliani Nenopoulou

Submitted for Doctor of Philosophy

Department of Psychology

School of Human Sciences

University of Surrey

February 2005

Abstract

This thesis investigated the literacy and phonological processing difficulties experienced by individuals with dyslexia and those with English-as-a-Second-Language (ESL). Theoretical perspectives of dyslexia and L2 learning are presented and assessments of literacy skills as well as phonological processing and general verbal abilities were carried out to inform procedures for identifying the underlying reasons for literacy deficits in dyslexic and ESL individuals. Six studies were undertaken to assess specific hypotheses about the abilities of these groups of individuals with the initial studies also comparing their performance with control groups of non-dyslexics who had English as their first language. Studies 1 and 2 addressed the issue of whether literacy and phonological tasks can distinguish the performance of dyslexics and ESL individuals. In Study 1, the results indicated that these two groups could not be distinguished in terms of their performance on the measures of literacy used, but that the level of ability presented by the ESL students was much higher than that of the dyslexics in many of the measures of phonological skills, particularly in measures of short-term memory and pseudo-word decoding ability. These findings led to Study 2 testing a larger cohort of ESL students that could be divided into high-English-experience and low-English-experience groups. Results indicated that those with more English language experience could be distinguished from dyslexics in measures of literacy ability. Studies 3 and 4 presented evidence for experiential effects that may be language and/or culturally based leading to Studies 5 and 6 which concentrated on testing individuals with Greek as their first language. Overall, the findings of these latter four studies indicated the need for careful selection of assessment measures if cultural/language differences are not going to affect the outcome of assessment procedures. The work is discussed with reference to implications for assessment practices and theoretical perspectives of dyslexia and bilingualism.

Acknowledgements

There are a number of people that I've met during my stay in the UK and those back home in Greece whom I would like to thank for making this thesis possible.

During my stay in the UK the last three years have been hard but certainly fruitful. I could not do without the valuable help and tremendous support of my supervisor, Dr. John Everatt, of Evanthia, who like a mother stood by me in difficult times, and of all the people from the dyslexia group, especially Sharman for sharing valuable knowledge and ideas, Rob Fidler and Peter Brooks for helping me with data collection.

I also need to thank all the students who took part in the research and all my Greek friends Irene, Anastasia, Lakis and Socrates for supporting me and my work and especially, my truest friend, family member and housemate, Theti, thank you for being so much encouraging.

Also, my parents for being a constant source of emotional and financial support- I owe so much to you for taking me one step further in my academic career. I dedicate my work to them. I cannot find any other way to show my deepest appreciation.

Last but not least, Carole Dorkings for being so kind and helpful all the way through, Adrian Oates and Andrian Barnes and the rest of the people from the department for creating such a friendly environment to work in.

The art of living lies less in eliminating
our troubles than in growing with them

Bernard M. Baruch

CONTENTS

Abstract	i
Acknowledgements	ii
List of tables	xi
List of figures	xiv
CHAPTER 1	
General Introduction	1
1.1 Aims, overview and structure of the thesis	1
1.2. Dyslexia	7
1.2.1 Definitions of dyslexia	7
1.2.2 Incidence of dyslexia	9
1.2.3 Symptoms and etiology of dyslexia	10
1.2.4 Dyslexia in adults	13
1.2.5 Dyslexia in different languages: cross-language comparisons	23
1.3 Dyslexia and bilingualism: possible links	34
1.3.1 Some issues in bilingualism and bilingual research: facts and definition problems	34
1.3.2 Bilinguals and ESL (English-as-a-Second Language) individuals: same or different?	36
1.3.3 Measuring bilingualism: the use of language background self-rating scales and questionnaires	37
1.3.4 Bilingualism, SLA and FLA: some further distinctions	38
1.3.5 Transfer	39
1.3.6 The contribution of L1 and L2 proficiency in L2 reading and reading comprehension ability	41
1.3.7 Bilinguals' mental lexicon and its role in L2 processing	43
1.3.8 Bilingualism and dyslexia: some identification and assessment problems	44

1.3.9 The use of phonological measures to differentiate between bilingual, dyslexic bilingual and monolingual individuals	45
1.3.10 Issues in identification and assessment of dyslexic and bilingual individuals	46
1.3.11 Picture naming ability in bilinguals	46
1.3.12 Rapid naming and the development of lexical fluency in L2: the process of lexical access for L1 and L2 rapid naming performance	47
1.3.13 Relations between rapid naming and reading	48
1.4. Reading	50
1.4.1 Towards a definition of reading	50
1.4.2 The process of reading	50
1.4.3 Theoretical models of reading	52
1.4.4 Explaining reading comprehension problems: A simple view of reading	54
1.4.5 Reading comprehension and dyslexia	54
1.4.6 The two components of reading: decoding and comprehension	55
1.4.7 The role of background knowledge in decoding and comprehension	56
1.4.8 Predictors of reading comprehension ability in adult dyslexics and non-dyslexics: evidence from recent research	57
1.4.9 Theoretical models of reading.	
The schema theory: the role of schemata in L1 and L2 reading	58
1.4.10 Reading problems in different languages: two different viewpoints	60
1.4.11 Reading difficulties and second language acquisition	60
1.4.12 The role of L1 and L2 ability in L2 reading comprehension	65
1.4.13 L2 reading and the use of reading strategies: individual differences in the use of reading comprehension strategies amongst L2 readers	67
1.4.14 Reading and writing relationships in L1 and L2	70
1.5 Spelling	72
1.5.1 Facts and issues in spelling research	72
1.5.2 The spelling process	72
1.5.3 The spelling stage model	73

1.5.4 The development of spelling ability	73
1.5.5 Theoretical models of spelling acquisition	75
1.5.6 Can current models of spelling generalise to different orthographies and writing systems?	77
1.5.7 Spelling systems	78
1.5.8 The English orthography and spelling system	79
1.5.9 The Greek spelling system	82
1.5.10 Phonological and orthographic processing skills: evidence for interrelations	84
1.5.11 Assessing phonological and orthographic processing skills	85
1.5.12 The role of vocabulary knowledge in spelling ability	86
1.5.13 Spelling methodologies	87
1.5.14 Characteristics of poor spellers	88
1.5.15 The spelling strategies of good and poor spellers	89
1.5.16 The role of morphology in different languages	90
1.5.17 The role of morphology in English spelling	91
1.5.18. Summary of the literature review	94

CHAPTER 2

Study 1: Initial comparisons between adult ESL and dyslexic students against E1L controls. Assessment of literacy and phonological skills: same or different?

2.1. Introduction	97
2.1.1 Dyslexia in adult students	97
2.1.2 Distinguishing between literacy and phonological skills	98
2.1.3 The phonological skills of dyslexic, bilingual and monolingual individuals	100
2.1.4 Issues and problems in the assessment of L2 reading and writing difficulties amongst bilinguals	101
2.1.5 Aims and research questions	103
2.2 Method	103
2.2.1 Participants	103

2.2.2 Measures	104
A. Measures of literacy	
2.2.2.1 Reading comprehension task	105
2.2.2.2 Single-word spelling task	105
2.2.2.3 Proof-reading task	105
B. Measures of phonological processing	
2.2.2.4 Pseudohomophone task	106
2.2.2.5 Auditory short-term memory task	106
2.2.2.6 Non-word reading (decoding) task	106
2.2.2.7 Rapid naming task (objects)	107
2.3 Results	107
2.4 Discussion	110

CHAPTER 3

Study 2: Assessment of high and low-proficiency ESL and dyslexic students on measures of literacy and phonological processing

3.1. Introduction	114
3.1.1 Literacy and bilingualism	114
3.1.2 Rapid naming	116
3.1.3 Aim and rationale for research	117
3.2 Method	118
3.2.1 Participants	118
3.2.2 Measures	119
A. Measures of reading	
3.2.2.1 Single-word reading task	119
3.2.2.2 Text reading task	119
B. Rapid naming measure	
3.2.2.3 Rapid naming (digits)	120
3.3 Results	121
3.4 Discussion	124

CHAPTER 4

Study 3: Assessment of verbal fluency and phonological skills amongst adult dyslexics and ESL students

4.1 Introduction	128
4.1.1 Measures of fluency and their relationship to reading	128
4.1.2 The development of lexical fluency in L1 and L2	130
4.1.3 Research on verbal fluency and dyslexia	131
4.1.4 The role of experience in verbal fluency ability	132
4.1.5 Assessing phonological skills using the PhAB: the applicability of the test battery to ESL populations	133
4.1.6 Research questions and aims of the study	134
4.2 Method	135
4.2.1 Participants	135
4.2.2 Measures	136
A. Fluency measures	
4.2.2.1 Semantic fluency task	136
4.2.2.2 Alliteration fluency task	136
4.2.2.3 Rhyme fluency task	137
B. Measures of phonological ability	
4.2.2.4 Spoonerisms task	137
4.2.2.5 Rapid naming task (objects and digits)	137
4.3 Results	138
4.3.1 Group differences	138
4.3.2 Correlations	140
4.4 Discussion	142

CHAPTER 5

Study 4: Non-word reading and reading comprehension ability in adult dyslexic and ESL students

5.1 Introduction	145
5.1.1 The non-word reading deficit in dyslexics	145

5.1.2 Reading comprehension ability in dyslexics	146
5.1.3 Models of reading comprehension	147
5.1.4 Measuring reading comprehension ability	148
5.1.5 Reading comprehension and the ability to construct inferences from text	149
5.1.6 Research questions and aims of the study	151
5.2 Method	151
5.2.2 Participants	151
5.2.3 Measures	152
A. Reading measure	
5.2.2.1 Text reading accuracy and speed	152
B. Non-word reading measure	
5.2.2.2 Non-word reading (decoding) task	153
5.3 Results	154
5.3.1 Non-word reading	154
5.3.2 Text reading	155
5.3.3 Reading comprehension	156
5.3.4 Relationship between non-word reading and reading comprehension	157
5.4 Discussion	159
5.5 Some final conclusions about reading	160

CHAPTER 6

Study 5: Greek and English measures of literacy and phonological processing: same or different predictors of reading ability?

6.1 Introduction	162
6.1.1 Literacy: the role of culture and educational background	162
6.1.2 The importance of assessing L1 ability in cross-linguistic research	162
6.1.3 Measuring bilingualism and level of language proficiency	163
6.1.4 Making (fair) cross-language comparisons	164
6.1.5 Aims and rationale of the study	165
6.2 Method	166

6.2.1 Participants	166
6.2.2 Measures	167
6.2.2.1 Literacy measures	167
6.2.2.2 Phonological measures	167
6.3 Results	170
6.3.1 Correlations	171
6.3.2 Regressions	173
6.3.2.1 Predictors of Greek reading ability for G1L	173
6.3.3.2 Predictors of English reading ability for G-ESL	174
6.4 Discussion	176

CHAPTER 7

Study 6: Beyond reading: assessing phonology, orthography and vocabulary skills in Greek and English spelling ability

7.1 Introduction	182
7.1.1 Links between reading and spelling	183
7.1.2 The role of orthographic and phonological processing skills in spelling	185
7.1.3 Spelling and adult dyslexia	187
7.1.4 Reading and spelling in different orthographies: the role of phonological awareness and orthographic representations	188
7.1.5 Spelling difficulties in adult L2 learners	
Cross-language comparisons: English VS Greek spelling	188
7.1.6 Spelling ability in L2 learning	189
7.1.7 The role of vocabulary knowledge in L1 and L2	191
7.1.8 Measuring vocabulary knowledge	191
7.1.9 Semantic reasoning and spelling	191
7.1.10 Cross-language comparisons: English VS Greek spelling	193
7.2 Aims and research questions of the study	195
7.3 Method	197
7.3.1 Participants	197
7.4 Measures	198
7.4.1 Tests of English spelling ability	198
7.4.2. Tests of Greek spelling ability	201

7.5 Results	204
7.5.1 Preliminary analysis	204
7.5.2 Correlations	
7.5.3 L1 and L2 differences	207
7.6 Discussion	208
CHAPTER 8	
General discussion	217
8.1 Assessment profiles: the reading, spelling, phonological and language abilities and disabilities of dyslexics and ESL individuals revisited	217
8.2 Usefulness and contributions of the research	224
8.3 Theoretical implications	228
8.4 The way forward: implications for practice and future research	231
8.4.1 Implications for assessment practices	231
8.4.2 Implications for further research	233
References	235
Appendices	
Appendix 1 Bespoke tests used in Study 1	(I)
Appendix 2 Passages and comprehension questions used in study 4	(II)
Appendix 3 English and Greek background questionnaires for Studies 5 and 6	(III)
Appendix 4 Greek versions of passages and comprehension questions and non-word reading test used in Study 5	(IV)
Appendix 5 Test materials used in Study 6	(V)

List of tables

Study 1

Table 2.1

Mean scores (with standard deviations) for each group on each of the measures, with the results of the analyses of variance 107

Table 2.2

Post-hoc pairwise comparisons for each of the measures 108

Study 2

Table 3.1

Mean scores (with standard deviations) for each group on each of the measures, with the results of the analyses of variance 121

Table 3.2

Post-hoc pairwise comparisons for each of the measures 121

Table 3.3

Mean proportions (with standard deviations) for each group on the different categories of comprehension questions 122

Study 3

Table 4.1

Mean scores (with standard deviations) for the three groups of students on the phonological tasks, together with the results of the analyses of variance for each measure 138

Table 4.2

Post-hoc pairwise comparisons between the three groups on the phonological tasks 139

Table 4.3

Pearson's correlations between the phonological measures for the three groups with p-values for each analysis 140

Table 4.4

Correlations between rapid naming, semantic and alliteration fluency for dyslexics 141

Table 4.5	
Correlations between rapid naming semantic and alliteration fluency for E1L non-dyslexics	141
Table 4.6	
Correlations between rapid naming semantic and alliteration fluency for ESL	142
Study 4	
Table 5.1	
Mean scores for the three groups on non-word reading accuracy and speed together with an analysis of variance and significance levels	154
Table 5.2	
Post-hoc comparisons between the three groups on non-word reading accuracy and speed	155
Table 5.3	
Mean scores of dyslexics, non-dyslexics and ESL individuals on text reading measures	155
Table 5.4	
Post-hoc pairwise comparisons between the three groups for measures of reading accuracy and speed	156
Table 5.5	
Mean number of correct responses produced by dyslexic, ESL, and non-dyslexics on the 4 types of comprehension questions from passages 1 and 2	156
Table 5.6	
Post-hoc pairwise comparisons of the three groups' performance on the 4 types of comprehension questions from passages 1 and 2	157
Table 5.7	
Pearson's correlations between non-word reading and reading comprehension (easy and hard passages) measures for dyslexics	157

Table 5.8

Pearson's correlations between non-word reading and reading comprehension (easy and hard passages) measures for non-dyslexics 158

Table 5.9

Pearson's correlations between non-word reading and reading comprehension (easy and hard passages) measures for ESL 158

Study 5**Table 6.1**

Average mean scores produced by G1L and G-ESL groups (with standard deviations in parentheses) for all of the literacy and phonological tasks 170

Table 6.2

Pearson's correlations between Greek phonological and literacy measures for the G1L group 171

Table 6.3

Pearson's correlations for English measures for the G-ESL group 172

Table 6.4

Regression analyses for predictors of reading amongst G1L 174

Table 6.5

Regression analyses for predictors of reading amongst G-ESL 175

Study 6**Table 7.1**

Mean number of correct responses of the 3 groups on the phonological, orthographic, spelling and vocabulary tasks with results of analysis of variance indicating differences in their performance 204

Table 7.2

Post-hoc pairwise comparisons between the three groups for each of the tasks 205

Table 7.3

Correlations between English measures for the G-ESL group	205
Table 7.4	
Correlations between English measures for the E1L dyslexic group	206
Table 7.5 Correlations between English measures for the E1L non-dyslexic group	206
Table 7.6	
Mean scores produced by Greek-English bilinguals (with standard deviations in parentheses) on Greek and English versions of the orthographic choice, pseudo-homophone and proof-reading tasks	207
Table 7.7	
Correlations between Greek and English versions of the OCT, PSH and proof-reading tasks for the ESL group	207

List of figures

Study 1

Figure 2.1 Average performance of the three groups on the measures of reading comprehension, spelling and proof-reading 108

Figure 2.2 Average performance of the three groups on the pseudohomophone task and the auditory short-term memory (STM) task 109

Figure 2.3 Average times of the three groups in the non-word reading and rapid naming tasks 110

Study 2

Figure 3.1 Average performance of the three groups on recall and inference comprehension questions in easy texts 123

Figure 3.2 Average performance of the three groups on recall and inference comprehension questions in hard texts 124

CHAPTER 1: General introduction

1.1 Overview and structure of the thesis

The accurate and reliable assessment and identification of literacy difficulties is of great importance for educators both in the UK and elsewhere in the world. Literacy difficulties can negatively impact on the educational and employment success of the individual, potentially leading to a loss of talent and resources for society. Moreover, such assessment/identification needs to lead to appropriate support procedures being implemented that can help to reduce or overcome the literacy difficulties. Different support procedures may be required depending on the reason for (or cause of) the literacy difficulties. An individual with a long-term difficulty that is potentially constitutional may require very different support from a similar individual with poor literacy skills due to a lack of experience. Consistent with this perspective, the research in this thesis investigated English language assessment procedures that may be used to differentiate dyslexics from individuals with English-as-a-second language (ESL). The support required by an individual with dyslexia, caused by some cognitive/neurological deficit that leads to long-term, potentially life-long difficulties in literacy, may be very different from the support required by an individual with English-as-a- second-language who may simply have to wait for English language experience to reach a certain level before literacy difficulties disappear. Distinguishing between these two groups of individuals, therefore, may be vital for educational procedures.

Contrasting dyslexic and ESL individuals may be important not only for educational practice. Identifying differences and similarities between these groups of individuals should inform theories relating to both dyslexia and its cause(s), as well as the acquisition of second language skills. Such theoretical viewpoints will be outlined in the General Introduction, chapter 2, of this thesis. This will provide background information relevant to literacy acquisition, dyslexia and second language learning. This chapter will be followed by a series of chapters presenting the methods and results of six studies. Study 1 addresses the issue of whether literacy and phonological tasks can distinguish the performance of dyslexics and ESL individuals. These two areas were specifically targeted as measures of these skills firstly because they are incorporated into most assessment procedures that have been designed to identify

literacy difficulties and secondly because they form the basis of most theories explaining the cause and main consequences of dyslexia. The findings obtained from Study 1 led to Study 2 testing a larger group of ESL students that could be divided into high-English-experience and low-English-experience groups. Study 2 concentrated on investigating literacy differences between these ESL groups and two groups of students who had English as their first language, specifically, a group of dyslexics and a group of controls without evidence of previous literacy problems. Study 3, on the other hand, focused on high-English-experience ESL students and specifically contrasted their phonological skills with those of dyslexics and controls. These studies presented evidence for experiential effects that may be language and/or cultural in origin. Study 4, therefore, selected a sub-group of ESL students from one language/cultural background and contrasted their performance with other ESL students, dyslexics and controls. This led to Studies 5 and 6 concentrating on testing individuals with Greek as their first language. Study 5 focused on predictors of reading ability and contrasted students with high levels of English experience with those with very little English usage experience. Study 6 focused on spelling skills, given the potential for spelling to be more difficult than reading for those learning Greek literacy skills, and contrasted the performance of ESL students in their first and second language.

A major contribution of this thesis is that it focuses on the assessment of dyslexia and L2 learning and tries to bring the two concepts together within an educational context. The work is innovative in that it attempts to investigate how dyslexics and ESL individuals may be found to be the same or different in terms of their literacy and phonological skills. The work also aims to obtain assessment profiles and identify areas of strengths and weaknesses amongst the two groups. As argued above, accurate identification and specification of those underlying factors that might be leading to observed literacy problems are both essential in determining appropriate support procedures (Brooks and Everatt, submitted; Miles, 1993; Snowling, 2000; Thomson, 1990). Research which informs procedures that identify these factors is therefore of fundamental importance. The work's focus on phonology, as well as different areas of literacy, is consistent with the relevant dyslexia and ESL literature and the thesis presents a discussion of data pertinent to these areas. The research undertaken as part of this thesis presents findings from a series of studies of dyslexic and non-dyslexic

individuals with English as their first language compared against matched ESL groups who may or may not present evidence of poor literacy skills. The research endorses both theoretical and practical perspectives for the kind of literacy abilities and deficits presented by these groups of individuals and the underlying reasons that explain why such deficits might or might not occur.

Research into difficulties with phonological processing and literacy skills has predominantly focused on children rather than adults. Although literature covering the assessment of children will be discussed in the thesis, the data collected in the studies performed as part of this research work were obtained from adult students undertaking courses as part of non-compulsory education. Assessing adults' reading and writing ability is essential not only for educational, but also for employment and career purposes. Reading and writing difficulties may hinder many aspects of adults' social life and although many have managed to overcome these they may still pose a threat to academic and work achievement. The use of adult participants in this research has the major advantage that the number of years of English experienced by the ESL participants can vary considerably, providing the opportunity to contrast those with large amounts of English experience and those with very little.

An additional aim of the research conducted as part of this thesis was to inform the development of appropriate literacy difficulties assessment tools for use with individuals learning to speak, read and write in two or more languages. The present research highlights the need to consider the appropriateness of test measures and materials across a range of language contexts and to redress the lack of suitable procedures for use within multilingual contexts (Cline and Reason, 1993; Cline and Shamsi, 2000; Peer and Reid, 2000; Smythe and Everatt, 2002). The development of test procedures based solely on factors related to one language can lead to disadvantages. Learning to read in one language is not necessarily the same as learning to read in another as the underlying causes of literacy difficulties may vary between languages. Similarly, there is no evidence to suggest that predictors of literacy ability are necessarily the same across all languages or scripts either. The framework of this research acknowledges the fact that certain linguistic and cultural aspects within which individuals are engrossed can make certain assessment measures inappropriate as tools for assessing literacy skills (Aaron and Joshi, 1989; Goswami,

2000; Katz and Frost, 1992; Leong and Joshi, 1997; Smythe, Everatt and Salter, 2003).

Despite the vast amount of research suggesting that phonological deficits constitute the core causal factor in literacy problems faced by both dyslexic children and adults (Snowling, 2000; Stanovich, 1988), this cause has not been yet confirmed across different languages (Cossu, Shankweiler, Liberman, Katz and Tola, 1988; Katz and Frost, 1992; Wimmer, 1993; Ho and Lai, 1999; Geva and Siegel, 2000; Goswami, 2000; Smythe, Everatt and Salter, 2004). An isolated phonological perspective needs to be shown to provide an appropriate assessment framework that could be used across a range of languages and scripts. What is predictive of literacy amongst the processes covered by the term phonological (awareness, access and/or storage), as well as the relative importance of different phonological units (phonemes versus syllables versus onset/rimes), may vary across languages. Individuals learning a script (orthography) with a more consistent relationship between written symbols (letters/graphemes) and sounds (phonemes) than in English, for example, are more likely to have progressed in literacy faster, and also process words at the level of the phoneme earlier on in their literacy development than those learning a less regular orthography (Goswami, 2000). Similarly, phonological awareness deficits may be less of a problem when learning a regular orthography with simple rules or correspondences (Wimmer, 1993). Deficits in other areas of phonological processing such as speed of access or storage of information may explain more of the variability in literacy ability amongst individuals using more transparent orthographies.

Comparisons between groups who have experienced literacy learning in an L1 with a more transparent script than the L2 in which they are required to learn literacy may indicate the extent to which phonological processes influence L2 literacy acquisition.

A range of measures were incorporated into the studies undertaken. Some were commercially available measures and procedures were taken from the test manuals for those measures; e.g., several measures from the Phonological Assessment Battery (PhAB; Frederickson, Frith and Reason, 1996) were used to assess phonological skills amongst the students assessed in these studies. These measures were chosen based on the evidence provided by the test authors suggesting that they can be used with individuals from different language backgrounds (see also Frederickson and Frith,

1998). However, given the need for new screening measures and assessment tools for use with adults and ESL individuals, the present research work also used bespoke tests that were newly developed for the purposes of such research and assessment work and, where appropriate, adapted and modified measures for use with the populations included in the studies. Tests such as the Adult Reading Test (ART; Brooks, Everatt and Fidler, 2004) were specifically designed to assess reading ability amongst the populations targeted for testing in the initial stages of this research. The test was recently developed and validated as a measure of reading accuracy, speed and comprehension for the assessment of students in further and higher education. However, aspects of the test were modified (details can be found in individual chapters that follow) to allow specific hypotheses to be assessed. Similarly, in Studies 1 and 6 of this thesis measures specifically designed for use with adult students were developed to assess different skills including literacy at the word level (recognise or produce correctly spelt words), literacy at the text level (identify errors in spelling, word order and meaning in short passages of text) and verbal reasoning (ability to understand meaning within their language). Finally, in Studies 5 and 6, measures were translated to provide assessments in English and Greek.

Cross-language adaptations of all language-based measures were undertaken. The researcher coordinating these processes was fluent in both the languages of assessment and familiar with current work in dyslexia and literacy assessment. Two types of translation processes were performed: a) those involving direct word-for-word translation and b) those requiring translation of the test concepts (i.e. functional translations). The former was performed by a professional translator from the university's translation department. The latter type was necessary in cases where word-for-word translation was unlikely to produce a test of the underlying cognitive factor under investigation. For example, tests that measure the ability to recognise words that rhyme cannot rely on simple word-for-word translation. A set of new words would be required with the same end sounds (items) that served the function of assessing rhyming skills. The researcher giving the measures was equally familiar with both languages under investigation and could therefore provide appropriate verbal instructions in both languages. All new or modified measures were subject to pilot work prior to use with groups in the research. All materials were piloted prior to

their use and examples of the test items were always included to ensure that individuals understood what the task required.

The present thesis used measures that could be readily translated and modified for use with individuals from different language contexts and backgrounds. In the case of non-verbal measures (rapid naming of digits and pictures) translation of test materials was not necessary. A measure of non-verbal reasoning was also incorporated in the studies to ensure that low levels of literacy skills were not due to global deficits in test taking. A non-verbal reasoning task was considered to be appropriate for the research given the evidence for low correlations between such tasks and literacy performance across a number of cross-linguistic studies of dyslexia (Herskovits and Gyarmathy, 1995; Ho and Bryant, 1997; Everatt et al, 2000).

1.2. Dyslexia

1.2.1 Definitions of dyslexia

A major concern for educators in the U.K. has been to research into what would be the most effective methods for assessing as well as improving adults' reading and writing skills. One of the literacy related difficulties most frequently experienced by individuals is dyslexia. The European Dyslexia Association states that dyslexia is "one of the several specific learning difficulties that inhibit the learning of literacy skills" (EDA, 2003). While the research continues, most of the existing evidence is geared towards the idea that dyslexia is a developmental syndrome that has a neurological basis and a strong genetic component and which can respond to structured intervention.

There are problems associated with using the term dyslexia to identify individuals with specific literacy difficulties. According to Bell, McCallum and Cox, (2003) the use of the term dyslexia to describe reading difficulties is not universally accepted and continues to raise debates among researchers and professionals who prefer the term reading disability (e.g. Torgensen and Wagner, 1998; Siegel, 1999). However, a growing number of experts define dyslexia as "a specific type of reading disability distinguished by decoding and spelling difficulties" (Bell, McCallum and Cox, 2003, p.505) often accompanied by reading comprehension as well as rapid naming problems. Clearly, any definition problems related to dyslexia need to be carefully considered before providing any kind of assessment or support to individuals with literacy difficulties.

A number of different definitions for dyslexia have been proposed over the last decades. According to the BPS Working Party of the Division of Educational and Child Psychology working definition: 'Dyslexia is evident when accurate and fluent word reading and/or spelling develops very incompletely or with great difficulty' (1999: 11). The BPS definition focuses on literacy learning at the word level and implies that problems are severe and persistent despite adequate learning opportunities. An example of a more detailed definition is that proposed by the British Dyslexia Association (BDA, 1999). This includes the following:

'Dyslexia is best described as a combination of abilities and difficulties which affect the learning process in one or more of reading, spelling, writing and sometimes numeracy. Accompanied weaknesses may be identified in areas of: speed of processing, short term memory ability, sequencing ability, auditory and/or visual perception, spoken language, and motor skills Dyslexia occurs despite normal intellectual ability and conventional teaching and is independent of socio-economic or language background. . . . Some dyslexics have outstanding creative skills or talents' (Peer, 1999, p.61).

Both the BPS and BDA definitions outlined above have in common a focus on the behavioural and educational outcomes (manifestation) of the disability without making any mention about the cause. This is mainly because there is still a major ongoing debate over the actual cause/s of dyslexia. These outcome- or working-based definitions (i.e., those that have not specified a cause but might be argued as working towards a more causal-based argument) can be contrasted with the causal definition proposed by the U.K. Adult Dyslexia Organisation. This suggests that:

'Dyslexia may be caused by a combination of phonological, visual and auditory processing deficits. Word retrieval and speed of processing difficulties may also be present. A number of possible underlying biological causes of these cognitive deficits have been identified and it is probable that in any one individual there may be several causes' (Reid and Kirk, 2001, p. 4-5).

This latter ADO definition highlights one of the problems for definitions, namely that research has yet to specify the cause or causes of dyslexia leaving definitions that incorporate views about causes to list several potential causal factors and use terms such as 'may' to describe the relationship between the potential cause and dyslexia. Clearly, theoretical and causal explanations should aim at outlining the potential causes for such reading and writing difficulties that individuals who are identified as 'dyslexic' often experience. Only through an identification of the potential causes of literacy difficulties will practitioners be able to target precisely remediation procedures and thereby better support and offer help to individuals in their efforts to overcome such difficulties.

1.2.2 Incidence of dyslexia

Dyslexia occurs worldwide regardless of culture or language origin and may affect some 8% of the population (Ott, 1999). Estimates vary, but an often quoted figure is that in the UK alone, some 10% of children may be affected by dyslexia to some degree, with possibly 4-5% of the general population being severely affected (Ott, 1999). This latter figure translates to about 2 million individuals who are likely to show some signs of dyslexia at some point of their literacy development (Ott, 1999). Yet, given the great degree of variability in the severity of learning difficulties presented by individual profiles, it is hard to provide accurate estimates of the actual incidence rates. What is more, a number of different subtypes of dyslexia-related disorders have been identified, while at the same time co-morbidity issues always need to be accounted for when assessing any type of learning difficulty (e.g. dyslexia may often co-occur with ADHD or dyspraxia or other language disorders from the wide spectrum of the range of 'specific learning disabilities') (Deponio, 2004).

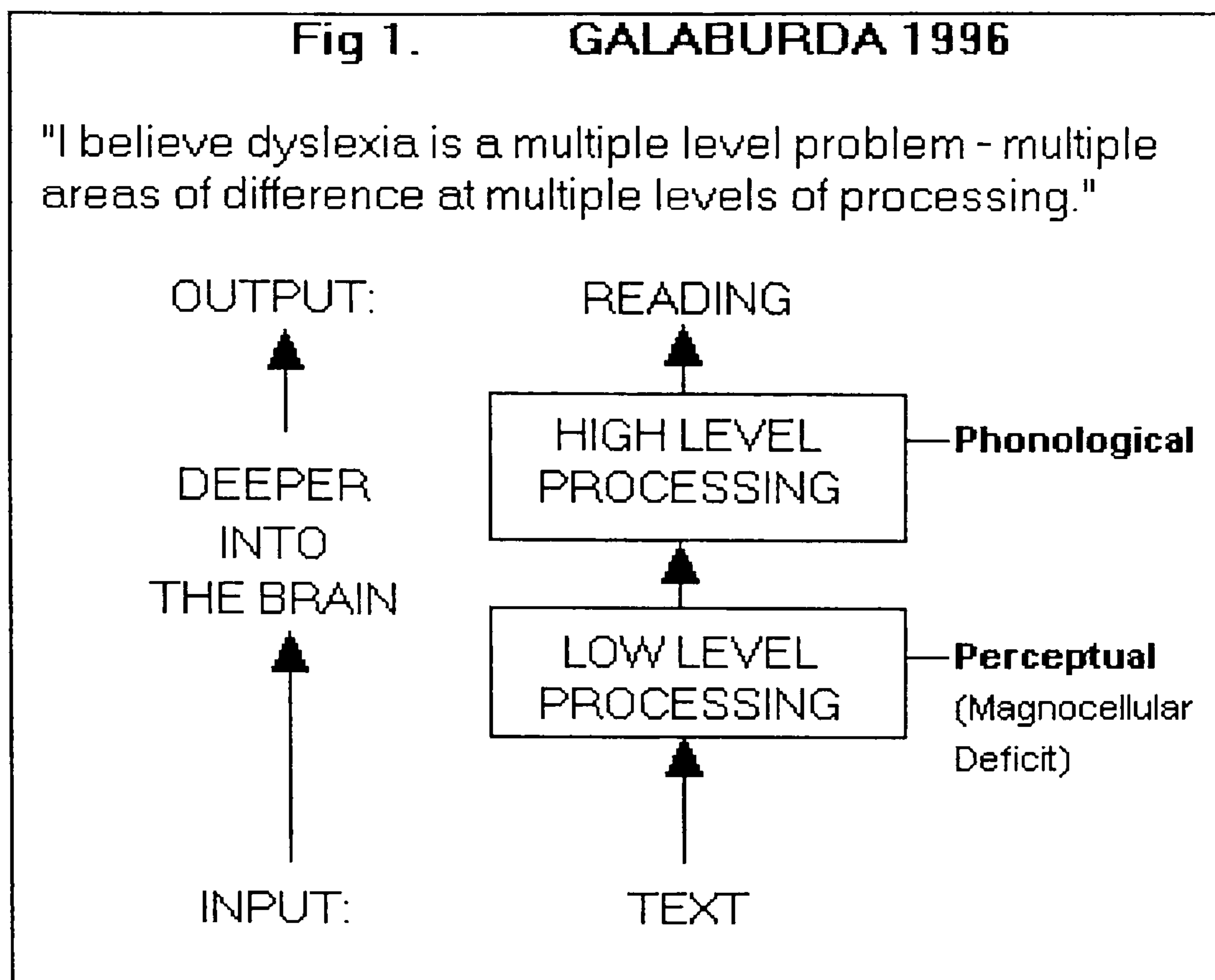
An example can be found in arguments over the incidence of dyslexia amongst males and females. Research focusing on gender differences and dyslexia has maintained for some time that dyslexia may be 3-4 times more prevalent in males than in females. This could be attributed to the fact that neurological anomalies have a greater impact on the language learning abilities of boys than girls and that any gender differences in brain organisation responsible for cognitive functions (e.g. phonological processing) can be found only in the left hemisphere in men, which is not true for women where both the right and left brain hemispheres are shown to be activated during such cognitive processes (Geschwind and Galaburda, 1987). Yet, this position has been challenged by recent epidemiological evidence supporting that an equal number of boys and girls are dyslexic. The claim that more boys are affected by dyslexia has been dismissed due to sampling biases neglecting the fact that males often manifest more behavioural problems, which subsequently leads to more males going through the assessment process than females (referral bias hypothesis) (Shaywitz, Shaywitz, Fletcher and Escobar, 1990; Shaywitz, Shaywitz and Pugh, 1995; Shaywitz, 1996). The way dyslexia manifests in the individual, therefore, may affect whether it is recognised, leading to variations in estimates of incidence within a population.

1.2.3 Symptoms and etiology of dyslexia

Some of the signs that dyslexic individuals frequently present are: letter/number reversals in reading and writing (e.g. b-d, 6-9), word reversals (e.g. was/saw, on/no), miscuing of similar words (e.g. house/horse), missing out words when reading or writing, bizarre spelling, untidy and ill-formed handwriting, confusion over left and right, difficulties with organising, memorising facts, names and places and reciting months of the calendar year, multiplication tables, problems in following oral directions or instructions, in concentration (i.e. distractibility), physical co-ordination or social/emotional behaviour (Reid and Fawcett, 2004).

This range of symptoms has led to the aforementioned differing views about causality. Most of the research on the causes of dyslexia has focused on the cognitive-behavioural, developmental and neurological deficits constituting the core of this disorder. The most critical question that still remains unanswered is whether it is a language-specific or a more general neurological-based disorder. There is to begin with, a wide breadth of research suggesting that dyslexia has a strong genetic component. In fact, a number of different genetic factors have been implicated for the development of the disorder suggesting that familial factors and genes are important (Pennington, 1990; Smith, Pennington, Kimberling and Ing, 1990; Smith, Kimberling and Pennington, 1991; Gilger, Pennington, and DeFries, J.C, 1991; Pennington et al, 1991). Although evidence from family and twin studies suggests there are higher prevalence rates amongst dyslexics with a family history of the disorder, genetic research tends to highlight more and more the importance of certain environmental influences in how dyslexia symptoms can be manifested (Olson, Forsberg and Wise, 1994b). More research into the contribution of genes and the environment is needed, however, to establish their separate contribution and their possible interaction in the development of the disorder.

Evidence from brain studies derived from MRI (Magnetic Resonance Imaging) scans suggests that there are three main areas of deficits, genetic, anatomical and fast – processing evident in dyslexics' brains. Phonological problems that disrupt the acquisition of literacy are likely to be accompanied by other problems in the fast processing of incoming sensory information (Brooks, 1994). According to this view, dyslexia is seen as a complex problem affecting multiple levels of processing (fig. 1).



Brain research has implicated other neurological factors in the development of the disorder. These include brain asymmetry (Dalby, Elbro and Stodkilde-Jorgensen, 1998), abnormalities of the magnocellular system (Stein and Walsh, 1997) and of cortical structures within the brain, (Robichon, Levrier, Farnarier, and Habib, 2000), left hemisphere dysfunction (Geschwind and Galaburda, 1987), cerebellar anomalies (Fawcett and Nicolson, 2001), chromosomal abnormalities (Pennington, Bender, Puck, Salbenblatt and Robinson, 1982; Fisher, Marlow, Lamb, Maestrini, Williams, Richardson, Weeks, Stein, and Monaco, 1999), problems in the short-term working memory system responsible for recoding and in the long-term memory system responsible for rapid accessing of stored information (Gathercole and Baddeley, 1993). PET scans have also found anatomical differences in dyslexics' brains that include hemisphere differences found in Wernicke's and Broca's areas both of which are implicated in language and speech processing (Paulesu and Frith, 1996). However, there is further evidence to suggest that dyslexia may be related to problems in the visual processing system (Stein, 1991; Paulesu and Frith, 1996), that is deficits in perceiving and/or processing the images of words on a page, as well as in eye-movement control and in peripheral vision (Pavlidis, 1991) that can affect reading. It has long been recognised that there are abnormalities in the magnocellular fast-

processing visual system (Livingstone, Rosen, Drislane, and Galaburda, 1991) as well as abnormalities in the auditory system (Tallal, 1980). In line with such evidence, dyslexics may be unable to adequately process fast incoming sensory information. Eden, VanMeter, Rumsey, Maisog, Woods, and Zeffiro (1996) have further shown that during MRI scans there is a different activation in the visual system in the cortex of dyslexic adults, which may be responsible for visual motion and motor coordination difficulties.

According to other line of evidence (Studdert-Kennedy and Mody, 1995; Rosen, 1999), dyslexia may be linked with deficits in the auditory temporal perception system, including hearing problems from an early age. Evidence for problems related to the processing of rapidly changing visual and auditory information leads to the possibility that there is a common neurological factor that is responsible for these deficits and reported symptoms. However, this evidence is still controversial (see BPS, 1999) and the theoretical explanations still require specification to clarify how the deficits reported can be due to a common temporal processing dysfunction.

Therefore, despite current research on different potential neurological causes of dyslexia, perhaps the strongest evidence has been provided for the phonological processing deficit hypothesis based on behavioural-level manifestations of dyslexia (Stanovich, 1998; Snowling, 1995; 1997; 2000). This viewpoint suggests that there is a delay/deficiency in the processing of sounds at the word level that reflects an underlying inability to process, store and manipulate phonological information. According to this hypothesis, there is a developmental delay in the process of translating visual (letter-grapheme) to phonological representations. This delay or deficit may be accompanied by inadequate development of phonological awareness skills, as evidenced by problems in phoneme discrimination (ability to perceive similarities/differences between initial and final word sounds, e.g. *fat/pat*), phoneme segmentation (ability to break down or analyse words into syllables and words into phonemes, e.g. what sounds do you hear in the word *hot*? or what is the last sound in the word *map*?), phoneme deletion or substitution (e.g. what word would be left in the /k/ sound when taken away from *cat*?), and phoneme blending (ability to combine or synthesise parts of words to form whole words, e.g. what word would you get if you were to put these sounds together /s/ /a/ /t/?). This phonological deficit is also

manifested by poor performance in tasks such as non-word reading (decoding).

According to more recent causal models, however, dyslexia should be viewed within a more comprehensive and multivariate theoretical framework, namely one that focuses on the interplay of biological, cognitive and behavioural factors or processes affecting the outcome of the disorder at different levels (e.g. see Morton and Frith's (1995) causal modelling framework in Reason, Frederickson, Martin and Woods, 1999). As Smythe and Everatt (2000) point out, 'only by assessing all the difficulties that affect the acquisition of reading and writing can we hope to understand the underlying cause of difficulties in the dyslexic individual, and find appropriate strategies and alternative learning methods to overcome these' (p.20).

1.2.4 Dyslexia in adults

Research on dyslexia in adults is scarce compared to the bulk of studies with dyslexic children. In most schools and Universities in Great Britain provisions and regulations for appropriate assessment and support of dyslexic pupils and students are common practice as part of the National Literacy Strategy (1998), the Code of Practice on the Identification and Assessment of Pupils with Special Educational Needs (2000) and the Special Educational Needs And Disability Act (2001) (Reason, 2001). Yet, it is not unusual for young adults to be diagnosed with dyslexia after they have finished school (Reid and Kirk, 2001). In a recent U.K. survey involving over 100 institutions it was reported that as many as 43% of the total dyslexic student population was first diagnosed as dyslexic only after entry to university or another higher-education institution (Singleton, 1999). In the U.K, students with learning disabilities represent 3.8% of all first year undergraduates (Higher Education Statistics Agency, 1999) and it is estimated that between 1.2 to 1.5% of U.K. higher education students are dyslexic (National Working Party's Report on Dyslexia in Higher Education, 1999; Heinman and Precel, 2003). There is an average of 51 dyslexic students per institution in the U.K. today, based on 1.5% of the total student population (Reid and Kirk, 2001). These figures do not include the percent of young adults who fail at school and never enter university and who therefore remain undiagnosed. In the U.S., the percentage of all students with disabilities who enter college may be as high as 8.8% of the total student population. Yet, if we compare this figure with those learning disabled

students who graduate, the percent drops to 3.6% of all graduates have a learning disability. These figures suggest that less than half of the students who enter college with a learning disability graduate. This is in contrast to a graduation figure of 62% of students without any learning difficulty (American Council on Education, 1995).

Many dyslexic individuals successfully manage to enter higher education and excel in their academic life despite their disability. In many cases these 'successful' dyslexics have found ways of overcoming their learning difficulties, possibly through the use of different coping strategies. These so-called 'compensated dyslexics' have been found to perform as well as non-dyslexics on tests of word accuracy, although they are neither automatic nor fluent in their ability to identify words (BDA, 1999). Gallagher and colleagues (1996) assessed a group of adult compensated dyslexic students with childhood diagnosis of dyslexia who had received extensive remedial support and therefore had a good academic record. They found that this group of individuals appeared to be 'compensated in terms of their reading accuracy which fell within the average range, although the reading process was still timely and laborious' (Zabell, 2003, p.155). A lot of evidence seems to show that two main areas where adult dyslexics continue to struggle with are speed of processing and decoding (Shaywitz, 1996), which may suggest that they have failed to acquire the automaticity and fluency for word recognition skills.

In contrast to the evidence for continued and/or compensated difficulties, research has also argued for adult dyslexics possessing outstanding talents in arts (Aaron and Guillemardo, 1993). Others have argued for talents to be associated with dyslexia in areas like music, drawing, architecture or math (Bloom, 1985), as well as in visual-spatial skills, although evidence for clear links between dyslexia and any accompanied special abilities and/or talents is mixed and inconclusive (Wimmer, Karolyi, and Malinsky, 2000). It has been argued that the mere fact that dyslexics choose specific occupations or do well in areas requiring the use of visual-spatial abilities or skills actually reflects their conscious choice 'to avoid verbal fields in which they have even greater deficits, fields that require extensive reading, such as law, medicine, history, etc' (Wimmer, Karolyi and Malinsky, 2000, p.29).

Such research identifying specific characteristics of dyslexic adult students is necessary to support the development of appropriate assessment tools. Everatt (1997) has argued that the assessment of adult dyslexics should emphasise reading rate/efficiency, spelling and reading comprehension (reading for meaning) as more valid measures of literacy ability than the single-word reading measures typically used to assess dyslexia in children. Research concerned with the assessment of adult individuals should consider how to best adapt the existing measures in the literature by imposing extra demands (e.g. impose a time limit) and constraints when administering various tasks to adult dyslexics. For example, Jamieson (2001) focused on the assessment of dyslexic students, gathering assessment details for 215 university students over 5 years. This work led to the development of a new non-word reading test that increased the number of syllables to be decoded in contrast to that typically used in tests of younger dyslexics, while using common letter sequences and orthographic patterns. Using such measures, Jamieson has found strong evidence for persisting difficulties in spelling, reading speed and accuracy, as well as in non-word reading and phonological skills (e.g., dyslexic students took over twice as long to complete a Spoonerisms test). The most sensitive measures in identifying students as dyslexic were reading, spelling, digit naming, fluency (especially rhyme) and time taken to complete the Spoonerisms task. The main diagnostic criteria identified were the co-occurrence of some persistent literacy difficulties and a weakness in one of the cognitive functions such as phonological awareness, rapid naming, and processing speed. The implications from such findings were that there might be a need to reduce the test battery for assessment of adult dyslexics to include some and not all of the tasks used for assessment of dyslexic children. This, however, would mean increasing the risk of false positive and/or negative identification and also reducing the amount of information available for planning appropriate interventions.

The need for appropriate assessment of learning disabled individuals has been well established in the literature. Yet, standardised, reliable and valid diagnostic instruments for the assessment of adults with learning disabilities are still scarce. Further research is needed to refine assessment practices, improve identification and eligibility criteria and derive objective diagnostic tools to deal with the complexity of problems presented by this special needs population. The assessment of adult dyslexics is therefore not simply an issue of devising age-appropriate versions of

literacy measures typically designed and used to assess dyslexic children's performance. Dyslexic adults often appear to have continuing, more stable, persistent and enduring deficits that are different in nature from those presented by dyslexic children (Hawks, 1996). The tests that have been used for the assessment of dyslexic adults in the present research have been specifically selected to assess their literacy (reading and spelling) ability, as well as their performance in certain core phonological and orthographic skills so as to ascertain how these relate to reading and spelling ability.

Typically, assessment of individuals with specific learning difficulties (dyslexia) has focused on three main areas over and above those of specific tests of literacy. These areas assess auditory processing, visual processing/speed of processing and memory. It has been found that performance across each of these areas predicts the acquisition of both reading and spelling skills amongst adult learning disabled individuals (Bell, McCallum and Cox, 2003). Yet, despite the number of tests devised to assess different sub-skills, to date 'no single test currently exists that provides a measure of the skills represented in each of these factors - auditory processing, visual processing speed, and memory plus reading skills' (Bell, McCallum and Cox, 2003).

Steps towards a more uniform cognitive and academic assessment of dyslexia have been made over the last years with an aim to obtain a more accurate learning profile of the individual's cognitive, intellectual and academic abilities and disabilities. The purpose of any assessment process is to determine whether students are failing in specific areas of literacy, and to what extent, compared with their same age peers. The main aim is to identify what are the difficulties that impede learning and academic success and, subsequently, what causes failure. An additional purpose is also to identify the individual's relative strengths and weaknesses and, finally, what can facilitate learning (i.e. determine what is the right kind of support). The diagnostic trend underlying the assessment process over recent years is to determine whether there is a discrepancy in scores between an individual's underlying abilities (i.e. verbal and non-verbal intelligence) and levels of actual achievement or educational attainment, i.e. how the student is performing in different areas of literacy (i.e. reading or spelling). Some diagnostic tests that have been developed for the assessment of dyslexic individuals are norm-referenced, meaning that the scores derived are related

to age, and are presented either in the form of an age score or in the form of a percentile (if, for instance, an individual is performing at the 60th centile, this means that 40% of the same age individuals perform better and 60% perform worse than this rate). Other tests are criterion-referenced, meaning that success or failure in a given area of literacy is related to the skill itself and not graded according to relative age of attainment that is being tested (e.g. rhyme ability cannot be measured on the basis of an age continuum). This means that comparisons of reading disabled individuals are often being made against chronological age-matched (CA) adults or reading level-matched (RL) children or both. Use of such criteria have, however, been accused of raising ethical problems related to negatively evaluating and even worse labelling dyslexic individuals as having a reading age or a spelling age of 'the average 8-year-old' for example, which implies that they are lagging behind in some specific skill/area. Finally, and most importantly, the assessment should be made by an authorised professional body, usually a chartered educational psychologist (Miles and Miles, 1999).

Some (e.g. Padget et al., 1996) have argued that a unified (uniform) or 'complete' assessment of dyslexia should further include, apart from a measure of general intelligence, a measure of listening comprehension, reading comprehension, spelling and, finally, a measure of phonological awareness skills. Additional areas of assessment should also include socio-cultural, psychological and emotional factors that relate to and influence academic achievement as well as obtaining a report of any home, school, or medical/developmental problems. Yet, others disregard the use of certain measures, with the most commonly debatable being the IQ-achievement discrepancy test, as a reliable measure for identifying reading disabilities and predicting academic achievement. Darden and Morgan (1996) argue that 'discrepancy criteria have the advantage of providing a more objective index of underachievement in light of ability but present a host of methodological, conceptual and practical problems' (p.187). (For a review and comparison of current diagnostic discrepancy models, see Brackett and McPherson, 1996).

The measures briefly discussed above are often combined in all-inclusive diagnostic tools of dyslexia. For example, the recently developed Test of Dyslexia (TOD, McCallum and Bell, 2001), which has been used with American populations and

which taps into several sub-components of reading and writing (Bell, McCallum and Cox, 2003). Other standardised American tests used in dyslexia assessment and that tap into different but not all areas of achievement include The Woodcock-Johnson tests of cognitive abilities and tests of achievement (WJ-III, Woodcock, McGrew and Mather, 2001), the CTOPP (Comprehensive Test of Phonological Processing Wagner, Torgensen and Rashotte, 2000) and the WRAT-R (Revised Wide Range Achievement Test, Jastak, Wilkinson and Jastak). U.K. based assessment tools suitable for use with adults include the Bangor Dyslexia Test (Miles, 1997), the Revised Adult Dyslexia CheckList (Vinegrad, 1994), the Dyslexia Adult Screening Test (DAST, Nicolson and Fawcett, 1994) as well as the Adult Reading Test (ART, Brooks, Fidler and Everatt, 2002). The diversity of tools used demonstrates the need for research to identify which measures should be included in assessment procedures and which may not be that useful.

Using assessment tools in an informed manner should always mean taking into account the individual's profile; hence, a range of measures seems more appropriate than a single focused test. Related to this, a key issue in the process of assessing dyslexic students is the use that the assessment process can have in enabling the individual dyslexic to understand their relative strengths and weaknesses, with an emphasis on building on existing strengths (e.g. visual or phonological) identified. Amongst the student university population in particular, assessment should include careful examination of academic-related difficulties as well as other behavioural problems that may impact on their academic success. By definition, dyslexic adults may have literacy difficulties that may not have been early identified and that have not been remediated. Indeed, many students with dyslexia taking programmes in adult/tertiary education institutions have been shown to experience difficulties consistent with their literacy problems during childhood (Bruck, 1993; Miles, 1993; Patton and Polloway, 1996).

Similarly, college-level students may seek support when strategies that they had developed in primary or secondary school prove to be less successful in adult education since the academic work required at higher education levels is much more demanding than that expected at compulsory levels. Support often focuses on developing general study skills strategies to help the dyslexic college-level student

adapt to the amount and level of work required. Very rarely is the assessment of dyslexia-related difficulties used specifically to recommend learning strategies. Despite the evidence that relating the assessment profile to proposed support procedures may be useful amongst children, little has been performed to assess whether the same assessment-remediation relationship might be found amongst adults with developmental learning difficulties or even more so among bilingual adults experiencing reading and writing difficulties in learning a L2 (Miles and Miles, 1999).

It has been argued that one defining characteristic of deficient literacy skills amongst adult dyslexics is poor spelling performance (Miles, 1993). According to Cook (1980) 'poor spelling is an inevitable concomitant of dyslexia' (cited in Ott, p.103) and is in fact more difficult to remediate than poor reading with most dyslexics remaining poor spellers throughout their adult life. Ott (1981) reports that dyslexics make one spelling error in five, whereas the ratio for normal readers is one in thirty five (p.103). It has been further demonstrated that dyslexics are not only more prone to more spelling errors; their spellings are qualitatively different from those of normal learners (Cook and Moats, 1983, p.104) and are much slower when retrieving familiar word spellings.

Everatt (1997) investigated this hypothesis using two spelling and two comprehension measures, the first asking participants to fill in missing words from a passage and the second to answer multiple-choice questions based on the passages read. Other measures included rapid naming tasks using colour words, colours, line drawings of familiar objects and non-word reading. Such measures were included to assess possible interference effects in rapid naming but also to 'determine whether naming deficits within dyslexics are confined to word-reading or are indicative of a more general name retrieval deficit (e.g. Wolf and Obregon, 1992)' (Everatt, 1997). The participants in this study were undergraduate students aged from 18-55 years old. The dyslexic individuals were contacted via the special learning support units of the universities that they attended and were already diagnosed as having dyslexia. A significant difference in spelling ability was found between the two groups, with the dyslexics performing significantly more spelling errors than the controls in both spelling tests. The results confirm previous research by Felton, Naylor and Wood

(1990), Bruck (1990) and Miles (1993), suggesting that literacy problems as evidenced by poor spelling and comprehension performance persist into adulthood for dyslexics. In addition, when presented with unfamiliar information (i.e. non-words), Everatt (1997) found that adult dyslexics were much slower than the controls. This is not the case when they were presented with familiar words, possibly due to several compensatory strategies that they have adopted over the years such as developing a sight word vocabulary after gaining adequate exposure to printed words. It has been argued that this non-word processing deficit may be due to poor orthography-to-phonology conversion processes (Everatt, 1997).

Hanley (1997) also studied the performance of adult dyslexics on reading and spelling tasks. The participants in this study were all undergraduate students previously undiagnosed as dyslexic during their school years and who were struggling through college. Their reading ability was assessed using the Nelson's (1983) National Adult Reading Test (NART) and the McKenna and Warrington's (1983) Graded Naming Test (GNT) vocabulary test. The two measures were selected to test the hypothesis of whether low scores on the reading test would produce low vocabulary scores and therefore to investigate the possibility of a relation between the two skills. Students were classified as dyslexics if they had a score of over 2 standard deviations below the mean on both the NART and the Schonell test. Results indicated that dyslexic students performed significantly lower than the non-dyslexics on both the NART and the Schonell test, with the exception of picture naming which did not distinguish between the two groups' performance. Significant differences occurred in non-word spelling, in regular and irregular word spelling as well as in the written rhyme test and the digit span test. As predicted, dyslexics who scored higher on the vocabulary test 'were better able to compensate for their reading problems than those with lower vocabularies' (Hanley, 1997). Furthermore, it was found that dyslexics' performance on the Spoonerisms tests was a significant predictor of the NART test, which suggests that poor performance on phonological awareness tasks is indeed evident among adult dyslexics. The findings presented in this study confirm those of previous research (e.g. Bruck, 1990; Felton, Naylor and Wood, 1990; Snowling, 1995) that adult dyslexics perform worse on non-word reading and spelling tasks as well as on phonological awareness tasks when compared against non-dyslexic controls.

Bruck (1993) investigated the word recognition and phonological processing skills of adult dyslexics and found that poor performance in this area was related to poor knowledge of spelling-sound correspondences, reliance on inadequate spelling-sound information for the recognition of familiar and unfamiliar words and poor phonological awareness skills. The participants in this study were individuals (mean age of 21) who were diagnosed as dyslexics in childhood. They were compared against two control groups, the first group including students of the same age as the adult dyslexics whose performance was above average on both standardized reading comprehension tests (79 centile) and on standardized word recognition tests (87 centile) and the second group including grade 6 children (mean age was 11 years) who performed similarly to the adult dyslexics on both the standardized reading comprehension and word recognition tests. The two control groups were of a different age level but were matched for reading comprehension and word recognition scores. They were tested on measures such as speed and accuracy of single word reading, knowledge of spelling-sound correspondences, and use of context to assist word recognition. It was found that the dyslexic group performed worse than their age-matched college control participants. Although adult dyslexics made the same number of errors in the word recognition task as the grade 6 children, they were significantly slower readers than the children in the control group.

Another important finding that emerged from this study was that adult dyslexics relied more on spelling-sound correspondence rules for word recognition of both high-frequency and low-frequency words than the other two control groups. Normal readers, on the other hand, were able to recognise highly familiar based on their visual-orthographic skills instead, which mirrors similar findings with dyslexic children. As Bruck (1993) explains, 'inadequate spelling-sound knowledge impedes the establishment of firm orthographic representations that can be used for direct word recognition' as well as "the establishment of abstract representations about the phonological units of words' (p.266).

Further evidence of phonological processing deficits amongst adult dyslexics is presented by Snowling, Nation, Moxham, Gallagher and Frith (1997). Fourteen dyslexic students (12 males and 2 females, age range 20-33 years) were initially assessed on a single word reading and spelling test, the Wide Range Achievement

Test-Revised (WRAT-R) in which they obtained a mean score of 84.5 for reading and a mean score of 73.5 for spelling. They were compared against a control group of 19 individuals (17 males, 2 females, age range 20-30) who attended the same university and who scored slightly above average on the WRAT-R. The two groups were matched for non-verbal ability, but differed significantly in vocabulary scores in the WAIS-R, with the dyslexics performing significantly poorer. Measures included reading and spelling of 15 non-words, phonological processing tasks (rhyme production, phoneme deletion and spoonerisms), fluency tasks (semantic fluency, phonemic fluency, digit naming and word and non-word repetition) and finally verbal short-term memory tasks (digit span, span for 1, 2, and 3 syllable non-words and speech rate for 1, 2, and 3 syllable non-words). Results from their study indicated that dyslexics performed significantly worse than the controls in the phoneme deletion, the phoneme fluency, the spoonerisms, the single word reading, spelling, and the non-word reading tasks. No differences were found however in speed or accuracy of rhyme production. The dyslexics also produced more errors in non-word repetition and digit span tasks. Snowling et al (1997) also reported significant differences between the two groups in alliteration and semantic fluency tasks, but not in rhyme fluency.

More recently, Zabell (2003) found that non-dyslexic adults students significantly outperformed the dyslexics students on all measures of literacy that they were compared against (including reading, spelling and reading comprehension), on measures of phonology (spoonerisms, semantic alliteration, rhyme fluency and rapid naming of digits and objects) and orthography (orthographic choice task). They also outperformed the dyslexics of measures of vocabulary, auditory short-term memory and processing speed. The two groups were the same only in terms of their non-verbal ability. All of the other measures in this study were found to reliably distinguish between dyslexic and non-dyslexic adults. The findings are also suggestive that even though dyslexic adults might be successful in their academic life, they continue to present evidence of persistent literacy difficulties as well as difficulties in their phonological and orthographic processing skills.

Zabell (2003) also investigated the extent to which phonological and orthographic processing, single word reading, decoding, vocabulary and processing measures could

predict individual differences in spelling ability of adult dyslexics and non-dyslexic students. It was found that for the dyslexic group, spelling ability varied as a function of orthographic processing skill and that overall it was significantly and highly positively correlated with all of the above measures used in her study. For the non-dyslexics, spelling ability was highly and significantly correlated with measures of single-word reading, and less so with measures of vocabulary and orthographic choice task. The orthographic choice task and the single word reading task predicted 55% of the variance in spelling ability.

Dyslexics' performance is characterised by poor spelling especially in their 'production of bizarre errors based on letter combinations that are not normally found in the English language' (Nicolson and Fawcett, 1995, p.21). If we are to take the connectionist approach, 'dyslexia can be viewed as a lack of computational resources being made available' (Brown and Loosemore, 1996, p. 333) during spelling. What happens with dyslexic individuals is that the transition from the logographic stage to the alphabetic stage is hampered by a working memory overload, which does not allow access to the orthographic stage where the whole word is recognised without breaking it down into individual phonemes. More specifically, dyslexics have difficulties in the ability to segment and translate graphemes to phonemes and vice versa and because of this inability to make the above conversion they cannot progress to the alphabetic stage (Nicolson and Fawcett, 1995).

According to Nelson (1980), spelling problems in dyslexics originate from 'the acquisition of spelling knowledge by the semantic memory system' (p.492), which in turn inhibits access to the two spelling routes (graphemic and phonetic), and thus not from an actual impairment in either of the two routes as the dual-route hypothesis would suggest. Beech (2002) explains that because of their phonological deficits, severe dyslexics are said to be 'reading holistically and are unaware of the sounds that the words make' (p.125). This explains why they are unable to successfully distinguish homophonic and non-homophonic non-words.

1.2.5 Dyslexia in different languages: cross-language comparisons

Although there is not one single worldwide definition of dyslexia, it is without doubt

an international concern. It is now fully recognised that learning difficulties can be identified across different languages, in individuals from different cultures, socio-economic status, race and gender. Yet, despite the fact that dyslexia is evident in almost all languages, tests to identify dyslexia amongst learning disabled individuals are found only in a few countries and even more importantly, there is no single international dyslexia test developed up to date. Furthermore, the majority of assessment studies reported in the dyslexia literature involve monolingual (and for that matter monocultural) individuals and not individuals learning to read and write in different languages (biliterate/biscriptal individuals). Attempts towards the development of a global screening tool for identifying dyslexia across different countries have faced many inherent difficulties like translating tests to produce comparable procedures or eliminating any culture-related factors (e.g. culture practices like tapping or rhyming tasks) that could lead to potential biases. Following extensive cross-linguistic research, the International Cognitive Profiling Test was the first attempt towards the development of an international dyslexia test (Smythe, 2002).

The ICPT has been trialled with success in a number of languages including Welsh, Russian, Chinese, Portuguese and Hungarian. Some parts of the test battery can be performed in the first language without the need for translation, and without even understanding the reply (e.g. in rapid naming of pictures it is the speed and hesitancy that is important). This may be more useful when assessing individuals who are not so verbally fluent in their second/additional language (i.e. ESL individuals), which may be reflected in their responses. The areas that the ICPT covers are phonological segmentation and assembly skills, auditory system, visual system, semantic lexicon, and speed of processing. This framework, however, does not cover all aspects of the difficulties faced by literacy disabled, and every individual should be treated on an individual basis. Further testing and research may therefore be required to investigate areas not covered by these tests.

Despite the dominance of the phonological deficit viewpoint in current perspectives of dyslexia, one question that still remains unanswered is whether this causal hypothesis can be generalized across all alphabetic orthographies despite their evident differences (such as in terms of orthographic consistency and grapheme-phoneme relations). If

this and other working models of dyslexia were tested against different languages then would it be possible to make, as Landerl, Wimmer and Frith (1997) put it, 'cross-orthography dyslexia comparisons'? (p. 318). These researchers attempted to answer this question by examining whether differences in the reading and phonological processing skills between dyslexic children coming from two different orthographic systems, such as English and German, would be language-related. The children from the two groups were matched for reading, spelling and non-verbal ability as well as chronological age. Results indicated that English dyslexic children were twice as slow as German speaking children in non-word reading and significantly slower in short high-frequency word reading. This according to Landerl, Wimmer and Frith (1997) might suggest that 'the process of phonological recoding itself may be organized differently for German and English children. This different organization of phonological recoding may be triggered by the key orthographic feature distinguishing German and English orthography, namely the difference in the consistency of grapheme-phoneme relations for vowels' (p. 328).

Past research has indicated that compared against reading age matched controls, adult dyslexics present deficits related to naming speed, namely deficits in their ability to obtain rapid access to lexical information from long-term memory. Specifically, it has been found that they present difficulties in naming speed of single letters, digits and objects. Such deficits present a major and prevalent characteristic of the reading disabled adults; yet in some they may be manifest with or without deficits in other areas of phonological awareness, a theoretical claim commonly referred to in the reading literature as the 'double deficit' (Wolf and Bowers, 1999). According to the double deficit hypothesis, literacy deficits often co-occur with deficits in phonological processing in dyslexic individuals. For example, dyslexics may have both a poor understanding of the phonological segments of the language as well as problems in speed of accessing lexical information. What is more, the naming speed deficit that adult dyslexics present does not seem to be influenced by the amount of exposure to print or by their reading level (Wolf, 1991).

Further evidence suggests that the naming speed deficit also appears to differentiate between readers of more regular orthographies than English (e.g. German, Dutch and Spanish), which suggests that it is likely to be equally predictive of reading ability in

transparent languages as well in languages where there are clear grapheme-phoneme correspondences, and that, for that matter, present fewer phonological-based demands. Such an argument would lead to the assumption that 'when phonological skills play a reduced role in the more transparent orthographies, naming-speed performance becomes an even stronger, more important diagnostic indicator and predictor of reading performance' (Wolf and O'Brien, 2001, p. 5). Over the past years research in rapid naming has focused on whether such naming deficits presented by dyslexics are confined to word-reading or whether they are likely to be indicative of a more general name retrieval deficit, for example, a deficit in lexical automaticity (e.g. Wolf and Obregon, 1992).

In a recent large-scale cross-linguistic comparison of different European orthographies such as French, Portuguese and Danish with the English orthography Seymour, Mikko and Erskine (2003) found that orthographic depth and syllabic complexity were the main factors that affected accurate decoding, word and non-word reading ability across different language systems. The development of such skills was found to be twice as slow in English orthography as it is in other shallow orthographies. Moreover, in deeper orthographic systems (e.g. Portuguese, French, Danish, and English) the attainment of both logographic and alphabetic skills account for more spelling complexities than in shallow orthographies (e.g. Finnish, Greek Italian, Spanish, and German). The cognitive maturity required to gain orthographic knowledge may in turn impede automaticity of letter processing.

Despite the dominance of English-based research in the area, reading and writing difficulties are not only present within English language populations. During recent years there has been a major shift towards the study of international and cross-cultural aspects of dyslexia and how it manifests in countries with different orthographic systems. A leading figure in this area, Goswami (2000) has argued that segmentation skills are related to reading ability across a number of languages, including Greek. However, the behavioural and cognitive features related to reading/writing problems may vary due to language or script. Research suggests that individuals learning a script (orthography) with a more consistent relationship between symbols (letters/graphemes) and sounds (phonemes) have been found to progress in literacy faster than those learning a less regular orthography (e.g. Snowling, 2000). Similarly,

phonological awareness deficits may be less of a problem when learning a regular orthography with simple rules of correspondence (e.g. Wimmer, 1993). The importance of relative strengths and difficulties in the acquisition of literacy skills would seem, therefore, to be a factor that will vary across different languages/scripts. The present cross-language comparison research is designed to investigate this possibility. Its main cross-language focus was on English versus Greek, with the research addressing the question of what impact differences between the two languages (i.e. English and Greek) have on the frequency and nature of the problems that occur when learning to read.

Undoubtedly, the study of dyslexia in two or more different scripts involves cross-language comparisons. In addition to differences in orthography, emotional, social and other cultural differences are important variables that need to be accounted for when doing research with bilinguals, as are degree of expertise in L1 and L2 within the bilingual group (degree of proficiency in a language), affiliation (affective relationship with a language) and inheritance (membership, by birth, of a family or community with a particular language tradition) (Cline, 2000). The Greek and English languages which were contrasted in this research differ in many respects. Greek has a high degree of correspondence between the written symbol and the sound that symbol represents in the language. English is much less consistent in its symbol-sound relationships. As an example of a transparent orthography (although spelling is more irregular as there are many grapheme-phoneme inconsistencies), any reading problems that Greek students may encounter could be argued to be due to poor encoding rather than to poor decoding (Miles, 2000). Furthermore, because Greek children from an early age learn syllables on the basis of simple consonant-vowel correspondence rules, they rarely use onset and rime unlike English speaking children.

Similarly, given the literature outlined above, the differences in transparency between English and Greek should mean that the impact of an individual's level of phonological awareness on literacy measures will vary between the two language conditions. The more transparent nature of Greek may mean that phonological skills will have to be relatively much weaker than those found for English individuals before they significantly impact on reading skills. We might expect to find that English poor readers present relative weaknesses in visual and phonological areas

whereas the profiles presented by Greek individuals with poor literacy skills are more likely to show relative weakness in phonological areas in comparison to visual strengths. The impact of such potentially different profiles is yet to be investigated. Furthermore, the relative difference between areas of strength and weakness is further important for providing strategies for overcoming difficulties regardless of language background.

It has been argued that in languages where there is a simple relation between spelling and sound (transparent orthographies) readers depend more on decoding for word recognition and processing than readers of opaque orthographies. Oney and Durgunoglu (1997) attempted to investigate the above hypothesis. In their study, participants (both second and fifth grade children and adults) named printed flashing images of target words that were preceded by a spoken pseudo-word that either rhymed or did not rhyme with the target. To the extent that readers depend on decoding (assembled phonology) to recognize the target word, preceding that assembly process with a spoken rhyme ought to facilitate it. The above assumption was tested in a transparent orthography (Turkish) in which each letter has only one pronunciation and a more opaque one (English). It was found that rhyme had a stronger effect in Turkish than in English and a stronger effect on younger than in older readers. A second experiment indicated that the difference between languages was not likely to have been an artefact of the proportion of rhymes used. The results support previous similar work suggesting that orthographic transparency determines the degree to which readers use phonology during word recognition (Wimmer and Goswami, 1994).

The question that arises then from such findings is whether L1, L2 and dyslexic individuals rely on their phonological awareness and decoding skills to the same extent across different areas of reading like, for example, reading comprehension. The above study would most likely suggest that L2 readers are likely to be less dependent on phonological mediation with experience and that this reduction is likely to be more rapid for readers of opaque orthographies. Yet, one area that has not been investigated is whether the same kind of problems and deficits as the ones described above can also be found to be characteristic amongst individuals with ESL. This was the key question that constituted the core of the present investigation.

Obviously, studies that contrast educational difficulties across languages/cultures need to consider the system within which that education is presented. Two areas will be briefly mentioned, the use of English in Greek education (clearly important as a factor related to bilingualism) and special educational needs/dyslexia. As far as the first issue is concerned, traditionally, within the modern Greek education system, English is introduced as a foreign language from as early as the third grade. This means that Greek school children start to learn English at, approximately, the age of 10 until the end of high school (in Greece called Lyceum) at age 18. The English language then becomes optional for those attending higher education courses, i.e. those entering public universities. Therefore, there will optionally be a level of Greek-English bilingualism across most populations tested within Greece and a potential influence of the one language on the other (L1 to L2 or vice versa) prior to adulthood, the target of the current research. However, English may not be typically used in normal day-to-day education by adults in Greek higher education.

As far as the second issue is concerned, the Special Education sector is considered as relatively new in the Greek educational system, although the respective legislation was initially introduced as early as 1972 (for a brief overview of the legislation of the Greek Ministry of Education and Religious Affairs, 1994 please refer to pp.93-96 of the Special Education information manual). It is only during the last 20 years that significant steps have been taken for the organisation and operation of the Special Education sector within the Greek educational system. Until recent years the scientific support and guidance of schools catering for people with special needs has been assigned to a Special Education independent body, the 'School Counsellors'. The recent Act (2817/2000) for Special Education introduced some new important elements in the overall structure of the system such as the establishment of 'Centres of Diagnosis, Assessment and Support' (CDAS), based in the capital city of each prefecture, with the main responsibilities being recording any problems of Special Education within the relevant catchment areas, organising the enrolment procedures in the Special Education schools of the given prefecture, monitoring of the standards in these schools, taking provisions for the full support and guidance for the teaching staff and parents alike, as well as publishing proposals for the improvement of the system (teaching methods, assessment procedures, technical infrastructure etc.) (See Mazi, Nenopoulou and Everatt, 2003).

Dyslexia research in Greece has focused more on etiology and diagnosis (Pavlidis, 1981; 1985; Kasviki, 1992) and less on remediation techniques (Mavrommati, 1995). In comparison to English, there are very few tests available for the assessment of Greek adult dyslexics with existing dyslexia tests being used for the diagnosis of dyslexia in children (e.g., The Pavlidis Early Warning Test for Dyslexia, REF; and a Greek version of the Bangor Dyslexia Test, Miles, 1993). In a recent study, Nikolopoulos (2001) investigated the manifestation of dyslexia in Greek schoolchildren. It was proposed that orthographic transparency would be a major factor in explaining manifestations of Greek dyslexia. Twenty-eight second and fourth grade dyslexic children were compared to CA and RA controls on measures of word and non-word reading, spelling, phonological awareness, phonological processing and syntactic awareness. Greek dyslexic readers were found to be highly accurate, but very slow when reading words and non-words and when responding to questions about the phonological structure of words. However, despite the small number of reading errors, dyslexics made significantly more errors than the controls on both reading measures and significantly more errors than the RA controls on non-word reading. Deficiencies were found on spelling too; those with written language difficulties were associated with deficiencies in the phonological domain as measured by phonological awareness and rapid naming tasks. It was concluded that although the underlying phonological deficit in Greek and English dyslexics is the same, the degree of severity and the manifestation of the deficit in these two orthographies might differ. Greek dyslexics suffer from milder cognitive, reading deficits and are more affected in terms of reading speed whereas English dyslexics suffer from more severe cognitive, reading deficits and are more affected in terms of reading accuracy (Nikolopoulos, 2001).

Auditory and visual cues seem to play an important role in predicting Greek reading and spelling ability particularly at an early age. Porpodas (1989) aimed to determine how much beginning readers rely on sound, shape and orthographic cues by having 6-year-olds read texts, which were systematically distorted and orthographically altered. The hypothesis was that if Greek children rely more on orthographic cues rather any other cue, then a heavy distortion of orthography would be expected to affect their reading performance. Half of children in the study were classified as good readers,

whereas the other half as slow readers. All children were presented with four different short descriptive stories of grade 1 difficulty, matched for vocabulary, grammar, and concept and were tested on reading speed, accuracy and reading comprehension. The stories had to be read in four different versions (conditions), where the words were manipulated in different ways to vary the effect of visual, auditory, and orthographic cues. For example, in the first condition, words were typed alternatively in a mixture of lower and upper case letters, in the second condition words were typed with lower case letters and were misspelled, in the third condition words were typed with lower case letters but one or two of them were replaced by other letters, which looked like the letters of the target word. It was found that both good and slow readers struggled to read distorted text, as there were no significant differences in their performance across the four conditions. A significant main effect was found, however, for reading ability and for the alteration of cues across conditions as well between reading ability and alteration of cues. Porpodas (1989) concluded that both good and poor beginning Greek readers can manage to read text even when only partial shape, orthographic and sound cues are available. This finding suggests that “beginning readers do not rely exclusively on any one particular cue for reading” (p.182). Additionally, manipulating sound cues within text seemed to significantly affect the reading speed of both good and slow readers, which in turn suggests that beginning Greek readers, in contrast to English readers, may depend much more on phonological cues rather than on orthographic cues, a finding that Porpodas (1989) explains may be attributed to the different degree of grapheme-phoneme correspondences in the two languages.

The role of spelling-sound correspondence in Greek readers was further investigated in another study whereby reading and spelling ability of Greek children was tested through the use of regular versus irregular words (Porpodas, 1989) to test if young readers depend on spelling-sound information or only on visual information while reading and spelling. Porpodas (1989) argued that if Greek children’s reading depends on knowledge of spelling-sound correspondences, then reading orthographically regular Greek words should be easier than reading orthographically exception words (i.e. phonetically irregular words), mispronunciations should be attributed to grapheme-phoneme translation errors and only minor errors should be expected in reading of Greek non-words. If, on the other hand, children’s reading

depends on the use of sound-spelling correspondence rules, then it was expected that orthographically regular Greek words would be spelled more accurately than exception words, misspellings would be mainly phonetic and spelling of Greek non-words would be fairly accurate.

The above predictions were tested in three groups of fourth grade Greek children (12 in each group). Children from the first group were good readers and good spellers, children from the second group were good readers and poor spellers and children from the third group were poor readers and poor spellers. All children were asked to spell a list of 24 orthographically regular, a list of 24 exceptional words and a list of 48 non-words. Words were matched for frequency, length, consonant complexity and grammar. Scores were derived from mispronunciation errors, which were classified as phonological, visual or derivational, and spelling errors, which were classified as phonetic and non-phonetic. Results revealed a significant main effect for the group*word class interaction. A statistically significant difference was found for the spelling performance in non-word errors between the three groups. Most mispronunciation errors were made by the poor readers and poor spellers group and were visual, not phonological. Therefore, fourth-grade (9 year-old) Greek readers, like English readers at this age, employ mostly sound-spelling correspondence rules for spelling. Moreover, good Greek readers could read regular words and exception words equally well, which would seem to support the hypothesis that good readers recognise words using both phonological and visual-based information cues. However, the same is not true for poor readers “who tend to rely mainly on print-to-sound correspondence knowledge because they commit more errors when they read exception words than when they read regular words. Good readers, therefore, seem not to depend exclusively on phonological information but use both visual and phonological processes” (Porpodas, 1989, p. 181).

In a more recent study, Porpodas (1999) further assessed the reading and spelling performance of first-grade Greek children with and without literacy difficulties (reading and spelling difficulties). He hypothesised that any phonological processing deficits likely to be found amongst children with literacy difficulties would be attributed to either lack of awareness of the phonological structure of the words presented or to an impairment in retaining phonological information into short-term

(working) memory. The spelling ability of the two groups of children that participated in this study was assessed on a word-spelling and a non-word spelling task in which they were orally presented with words and non-words both outside and within a sentence context each repeated three times and asked to write them. Results indicated that children with reading and writing difficulties were significantly poorer than normal readers and spellers especially in real word spellings. Although there was a large within-group effect between word and non-word spelling accuracy rates (88% of non-words compared to 25.5% of words were spelled correctly), the same was not true for spelling high and low-frequency exception words, that is words with grapheme-phoneme inconsistencies. Such a finding would suggest that this group of children could accurately translate phonemes to graphemes only when the orthographic form of the words presented could be derived through the use of sound-spelling correspondence knowledge. Beginning Greek readers and spellers are therefore able to successfully decode orthographically regular words (although at a slower-rate compared to controls) probably due to the nature and structure of the Greek writing system (Porpodas, 1999).

1.3 Dyslexia and bilingualism: possible links

“Bilingualism is for me the fundamental problem of linguistics” (Jakobson, 1953).

1.3.1 Some issues in bilingualism and bilingual research: facts and definition problems

Bilingualism is a widespread phenomenon that affects the world population, many contemporary societies and nations as a whole. It has been studied both as a social and individual phenomenon and within different contexts such as education, politics etc. Numerous definitions of bilingualism have been proposed over the past years. Some of these include: “speaking two languages interchangeably”, “both languages are regularly employed as media of intercourse”, “the practice of alternatively using two languages” or as “the regular use of two languages”, “the regular acquisition and use of two or more languages”, “native-like ability in both languages” and so on (Schreuder and Weltens, 1993).

These are, however, broad and general definitions and have inherent problems with some of the terms being used to define what bilingualism is and what is not. For example, terms like “natural, or “formal” L2 learning and acquisition are unclear and problematic to start with (Schreuder and Weltens, 1993). There are, without doubt, a number of problems in defining bilingualism and in distinguishing between levels of bilingual proficiency. Who is considered to be a bilingual and who is not? And what are the criteria for measuring the level of bilinguals’ proficiency? Clear operationalisation of the concept of bilingualism is necessary for the purposes of deriving objective measures and assessment procedures regarding bilinguals’ linguistic abilities and disabilities (Schreuder and Weltens, 1993b). It is also essential when comparing bilinguals’ linguistic abilities with those of other groups, i.e. against monolinguals.

Defining a bilingual is further complicated according to Baker (1993). “A person may be **able** to speak two languages, but tends to speak only one language in practice. Alternatively, the individual may regularly speak two languages, but competence in one language may be limited. Another person will use one language for conversation and another for writing and reading” (p.5). We therefore need to distinguish between

level of ability or fluency (degree) and *level of use or usage* of bilingual ability (**function**) across all language skills. Bilinguals may use their language repertoire selectively for different purposes in every domain of life and with different people depending on the social context. Another important distinction we need to make with reference to bilinguals' language skills or abilities is this between some terms that, although they look similar and are often used interchangeably in the literature, are in fact intended to mean different things. These are:

1. *Language skill*: refers to specific components and sub-components of bilinguals' literacy such as reading and writing
2. *Language competence*: refers to bilinguals' underlying language skills
3. *Language performance*: refers to the manifestation of the degree of bilinguals' language competence
4. *Language ability-proficiency*: refers to a "latent disposition, a determinant of eventual language success", the outcome of the knowledge attained or an "indication of current language level" (Baker, 1993,p.5), and, finally,
5. *Language achievement*: refers to the end result of having learned a specific language—in this case L2—after formal instruction (Baker, 1993).

Grosjean (1998) further outlines the language factors that bilingual research needs to take into account and control for with respect to individual differences in language competence and skills. This often means acquiring information on the following:

- *Biographical data* (age, sex, socio-economic and educational status etc)
- *Language history and language relationship* (which two languages were acquired, when and how, the linguistic similarity between L1 and L2, the role of the cultural context that the two languages were acquired etc)
- *Language stability* (the process of language attainment that the bilingual has in each of the two languages, i.e. is one or both languages still being actively acquired, restructured or is the individual "losing" one or more language skills altogether as a result of change in the linguistic environment?)
- *Function of languages* (in what context, for what purpose and to what extent are each of the two languages being used?)
- *Language proficiency* (across all four language skills in both languages) and

- *Language code-switching modes* (how often and for how long is one or both languages active at the same time).

Given such degree of individual variability the process of accurately assessing the specific population is not an easy one.

‘True’ bilinguals are difficult to find; the vast majority of this group of individuals in most studies are often referred to as ‘unbalanced’ bilinguals (Van Wijnendaele and Brysbaert, 2002), meaning those without perfect knowledge of the L2. This raises definition problems concerning who is considered a bilingual and who is not.

Therefore, research into bilingualism needs to take into account certain criteria about L2 proficiency level of the population under study like language history, language stability, number and type of languages known, competence in sub-component language skills like reading, writing, speaking and listening, and domain-specific use of the two languages (Van Wijnendaele and Brysbaert, 2002).

1.3.2. Bilinguals and ESL (English-as-a-Second Language) individuals: same or different?

The terms bilingual and ESL (English-as-a-Second Language) are frequently used (for example in the U.K. and Canada) interchangeably to refer to the same group of individuals. Others (for example in the U.S) prefer to refer to bilinguals using terms like LEP (individuals with Limited English Proficiency), which could possibly entail the danger of attaching a negative label and imply the existence of a deficiency rather than a proficiency. The use of such terms should be made with caution as, like with dyslexics, there are ethical issues relevant to labelling individuals (Baker, 1993).

Ideally, a bilingual is someone who is equally highly fluent in both languages. Such individuals are also called **balanced bilinguals** (or equilinguals or ambiilinguals).

True or balanced bilinguals are very hard to find as “most bilinguals will use their two languages for different purposes and functions” (Baker, 1993, p. 8). It is yet another definition that renders caution.

Categorising individuals into groups is necessary for comparing their linguistic abilities and disabilities. But even using monolinguals as the point of reference for comparisons with bilinguals may be problematic in itself. Perhaps it would be more appropriate and fair in some cases to compare bilinguals against other bilinguals or against 'balanced' bilinguals for that matter (Baker, 1993).

Another distinction we need to draw is between *conversational fluency* (manifested in different social contexts), which can be attained depending on individuals' experience/degree of exposure to the L2 and *cognitive/academic related fluency* (especially with bilingual student populations), which may take 5-7 years of instruction to master (Baker, 1993). Finally, we need to distinguish between *simultaneous bilingualism*, (attained up to age of 3) which refers to the case when two languages are being acquired at the same time, and *sequential bilingualism* which refers to the idea that bilingualism was attained later in life through formal or informal education/instruction (Baker, 1993).

1.3.3 Measuring bilingualism: the use of language background self-rating scales and questionnaires

Research into bilingualism has long employed the use of tools like self-rating scales and questionnaires to assess bilinguals' actual use and level of L1 or L2 competence. Some of the problems or limitations of such methodologies are the potential ambiguity in answering the questions or in obtaining socially desirable answers. Questions need to include all domains of life like social, academic etc and should be able to discriminate between language ability and language usage in these different contexts. They should clearly tap into the four language abilities (e.g. 'How many years have been *speaking* ESL'? is clearly a question referring to the ability to speak), depending on which of the four is under investigation by the researcher. The use of self-rating scales and questionnaires as tools for acquiring background information on bilinguals' language abilities is not without problems as some individuals may sometimes tend to over-rate themselves and others may under-rate themselves when asked to provide some form of a self-evaluation of their linguistic competence (Grosjean, 1998).

1.3.4 Bilingualism, SLA and FLA: some further distinctions

Lalleman (1996) draws the distinction between SLA (Second Language Acquisition), FLA (Foreign Language Acquisition) and bilingualism. The term SLA implies that L2 learning takes place where this specific language is the dominant one, whereas the term FLA is used to refer to the learning of a second language “outside of its own language area” (p.4). Furthermore, the two terms differ in that SLA is spontaneous and can occur with or without formal instruction (e.g. a French native English learner working in the UK for a UK company), whereas FLA almost always implies formal instruction (e.g. Greek pupils being taught English as foreign language as part of their curriculum at school). Both forms of language acquisition differ from bilingualism, which is usually referred to as the *simultaneous* (and not spontaneous) acquisition of any two languages neither of which is subsequently a second or foreign language for that particular individual (Lalleman, 1996).

In distinguishing between the terms language acquisition and language learning Lalleman (1996) argues that the two concepts are essentially different. He explains that “acquisition (comparable to L1 acquisition) is a subconscious process and comes about only through social interaction and situations where there is a ‘natural conversation’. Learning on the other hand, is a conscious process; rules are being consciously applied at any given context where it takes place. Acquisition and spontaneous production, on the other hand, do not automatically nor necessarily follow from learning” (p.35). His account contrasts cognitivist theories (e. g. McLaughlin, 1992) claiming that L2 acquisition (automaticity) occurs only after learning (controlled processing).

Some theorists have argued that SLA is a universal process (e.g. Krashen, 1982; Dulay, Burt and Krashen, 1982). More specifically, some aspects of SLA that they claim to be universal are related to knowledge of certain syntactic and morphological rules, lexical development and phonological development, pragmatic (functional) development for example, how linguistic forms are linked to the context/situational demands in which they occur and use of certain strategies (learner, production, and communication strategies).

In conclusion, there is a set developmental order involved in the process of SLA “whereby certain structures can be learnt only after others have been acquired” (Lalleman, 1996, p.20). SLA is therefore a universal process to a great extent although not entirely so. Successful SLA is also a function and a combination of certain learner characteristics like degree of motivation and formal education, speed in which a language is learned as well as other situational, psychological and biological factors (Lalleman, 1996).

1.3.5 Transfer

Further research into the influence of L1 on L2 acquisition has investigated the role of transfer of L1 in L2 development and acquisition (Wode, 1981; Adiv, 1984). Broadly defined, transfer refers to “the use of L1 elements and structures in the L2; L1 elements and structures, for instance word forms or word meanings are *transferred* to the L2” (Appel, 1996, p. 390-91). Transfer has been also described in the literature with terms like interference, facilitation or cross-linguistic influences. Different types of transfer that can take place are lexical and phonological.

The concept of transfer is fundamental in theories of second language acquisition like the contrastive analysis theory described above. An area that has been extensively investigated is also the contribution of transfer as an inter-language process in the organisation, retrieval and output of L2 knowledge from L1 knowledge or as the process of “bridging gaps in L2 knowledge” (Kellerman and Sharwook Smith, 1986, p.22). Transfer has further been studied as a strategy, or a decision making process of L2 learning, whereby L1 is utilised in order to solve L2 learning problems or L2 linguistic demands where L2 resources are limited (e.g. McLaughlin, 1987). Finally, as a learning mechanism, transfer depends on the relative closeness or structural similarity between L1 and L2. As Ringbom (1986) notes, “the less the learner knows about the target language (L2), the more he is forced to draw upon any other prior knowledge he possesses” (p. 155), that is upon L1.

A common characteristic among second language readers is that of transfer of their reading strategies from L1 to L2. Anderson (1991) maintains that L2 readers make use of different strategies in various reading contexts. Yet, according to different line of evidence, it is the kind of strategies that bilinguals (L2 readers) use when reading in

their second language that essentially determine their level of reading ability and transference. More specifically, Cowan (1976) argues that the specific “strategies which readers employ to process text must be to some extent language-specific” (Alderson, 1998, p. 10). When a reader is faced with different syntactic and grammatical structures different strategies must be employed. Cowan (1976) further extends this argument of language-specific strategy use to conclude that only “to the extent the [two] languages are similar, transfer of reading strategies will be facilitated” (Alderson, 1998, p.10). So, according to his theory, for any two languages that are structurally similar, it would be expected that the good L1 reader would be superior to the poor L1 reader if both were to be assessed in their first language reading ability.

There are a number of linguists who seem to contradict the above theory however. Ulijn (1978), for example, has argued that the mere fact that two languages are structurally dissimilar should not pose a problem for second language learners in terms of their reading comprehension and their reading speed ability. In a study with Dutch-French bilinguals and native French adults Ulijn (1978) found that the two groups performed similarly in measures of text reading. The results of this study showed that the only significant differences found between the two groups of individuals were not due to insufficient grammatical knowledge, but to insufficient conceptual knowledge of the text (i.e. word meanings and specific subject knowledge).

In another study with Mexican-English university students Alderson, Bastien and Madrazo (1977) tried to control for subject knowledge by administering texts in the students’ study area in both languages (Spanish and English). They found that reading ability was better predicted by foreign/second language competence rather than reading ability in the first language suggesting that “a student’s knowledge of the foreign language is more important to the comprehension of foreign language texts than is reading ability in the first language” (cited in Alderson, 1998, p.13). More specifically, it was found that for comprehending conceptually easier texts in one’s second/additional language, foreign language experience was not so important. For understanding conceptually harder texts, however, the level of one’s second language experience does seem to play a more significant role (Alderson, 1998).

Yet, using a similar sample of Spanish-English students, Aron (1978) found only low correlations between L1 and L2 reading ability on two text reading tests assessing recall of details, understanding main ideas not explicitly stated in the text and ability to make inferences from text. It would be logical to interpret Aron's (1978) low correlations as inadequate language knowledge. Yet, Cziko (1978) and other researchers would argue that that the problem is slightly more complex and that the use of syntactic and semantic contextual constraints directly influence L1 and L2 language ability. Thus, less competent L2 students "are not able to use their good first-language reading strategies . . . because of their low level of competence" (Alderson, 1998, p.16).

It should be noted, however, that in all of the above mentioned studies reading ability in L1 and L2 was not accurately measured, thus making it impossible to draw direct comparisons of individuals' reading ability across the two languages.

Clarke (1979) tried to overcome this methodological concern by testing for any relationships between first (Spanish) and second (English) language reading ability within the same group of individuals and by selecting individuals having the same level of competence English as a foreign language reading. He hypothesised that good readers having the same level of second language proficiency would more efficiently utilise their good reading skills and would be better able to transfer their reading strategies compared to poor L1 and L2 readers. Indeed, scores in foreign language cloze tests indicated that good L1 readers performed significantly better than poor L1 readers, suggesting that overall "the good first language readers as a group are better foreign language readers than the poor first-language readers" (Alderson, 1998, p.17). Based on the results of this and other follow-up studies, Clarke (1979) concluded that "there is no direct transfer of ability or strategies across languages, and that foreign language competence is required before transfer can occur" (p.17).

1.3.6 The contribution of L1 and L2 proficiency in L2 reading and reading comprehension ability

It has been widely demonstrated that the transfer of L1 reading ability to L2 reading comprehension largely depends on readers' degree of L2 language proficiency

(Yamashita, 2002). The issue of mutual compensation between L1 reading ability and L2 language proficiency in L2 reading comprehension has been recently addressed by researchers (e.g. Yamashita, 2002). Two questions currently appear to emerge from the literature: Can high L1 reading ability compensate for low L2 language proficiency and can high L2 language proficiency compensate for low L1 reading ability in bilingual readers?

The relation between L1 and L2 reading has been further explained by two different hypotheses: the *linguistic interdependence hypothesis* and the *linguistic threshold hypothesis*. According to the first hypothesis, it is proposed that L1 reading ability transfers to L2 reading and that it would therefore be expected that a skilled L1 reader is also a good reader in his/her L2 language as well. According to the second hypothesis, however, there is a certain threshold level of competence that second language readers need to reach in their second/foreign language learning before they are able to read at a comparable level with native language readers. Yet, supporters of this theory (Cummins, 1979; 1991) have not clearly defined where this threshold lies as it depends on various factors such as the learner's level of cognitive development and learning demands.

In an attempt to explore the above relationship, Carrell (1991) measured the L1 and L2 reading abilities of two groups of students, native English speakers studying Spanish and native Spanish speakers studying English by administering reading comprehension tests in each language. He found that both L1 reading ability and L2 language proficiency made significant contributions to L2 reading ability. In the case of native English speakers, L2 language proficiency was a stronger predictor of L2 reading ability, while in the case of native Spanish speakers the stronger predictor was L1 reading ability. Such a finding could be attributable to the nature of second language learning (in the case of the ESL Spanish-English students) and foreign language learning (in the case of native Spanish students). Also, the English learners of Spanish had overall lower L2 proficiency than the ESL learners. It might therefore be possible that L2 proficiency is a more important predictor of L2 reading comprehension until a certain level of proficiency is attained, only after which L1 literacy becomes a more important predictor of reading comprehension.

It has further been suggested that as L2 learners' proficiency levels increase, the relative contribution of L1 reading ability increases too. Yamashita (2002) explains that "lower-level L2 readers are either not able to transfer their L1 reading ability (Perkins, Brutton and Pohlmann, 1989; Taillefer, 1996), or even if they do, the degree of transfer is smaller in comparison with higher-level learners (Brisbois, 1995; Lee and Shalleart, 1997)" (p.82).

Other researchers (e. g. Taillefer, 1996) in the area have further argued that specific components of L2 proficiency like vocabulary and grammar make different contributions to L2 reading ability and transfer. Coady (1997) investigated the role of vocabulary knowledge on L2 reading comprehension. He argued that L2 learners cannot read in a L2 at a level of comprehension sufficient to learn new words from context until they have gained a certain threshold of vocabulary in the second language. This threshold has been estimated to be in the range of 3,000 to 5,000 word families, or 5,000 to 8,000 lexical items. Before attaining this level, it will be impossible for L2 readers to comprehend with accuracy. This is a paradox: beginning language learners need to read to gain vocabulary, but they need to gain vocabulary to read! Coady (1997) suggests that special attention should be given to vocabulary learning until learners have reached the vocabulary threshold. He also suggests that when reading in a L2 top-down processing seems to be more effective—and better able to overcome the effects of limited vocabulary—if the student reads texts that are personally interesting and familiar. Bottom-up processing instruction in vocabulary and structures, on the other hand, could be effective if complemented with an emphasis on readers' interests and a match between text and background knowledge.

1.3.7 Bilinguals' mental lexicon and its role in L2 processing

A major focus on bilingual research during recent years has been on the use of bilinguals' *mental lexicon*. The topic under investigation was: are words stored together in one lexicon or two separate ones for each language? According to Schreuder and Weltens (1993) "the mental lexicon is a very important part of any model of language processing. It plays a central role because it provides a bridge between form and meaning. In the mental lexicon information from all different

linguistic levels is combined. Phonology, orthography, syntax, argument structure, morphology, and lexical semantics all appear to be important components in the entries of the mental lexicon” (p. 4).

There are two models that describe bilinguals’ memory representations. According to the *word-association model* L1 interferes with L2 at the lexical level through the means of cross-language word associations. According to the above theory, “access to concepts from L2 words is therefore mediated through the first language by activation of translation equivalents in L1” (Kroll, 1993, p. 66). According to the *concept mediation model*, however, each language has independent access to a common conceptual representation.

It has been argued that as L2 proficiency increases, there is a shift from word association to concept mediation, which suggests that L2 learners are developmentally ready to integrate meanings across languages. Interference from L1 gradually diminishes with the development of L2 expertise. Therefore, “second language learners rely on first language mediation until they are able to conceptually mediate the second language directly” (Kroll, 1993, p. 68).

1.3.8 Bilingualism and dyslexia: some identification and assessment problems

The study of dyslexia has mainly focused on monolingual individuals, while at the same time the study of bilingualism has so far focused on individuals without literacy difficulties. Further research is needed to explore possible links between these two areas so as to be able to understand “the impact that dyslexia has on language learning and the impact that multilingualism has on literacy learning” (Cline, 2000, p. 3).

There are indeed only a few studies within the existing reading literature that have investigated the relations between dyslexia and bilingualism. Attempts to find common points of reference have been problematic partly because of definition issues. Accurately defining who is a ‘bilingual’ and who is ‘dyslexic’ (or even whether someone is both a dyslexic and a bilingual for that matter) is further essential for sampling purposes, that is for accurately assigning the right individuals to control and experimental groups.

One clear obstacle in undertaking this kind of research is that within the student population bilingual individuals who have reading problems are hugely under-represented. They are only a very small percent of the total student population within mainstream schools or universities (Deponio et al., 2000).

Another problem is that of identifying dyslexia by using IQ scores as a diagnostic tool in the process of assessment. IQ tests have long been accused for not culturally specific (culturally biased); it would therefore be dangerous to use them as an exclusionary criterion for dyslexia given that bilingual learners may not have acquired adequate language proficiency or adequate cognitive skills to score high in an IQ test originally designed for monolingual populations and administered in a foreign language. Yet, at the opposite end, (e.g. Gersten and Woodward, 1994; Cline and Frederickson, 1999) “avoidance of IQ testing with bilingual pupils will also lead to under-identification” of these same individuals (Cline, 2000, p. 5).

1.3.9 The use of phonological measures to differentiate between dyslexic, bilingual and monolingual individuals

Everatt et al (2000) found that measures that reliably differentiate between dyslexic English-Sylheti (7-8 year-old) bilingual children and their matched monolingual controls are phonological processing (non-word reading, rhyme, alliteration and sound discrimination) and rapid naming. Measures that reliably differentiate between bilingual and monolingual control children, on the other hand, include non-word reading, rhyme, reciting months of the year, repeating novel sequences of unknown or non-linguistic auditory information and recognizing previously seen shapes.

Overall, it was found that tasks involving sound-based information are better able to differentiate those with poor literacy skills and those without, whereas tasks requiring visual and motor sequencing type of skills do not (Everatt, Smythe, Adams, and Ocampo, 2000).

Whether the same measures can reliably distinguish individuals with and without literacy difficulties as well between bilingual, monolingual, and dyslexic groups of adults is still uncertain. It also remains unclear whether such measures are able to differentiate between groups of individuals in different orthographies (i.e. other than

English). Such research would not only have to take account of factors like language capability and general cognitive ability, but also other socio-linguistic and cultural factors (Everatt et al., 2000). The present research will attempt to address the above question.

1.3.10 Issues in the identification and assessment of dyslexic, bilingual and dyslexic bilingual individuals

There are certain issues in the assessment process of the dyslexic bilingual pupil, such as the use of culturally inappropriate reading material, second language development or lack of maintenance of the first language that seem to be of importance. Such factors also need to be carefully examined when assessing dyslexia particularly in the early stages of second language acquisition.

The issue of under-representation of ESL students with dyslexia has also been frequently reported in the learning difficulties literature (Deponio et al., 2000). Researchers in the area point out that “it is likely that the identification of dyslexia in bilingual pupils is a neglected area because of the often mistaken assumption that the primary difficulty is second language learning and not dyslexia” (Deponio et al., 2000, p.30). Furthermore, appropriate assessment procedures for identification of dyslexia amongst English and Greek adult bilinguals are scarce (e.g. Sutherland et al’s, 1998 assessment and support materials for English adults and young people with EAL which include diagnostic interviews, reports and support strategies).

1.3.11 Picture naming ability in bilinguals

Picture naming is a commonly used task to assess bilinguals’ mental lexicon that requires concept mediation (Smith and Magee, 1980) since it requires access to the concept before activation of the specific L2 lexical entry for production. In order to name a picture it is first necessary to access that picture’s meaning before accessing its name. Picture naming is a semantic memory task that can provide us with information about the process involved in accessing the bilingual lexicon (Snodgrass, 1993). It has further been hypothesised that since producing a word in L2 takes bilinguals considerably longer than it does to produce a word in their L1, picture naming also takes longer in L2 than in L1. Input language must first be encoded for output language to be produced, which accounts for the longer time that bilinguals

take in this task. This gap from encoding to production becomes less apparent with L2 expertise however (Snodgrass, 1993).

The picture naming task used in this study included pictures that were semantically related (door, table chair, bow, hat). It has been argued that “category structure plays an important role in picture naming. This means that naming latency is sensitive not only to the characteristics of the stimulus itself, but also to characteristics of the relationship of that stimulus to other stimuli which are semantically related” (Snodgrass, 1993, p.109). It was hypothesised that using semantically related pictures would facilitate rapid naming of the stimulus pictures.

It has further been found that in lexical decision and homograph recognition tasks bilinguals’ lexical access is not always language-selective, both their lexicons are being activated when they are required to enter a bilingual language mode (Grosjean, 1998).

There is also evidence to suggest that naming speed is required for the development of orthographic skills (Wolf and Bowers, 1999). In particular, cross-linguistic research in the area supports that the naming speed deficit appears to differentiate between readers of more regular orthographies than English (e.g. German, Dutch and Spanish), which suggests that it is equally predictive in transparent languages such as Greek that present fewer phonological-based demands. Such evidence would bring us to the conclusion that “when phonological skills play a reduced role in the more transparent orthographies, naming-speed performance becomes an even stronger, more important diagnostic indicator and predictor of reading performance” (Wolf and O’Brien, 2001, p. 5).

1.3.12 Rapid naming and the development of lexical fluency in L2: the process of lexical access for L1 and L2 rapid naming performance

The way adult L2 readers acquire lexical representations for L2 and the way in which they then connect them to existing representations within the cognitive network (or ‘mental lexicon’) for words and their meanings in L1 is a key issue for the development of lexical fluency in L2. It has been typically measured through

production tasks like simple word or picture naming that require cognitive and conceptual processing. Naturally, the more fluent a L2 learner, the more easily they can access meaning directly for L2 words. L2 readers' performance in rapid naming becomes faster with increasing L2 proficiency as they manage to acquire a richer lexical network for words in L2, which is said to account for their increasing speed and accuracy (Kroll, Michael, Tokowicz, and Dufour, 2002). Less proficient L2 learners, on the other hand, seem to depend more on external cues to language when performing naming tasks.

The process of naming pictures or words in a L2 is often facilitated in cases where there is L1 and L2 word similarity or when there is absence of unknown L2 vocabulary. Cross-language similarity of lexical features also seems to facilitate naming performance when there is a straightforward correspondence between orthography and phonology between the two languages (Kroll et al., 2002).

As far as digit naming is concerned, Meuter and Allport (1999) found that "when bilinguals had to switch between languages in naming numbers, there were larger switch costs into L1 than into L2" (p. 165). They explain that L1, which is more active, becomes inhibited at the cost of L2 production, so that when there is a need to switch from one language to the other L2 readers can lower their actual processing speed (Kroll et al., 2002).

1.3.13 Relations between rapid naming and reading

Slow naming of common symbols and poor phonemic awareness have both been found to contribute somewhat independently to poor reading skills. However, the route through which the processes associated with performance on tests of rapid naming affect reading is not well understood. In an attempt to answer the above question, Bowers, Sunseth and Golden (1999) administered a test of word recognition using different types of letter strings. In study 1, grade 2 and grade 3 children were assigned to no-deficit, single-deficit, and double-deficit groups on the basis of their cut-off scores on tests of rapid naming and phonemic awareness. Of special interest was the finding that, in grade 3, rapid naming skill was the only predictor of non-word string recognition and interacted with phonemic awareness in predicting the report of letters in pseudo-word strings. In Study 2, third grade children were selected based on deficits in naming speed (naming speed deficit [NSD] group) or in phonemic

awareness (phonological deficit [PD] group). As in Study 1, NSD children were less accurate than PD children in reporting letters of non-word strings. They were more accurate but slower readers and demonstrated less knowledge of orthographic patterns. Such results provide some support for the hypothesis that the failure to sufficiently automatise letter recognition interferes with letter string processing and growth of orthographic knowledge.

Yet, the route by which the ability to name symbols quickly affects reading achievement has been difficult to establish. There is ample evidence that slow naming speed characterises children with reading disabilities (e.g., Denckla and Rudel, 1976; Wolf, 1991), but it still remains unresolved whether the same is true for adults, although there is some research to support that naming speed deficits continue to be a persisting characteristic of reading impaired adults even at later stages of reading development (Felton, Naylor and Wood, 1990). The combination of a deficit in naming speed with the widely acknowledged deficit in sensitivity to the phonemes in oral language is further associated with more severe reading problems (Bowers and Wolf, 1993). While the poorest readers often show deficits in naming speed for common objects and colors as well as symbols, letter and number names are more reliable markers of the speed deficit by Grade 2 (Felton, Wood, Brown and Campbell, 1987). Further research into the different processes involved in reading is necessary, however, in order to identify where the areas of difficulties in reading lie and how such difficulties can impact on individuals' literacy and general language skills.

1.4 Reading

Reading is perhaps the most important cornerstone of literacy in almost every part of the modern world. Yet, not everyone seems able to master the art of reading. There is no wonder why there has been a vast amount of research into reading skills and processes over the last century.

1.4.1 Towards a definition of reading

According to the Reading Excellence Act's (REA) definition of reading, the term '*reading*' means a complex system of deriving meaning from print that requires all of the following: the skills and knowledge to understand how phonemes or speech sounds are connected to print, the ability to decode unfamiliar words, the ability to read fluently, sufficient background information and vocabulary to foster reading comprehension, the development of appropriate active strategies to construct meaning from print and the development and maintenance of a motivation to read.

(Section 2252 (4) Reading Excellence Act. (1998), U.S. Department of Education, Office of Special Education Programs) www.ed.gov/offices/OESE/REA/reading_act.pdf, 2003).

1.4.2 The process of reading

How does the reading process take place in normal readers? Reading is a complex process that follows a specific pattern or sequence of events that are taking place from decoding to recognition to comprehension. These are:

1. Control of eye movements. This involves a fixation on a particular point in the text followed by a saccade (movement into the next point of text) and occasional regressions or return sweeps (going back to the text usually when something is not clear to the reader). This process is repeated and is controlled by the eye's muscles, which essentially control the different movements, i.e. the fixations and saccades.
2. Word recognition. Once the reader fixates to a word, the word must become meaningful to the reader; the reader has to put together (meaningfully combine) the series of letters to form a meaningful and recognizable unit by successfully

accessing the right word through the mental lexicon and then deciding what that given word means. After selection of the appropriate meaning for that particular word, the reader then has to combine the different words together, determine their syntactic function, the grammatical and syntactic relations by mentally breaking the sentence into fragments. The reader must then try to make sense of the sentence often by drawing inference/s from past knowledge and relating the meaning of the sentence to this of the other sentences within the text to integrate the information and potentially use and/or learn it (Gough, Hoover and Peterson, 1996).

Reading is not only a complicated cognitive process but also one that is extremely difficult to define and capture theoretically. A comprehensive theory of reading must deal with a wide range of issues and account for a wide range of behaviors and capabilities. These are:

1. *Processing words and sentences*: The starting point for reading is the input of the words in a sentence, word-by-word and then sentence-by-sentence. Before anything can be understood about any given text, this needs to be processed. Much research in language processing is concerned with how word meanings are looked up, how ambiguous words are disambiguated, how the meanings of the words in a sentence are combined into a meaning for the sentence as a whole, what the role of various punctuation is, what the tense of the sentence is, when and how a reader might go back and re-read some text, and so on. The important skill that readers need to acquire is *sentence processing*, although it is often necessary to deal with sentence fragments as well.

2. *Drawing inferences*: One of the most important tasks the reader must carry out while reading is to be able to determine hidden meanings and make explicit what was left implicit in the text. In order to achieve this, the reader must draw on the context provided by the text that has been read so far, by the external situation that the reader is in, and by the overarching task that the reader is carrying out. The reader must also draw on background knowledge about the world in general and relate this to any past experiences. Much of the research in this area of reading is concerned with *knowledge representation*—how contextual and background knowledge is encoded, with *memory*—how this knowledge is organized such that it can be retrieved at the appropriate moment using the available cues, and with

abduction—how background knowledge and current context can be brought together to enable the reader to draw plausible inferences from the material in the text.

3. *Dealing with novel words* or the metaphorical reuse of words in new contexts to the description of unfamiliar or novel concepts through the use of language.

4. *Controlling the process*: During the reading process, readers are also concerned with other goals, activities, and occurrences in the world around them, which demand attention. There is less research into this aspect of reading, but some studies have been concerned with *situated reading*—how the reading task interacts with, and is affected by, the larger context in which it is carried out; *focus of attention*—how a reader pays attention on different aspects of the text, switching dynamically between skimming and in-depth processing, and *meta-reasoning*—reasoning about the reading process itself (Ram and Moorman, 1999).

1.4.3 Theoretical models of reading

Top-down and bottom up text processing skills in reading comprehension

Top-down and bottom-up theories have dominated the reading research literature during the last years (Stanovich, 1980). *Top-down (knowledge-driven)* theories of reading highlight the importance of a reader's knowledge, expectations, hypothesis testing, and active text modeling and view the reader as cognitively active. According to this theory, the decoding of text serves a comparatively minor role, for instance, to confirm the reader's expectations. These accounts underscore the importance of the metacognitive control a reader has over reading (Rayner and Pollatsek, 1989). They further support that it is the higher levels of processing (i.e. comprehending and constructing the meaning of what is being seen, read or heard) that determine the processing of words and letters. Readers, according to this view, do not read every word, but rather scan the text making hypotheses or guesses about where the next word is and guess the meaning of that word or phrase primarily based on previous knowledge.

Top-down models (Goodman, 1973) suggest that good readers will use the overall context in which a word appears for recognising or even guessing that word. There is evidence, however, which suggests that it is actually poor readers who use context for

guessing words, and that in fact good readers are distinguished by quick automatic recognition of words (Stanovitch, 1980). It has been found that both first and second-language learners often use top-down strategies to compensate for their weak language skills (Amos, 1997).

In contrast, *bottom-up (data-driven)* models emphasise the importance of text-specific elements. Such accounts assert that reading involves a hierarchical arrangement of reading sub-components, lower-level processes work towards transmitting information to sub-components at higher levels (Rayner and Pollatsek, 1989). The reader is seen as a more passive recipient of text information, responding to the text as it is encountered, whereas the control of reading resides in the text itself (LaBerge and Samuels, 1974).

Bottom-up models support the idea that comprehension proceeds linearly from the isolated units (i.e. letters) to higher levels of processing. Linguistic information or meaning is processed beginning with the smallest units of language (i.e. letters and words) and ending with larger units (i.e. sentences). Thus, the reader will perceive every letter, organise the perceived letters into words, and then organise the words into phrases, clauses, and sentences. All letters and words need to be processed before the reader is able to construct meaning. Reading largely depends on the visual printed stimulus that needs to be carefully processed. If that wasn't the case, then reading speed and accuracy would not be affected if words were unclear in a given text (Amos, 1997).

More recently, current models of the reading process have focused on the interaction of top-down language and background knowledge with bottom-up text processing. Interactive models indicate successful readers need to decode and interpret simultaneously. For ESL students, this would indicate that if they have deficiencies in either component -- decoding skills or with language or background knowledge -- they will have difficulties reading in English.

Interactive models have tried to incorporate elements of both top-down and bottom-up theories (Stanovich, 1980; Rayner and Pollatsek, 1989). According to the interactionist viewpoint, knowledge-driven and data-driven aspects normally interact in a skilled reader. Although interactive accounts capture the complexity of reading better than strictly top-down and bottom-up views, they fail to clarify how sub-component inefficiencies can affect comprehension under various task conditions. Assuming that attention can be reallocated to assist in decoding, does this reallocation impair comprehension, or do readers suspend processing to resolve a problem on-line and resume from where they left off? The answer is likely to depend on the type of the reading task.

1.4.4 Explaining reading comprehension problems: A simple view of reading

The '*Simple View of Reading*' (Gough and Tunmer, 1986) is a theory that helps explain reading comprehension deficits. It postulates that dyslexics' weak decoding skills could interfere with their ability to comprehend text and could affect the accuracy and speed of information processing necessary during comprehension. The '*Stage Theory of Reading Development*' (Chall, 1996) on the other hand, maintains that phonological/decoding accuracy and fluency are essential skills in reading comprehension ability. When decoding is not an automatic process for individuals with reading difficulties, the processing resources become very limited and inefficient for adequate comprehension. As Swanson and Alexander (1997) explain, what happens in this case is that the processing required for word recognition will place an additional demand on working memory functions and will eventually restrict the attentional resources necessary for comprehending text.

1.4.5 Reading comprehension and dyslexia

Recently Zabell (2003) investigated the extent to which measures of phonological and orthographic processing, single word reading, decoding, and vocabulary measures could predict individual differences in spelling ability of adult dyslexic and non-dyslexic students. It was found that for the dyslexic group reading comprehension was significantly highly correlated with measures of single-word reading, vocabulary, spoonerisms (speed), orthographic choice task (accuracy and speed), and digit

symbol, with word recognition and processing speed being the strongest predictors. For the non-dyslexic group, reading comprehension was highly and significantly correlated with measures of vocabulary and orthographic choice tasks (accuracy) and less so with the other measures with vocabulary and orthographic processing being the strongest predictors.

Gottardo et al (1997) found that vocabulary was the best predictor of reading ability amongst adult good and poor readers assessed on the WRAT (Wide Range Achievement Test; Jastak and Jastak) in their study. These results are also supported by Hanley (1997) who found that vocabulary was also the single best predictor of singly word reading accounting for 44% of the variance for her group of adult dyslexic students assessed on the NART (National Reading Test; Nelson, 1980) test with Spoonerisms and vocabulary together accounting for 53% of the variance in reading ability. It could be argued that this high relationship between vocabulary and reading is indicative of the fact that “individuals with good vocabularies were potentially better equipped to compensate for their decoding/reading difficulties” (Zabell, 2003, p. 235).

Does this mean that dyslexics’ poor reading comprehension and spelling skills are due to their poor decoding ability? Given the positive relationship between the two variables, it could be argued that poor decoding skills can indeed impact on word recognition skills, which can in turn influence reading comprehension and spelling ability. Simmons and Singleton (2001) and Long, Oppy and Seely (1997) have found a relationship between reading comprehension and inferential processing with working memory deficits being the main factor influencing readers’ inferential processing skills. It appears that “the ability to connect information from different parts of the text and to make subject related inferences, requires the temporary storage and concurrent processing of information in working memory” (Zabell, 2003, p.238). As processing speed increases so does performance on reading comprehension, suggesting a close positive relationship between the two variables.

1.4.6 The two components of reading: decoding and comprehension

Decoding and reading comprehension are two literacy components that are not directly interrelated. Both, however, are essential for reading for successful reading.

Reading comprehension seems to be dependent on successful decoding of words within the text, although there is evidence to suggest that this is not always the case and that these two processes can be dissociated- individuals with literacy difficulties have often been found to present problems in one of these two areas of reading. Good decoders are not always good comprehenders of text and vice versa although there is mixed evidence for this within the reading literature (Simmons and Singleton, 2000).

To ascertain the role and the relative contribution of decoding and reading comprehension in reading ability, Hoover and Gough (1990) assessed 254 bilingual children (grades 1-4) on measures of decoding (pseudo-word naming), listening comprehension (listening to a story and answering questions about the story), and reading skills. Analysis of the results revealed very strong correlations between the three variables investigated. It was found that reading ability in this study was the product of both decoding and comprehension skills. Moreover, children who were good decoders were also good in listening comprehension and vice versa, whereas children who were weak decoders performed poorly in listening comprehension. When these data were compared with monolingual children's performance on the three tasks, the researchers found that the extent to which the three variables were related to each other depended on the grade level (Gough, Hoover and Peterson, 1996). It was concluded that if poor readers are good at decoding, then they should be expected to be poor at comprehension. If on the other hand, poor readers are good comprehenders, then they should be expected to be poor at decoding.

1.4.7 The role of background knowledge in decoding and comprehension

Evidence suggests that it is comprehension and not decoding that is mostly influenced by the reader's prior knowledge or specific subject knowledge (Peterson, 1996). This would suggest that comprehension is subject-specific and decoding is a more general literacy ability that readers manage to acquire at some point of their literacy development.

Such issues are particularly important to bear in mind when assessing individuals' decoding and comprehension and decoding abilities or their literacy skills in whole. If we are to provide reliable assessment for individuals with literacy problems, then we ought to "determine whether the disability results from a weakness in decoding, a

weakness in comprehension, or (as is most likely) weaknesses in both, for the two disabilities call for very different types of remediation” (Gough, Hoover and Peterson, 1996, p. 12). Good readers are good decoders they have developed automaticity and word recognition skills usually through exposure to print. Focusing on the development of automaticity and word recognition skills should therefore help ESL students become good decoders. This can be achieved by systematic exposure to large quantities of print to enhance automaticity of word recognition skills. Other reading strategies that ESL instruction could focus on include: predicting, guessing words from context, scanning and skimming through text (Schneider, Elke, and Ganschow, 2000).

1.4.8 Predictors of reading comprehension ability in adult dyslexics and non-dyslexics: evidence from recent research

Zabell (2003) found that *vocabulary* predicted reading comprehension and that both of these skills are influenced by verbal ability. As she explains: “the ability to make inferences, to integrate sentences and information contained in different parts of the text, and to induce word meanings are skills possessed by the verbally competent and are essential to the comprehension of written material” (p.242). Such findings are supported by earlier research by Stanovich et al (1996) and Nation and Snowling (1998).

Zambell (2003) further found that *orthographic processing skills* also predicted reading comprehension ability amongst adult non-dyslexics. Such a finding is also consistent with research by Stanovich and West (1989) and Stanovich et al. (1996) who supported the idea that orthographic processing is a skill developed through exposure to print; the more reading experienced one is, the more automatic word recognition skills they have acquired and the more competent they therefore become in text processing. Thus, orthographic processing skills facilitate reading comprehension through automatic word recognition attained by means of having acquired a good sight vocabulary.

Conversely, because of the fact that dyslexics read less they undoubtedly limit their opportunities to acquire new vocabulary. This finding is often referred to in the reading literature as the ‘*matthew effect*’ which suggests that there is a reciprocal

relationship between reading comprehension and exposure to print: those with good verbal skills have more reading experience. Exposure to print in turn aids the development of comprehension skills, which in turn further facilitates the development of verbal ability (Zabell, p.242).

Zabell (2003) reported that dyslexics' performance on the orthographic choice task (OCT) was found to be predictive of their spelling ability. The performance of the adult dyslexic group in this study was found to be equally impaired at phonological and orthographic processing measures in which they were assessed: there was no evidence of the hypothesis that dyslexics are better at phonological processing tasks than they are at orthographic processing tasks and vice versa. Does this provide evidence for the fact that amongst adult dyslexics the two processes are interrelated and that phonological processing deficits are after all independent from orthographic processing deficits or vice versa?

1.4.9 Theoretical models of reading

The schema theory: the role of schemata in L1 and L2 reading

Schemata are knowledge structures. They are organized hierarchically, such that larger, more general categories comprise smaller, more specific ones. For example, under the semantic category of 'sports' one would find the smaller categories of 'tennis', 'football', 'athlete', 'competition' and under those categories there are other, more specific categories as well. When processing text, all information must be taken into account. For a schema to become activated, the reader must use the incoming data to locate possible specifics in the schema. This in turn activates the top-down processing mechanism, which searches for the appropriate schema to account for all the details in the input (Adams and Collins, 1985).

Schema processing can be blocked in two ways during L2 reading. Firstly, because it is data-limited, it depends on the reader's ability to receive input data. Therefore, difficulties that L2 readers often present such as a lack of vocabulary knowledge can often impede the process. Secondly, because the processing system is resource-limited, it cannot use more resources than those available in the working memory. So, if both the vocabulary and the structure of the text, for example, are unfamiliar, the

reader will be unable to allocate sufficient working memory resources to top-down and bottom-up processing. Normal reading will therefore be interrupted because the processing demands involved in reading exceed the learner's resources (Singer and Ruddel, 1985).

Adams and Collins (1985) used a short text to illustrate how a schema is invoked at different levels of comprehension by a reader. They argued that a schema plays an important role, to begin with, at the *orthographic level*, that is, during orthographic processing, where it is invoked to process words more quickly and efficiently. Skilled English readers, for instance, do not need to look at each letter to process a word; rather, they apply their schema of English orthography. A similar phenomenon occurs at the level of syntactic processing, in that the L2 learner invokes background knowledge of English sentence structures to more quickly process the syntactic relationships within sentences. At the *semantic level*, the L2 reader tries to fill in the details that are not in the text. For example, in a text beginning with the following statement 'a poor man went to a large house', the reader must invoke her knowledge of both "poor men" (i.e. men that don't have wealth) and "large house" (i.e. house that costs a lot of money) schemata to infer that the house does not belong to the poor man. Semantic processing of this sort must occur throughout the text for information to be successfully comprehended. Finally, a schema of the nature of texts is also being applied at the *interpretive level* for the reader to understand the rationale of the story in the text lying beyond the surface meaning (Adams and Collins, 1985).

To conclude, the schema theory not only applies to meaning-based concepts, but to all knowledge structures. Application of existing schemata in reading requires background knowledge of concepts as well as background knowledge of the language and orthographic systems.

Future research could investigate the techniques for helping L2 adult learners to apply schemata at any level of processing either phonological, semantic, syntactic or interpretational. The impact and role of culture and different language systems in applying schemata is another area that could benefit from further research.

1.4.10 Reading problems in different languages: two different viewpoints

Within the reading literature there are two dominant theoretical perspectives that address the problem of word reading deficits in different orthographies. The first is the *Central Processing or Universalistic* theory according to which the development of word-based processes in different languages is shaped by common underlying cognitive and linguistic processes such as verbal memory, phonological awareness, rapid naming etc which predict reading ability no matter which language or orthography. The above viewpoint suggests that there is a biological basis for deficits in reading. The second is the *Script-dependent* theory (Frost, 1994; Kats and Frost, 1992), according to which it is the orthographic peculiarities that influence word-based reading processes in different languages. Although these two viewpoints present alternative explanations about the nature of reading problems faced by individuals from different language backgrounds, it could be argued that they are not entirely different given the converging evidence underlying the basic principles behind the two theories.

1.4.11 Reading difficulties and second language acquisition

Reading difficulties are a common source of problem in the process of second language learning for many individuals. Particularly, difficulties that bicultural readers present are often slow reading rate and lower comprehension ability.

Research suggests that bilingual individuals take considerably longer to read text in their second language than they would in their first language and that they have difficulty understanding text in a second language despite adequate grammatical and syntactic knowledge as well as vocabulary (Alderson and Urquhart, 1984). It would seem, however, that poor reading comprehension in a second language is not solely dependent on the above factors as it is a complex issue that may have other causes.

While the fact that reading in a second language is a difficult task for most second language learners has been well established in the literature, it is still unclear whether this difficulty stems from problems in learning the language or problems in reading. Is it, as Alderson (1998) puts it, 'a reading problem or a language problem?'

It has long been proposed that second language reading problems may occur because of problems that those individuals present in their native language in the first place.

In line with this argument, Jolly (1978) proposed that “reading in a foreign language requires ‘the transference of old skills, not the learning of new ones’ and that therefore those “who fail to read adequately in the foreign language fail because they either do not possess the ‘old skills’, or because they have failed to transfer them” (Alderson, 1998, p.2). Alternatively, it has further been proposed that poor reading in a foreign language may result either from poor use of a reading strategy in that language or use of different reading strategies from those employed while reading in one’s native language (Alderson, 1998).

Such an argument would also lead to the simple conclusion that second language reading is a reading problem rather than a language problem (Coady, 1979). Theorists (e.g. Goodman, 1973; Rigg, 1977) in this area who adopt the universalistic perspective have argued that the reading process is essentially the same for all languages. Critics of the above view (e.g. Clarke, 1979) argue, however, that “if the reading process is the same or very similar in all languages, then one would expect reading ability to transfer across languages” and “good native speakers to be good second language readers” as well (Clarke, 1979, cited in Alderson, 1998, p.3). With reference to the transfer of ineffective strategies from the first language to the second, the *parallel processing hypothesis* has also been proposed. Proponents of this hypothesis argue that L2 readers employ separate syntactic processors for dealing with each language. At early stages of second language learning, readers might transfer the language-specific processing strategies of their first language to reading in their second language. In areas where the languages differ syntactically, they will have poor reading comprehension. After a certain level of language learning has been attained, the readers gain syntactic processing strategies specific to the second language.

While some studies seem to support this hypothesis, there is also contrasting evidence from research which shows that even at low levels of language proficiency L2 readers are able to apply second language syntactic constraints to the interpretation of texts, refuting the parallel processing hypothesis (Alderson, 1998). Proponents of this opposite view take on a somewhat different perspective. Yorio (1971), for example, argues that second language reading difficulties are mainly the result of four key factors: inadequate knowledge of the second language, interference from the

first/native language, ability to identify and remember the correct cues and ability to make the right associations between the different cues within the text. Such views, however, are not backed by empirical evidence (Alderson, 1998).

There is a considerable amount of data gathered from researchers who have tested these two different hypotheses. Such evidence comes from studies with bilingual populations in which subjects' transference skills were assessed in terms of their reading ability. Evidence for the first hypothesis has been obtained in studies with Mexican-Indian children who were first taught their native language and then their second language (Spanish) showed improved second language reading ability when compared against children who were first taught in the second language, which would suggest a transference effect across the two languages. Studies with English- French Canadian populations, however, present contrasting results. Barik and Swain (1975), for example, found that children who were first taught to read in a second language (French) performed as well as the monolingual controls, in L2 reading tasks, which would suggest that "they were able to transfer the strategies learned in the second language back into their first language" (Alderson, 1998, p. 8). Yet, other studies (Cowan and Sarmad, 1976) present evidence that bilingual English-Farsi children performed significantly worse in both their first and second languages when compared against their monolingual controls as they were unable to achieve transfer of their reading ability in one language or the other (Alderson, 1998).

Are such conflicting results due to language differences or is it that each bilingual case is essentially different so it is hard to derive to 'universal' conclusions as Cummins (1976) would argue? And if we were to accept the findings of these two studies then could we assume that transfer of reading ability works both ways (i.e. from first to second and from second to first)? Cummins (1979) asserts that first language proficiency certainly plays a key role in second language proficiency (cognitive and academic) and that those who are already good readers in their first language are more likely to become proficient readers in the second/foreign language (Alderson, 1998). This assertion was tested in an English-French bilingual study (Carey and Cummins, 1979) where the researchers found strong positive correlations between participants' reading ability both in the first and second language as measured in the *Canadian Test of Basic Reading Skills* and in cloze type tests,

although there was contrasting evidence to disprove any association between bilinguals' reading achievement in either their first or second language (e. g. Lapkin and Swain, 1977) when compared against monolingual controls. Such a claim would suggest that “the same ability underlies both languages” and that “a reading ability learned in the second language transfers to the first language and that there is no evidence that bilingual reading behaviour is different in kind from native-speaker reading behaviour” (Alderson, 1998 p.9).

According to different line of evidence, it is the kind of strategies that L2 readers use when reading in their second language that essentially determine their level of reading ability and transference. More specifically, Cowan (1976) argues that the specific “strategies which readers employ to process text must be to some extent language-specific” (Alderson, 1998, p. 10). When a reader is faced with different syntactic and grammatical structures different strategies must be employed. Cowan (1976) further extends this argument of language-specific strategy use to conclude that only “to the extent the [two] languages are similar, transfer of reading strategies will be facilitated” (Alderson, 1998, p.10). So, according to his theory, for any two languages that are structurally similar, for example, in the case of Spanish-English or French-English bilinguals, it would be expected that the good reader in the first language would be better than the poor first language reader when both are tested in their foreign language reading ability. Yet, one aspect that the theory fails to account for is the actual level of foreign language competence (proficiency) required for successful reading to take place.

In fact there is evidence that contradicts the above theory. Ulijn (1978), for example, argues that the mere fact that two languages are structurally dissimilar does not pose a problem for second language learners in terms of their reading comprehension ability and their reading speed. In a study with Dutch-French bilingual and native French adult individuals, Ulijn (1978) found that the two groups performed similarly in all measures of text reading. It was reported that the only significant differences found were not due to insufficient grammatical knowledge, but to insufficient conceptual knowledge of the text (i.e. word meanings and specific subject knowledge). In another study with Mexican-English university students Alderson, Bastien and Madrazo (1977) tried to control for subject knowledge by administering texts in the

students' study area in both languages (Spanish and English). They found that reading ability was better predicted by foreign/second language competence rather than reading ability in the first language suggesting that "a student's knowledge of the foreign language is more important to the comprehension of foreign language texts than is reading ability in the first language" (Alderson, 1998, p.13). More particularly, it was found that for comprehending easier texts in one's second/additional language, foreign language experience was not so important. For understanding conceptually harder texts, however, the level of one's second language experience seems to play a more significant role (Alderson, 1998).

Using a similar sample of Spanish-English students Aron (1978), on the other hand, found only low correlations between first and second language reading ability on two reading tests assessing recall of details, understanding main ideas not explicitly stated in the text and ability to make inferences from text. It would be logical to interpret Aron's (1978) low correlations as inadequate language knowledge. Yet, Cziko (1978) and other researchers argue that the problem is slightly more complex, suggesting that the use of syntactic and semantic contextual constraints directly influence first and second language ability. Thus, less competent foreign language students "are not able to use their good first-language reading strategies . . . because of their low level of competence" (Alderson, 1998, p.16).

It should be noted, however, that in all of the above mentioned studies reading ability in the first and second language was not accurately measured, thus making it impossible to make direct comparisons of individuals' reading ability across the two languages.

Clarke (1979) tried to overcome this methodological concern by testing for any relationships between first (Spanish) and second (English) language reading ability within individuals and by selecting individuals with the same level of English as a foreign language. It was hypothesised that good readers having the same level of second language proficiency would utilise their good reading skills and be better able to transfer their reading strategies compared to poor first and second language readers. Indeed, scores in foreign language cloze tests indicated that good first language readers performed significantly better than poor first language readers, suggesting that

overall “the good first language readers as a group are better foreign language readers than the poor first-language readers” (Alderson, 1998, p.17). Based on the results of this and other follow-up studies Clarke (1979) concluded that “there is no direct transfer of ability or strategies across languages, and that foreign language competence is required before transfer can occur” (p.17).

Returning to the original question posed, namely is it ‘a language problem or a reading problem’, no definite answer has been provided. Most of the evidence, however, seems to indicate that it is a language problem at least for low levels of L2 acquisition, although it remains unclear whether the same holds for individuals with high levels of L2 acquisition.

1.4.12 The role of L1 and L2 ability in L2 reading comprehension

It has been widely demonstrated that the transfer of L1 reading ability to L2 reading comprehension largely depends on readers’ degree of L2 language proficiency (Yamashita, 2002). The issue of mutual compensation between L1 reading ability and L2 language proficiency in L2 reading comprehension has been recently addressed by researchers (e.g. Yamashita, 2002). Two common questions currently under investigation are whether high L1 reading ability can compensate for low L2 language proficiency and whether high L2 language proficiency can compensate for low L1 reading ability in readers with different ability backgrounds.

The relation between L1 and L2 reading has been explained through two different hypotheses: the *linguistic interdependence hypothesis* and the *linguistic threshold hypothesis*. According to the first hypothesis, it is proposed that L1 reading ability transfers to L2 reading and that we would therefore expect a skilled L1 reader to read well in his/her L2 language as well. According to the second hypothesis, however, there is a certain threshold level of competence that second language readers need to reach in their second/foreign language learning before they are able to read at a comparable level with native language readers. Yet, supporters of this theory (Cummins, 1979; 1991) have not clearly defined where this threshold lies as it depends on various factors such as the learner’s level of cognitive development and learning demands.

In an attempt to explore the above relationship, Carrell (1991) measured the L1 and L2 reading abilities of two groups of students, native English speakers studying Spanish and native Spanish speakers studying English by administering reading comprehension tests in each language. He found that both L1 reading ability and L2 language proficiency as predictors made significant contributions to L2 reading ability, providing support for Alderson's (1984) conclusions. In the case of native English speakers L2 language proficiency was a stronger predictor, while in the case of native Spanish speakers it was L1 reading ability. Such a finding could be attributable to the nature of second language learning (in the case of the ESL participants) and foreign language learning (in the case of the students of Spanish). Also, the L1 English learners of Spanish had overall lower second language proficiency than the ESL learners. It is possible that second language proficiency is an important predictor of second language reading comprehension until a certain level of proficiency is attained, after which first language literacy becomes a more important predictor of comprehension.

Even more, it has further been suggested that as L2 learners' proficiency levels increase, the relative contribution of L1 reading ability increases too. Yamashita (2002) explains that "lower-level L2 readers are either not able to transfer their L1 reading ability (Perkins et al, 1989; Taillefer, 1996), or even if they do, the degree of transfer is smaller in comparison with higher-level learners (Brisbois, 1995; Lee and Shalleart, 1997)." (p.82). Other researchers (Taillefer, 1996) in the area have argued that specific components of L2 proficiency like vocabulary and grammar make different contributions to L2 reading ability and transference. In examining the effect of different reading components in reading ability Stanovich (1980) concluded that if one reading component is weak in a reader (for example, word recognition skills) another reading component may compensate for that matter (for example, use of contextual information). Compensatory mechanisms have been found to work differently at different levels of reading in poor readers, yet as a general rule, stronger components tend to compensate for weaker ones. Future investigation into the interaction and compensation of various components of L2 reading comprehension may provide a clearer picture towards our understanding of the relationship between L1 and L2 comprehension in L2 readers.

To conclude, it would seem that the language versus reading problem in foreign/second language reading difficulties remains an ongoing debate. Although there is stronger evidence for the language problem at least for low levels of foreign language competence, the answer lies somewhere in between. Certainly, more investigation into the area of first and foreign language competence and its relation to reading performance is needed for this matter.

1.4.13 L2 reading and the use of reading strategies: individual differences in the use of reading comprehension strategies amongst L2 readers

Second language readers make use of different strategies in various reading contexts. A common characteristic among second language readers is that of transfer of their reading strategies from their first to their second language (Anderson, 1991). There are several studies (e.g. Cohen, 1986; Alderson, 1998) that have tried to look into the specific strategies that second language readers employ though the use of think aloud protocols, a method that allows an individual “to verbalize his/her thought processes while completing a given task” (Anderson, 1991, p.460). Think aloud protocols have further been used as a way to identify and validate language learning strategies (e.g. see Oxford and Crookall, 1989).

After examining the effect of different reading components in bilinguals’ reading ability, Stanovich (1980) concluded that if one reading component is weak in a reader (for example, word recognition skills) another reading component may compensate for that matter (for example, use of contextual information). Compensatory mechanisms may work differently at different stages of reading in poor readers, yet, as a general rule, stronger components tend to compensate for weaker ones. However, further investigation into the interaction and compensation between components of L2 reading comprehension can provide a clearer picture towards our understanding of the interaction between L1 and L2 on the reading ability of L2 users.

To start with, L2 readers often use *metacognitive strategies* to aid their reading comprehension. The *compensatory-encoding model* of reading suggests that experienced readers compensate metacognitively for inefficient reading sub-components or cognitive resource limitations. For instance, readers with less efficient

access to information in working memory are predicted to look back in text more than those with more efficient access to information in working memory do. So, those readers with more efficient access to information in verbal working memory look back less, according to the model.

Reading researchers have not yet understood how automatic aspects of reading (i.e., reading activities occurring beneath conscious awareness) interact with strategic (e.g. metacognitive) aspects of reading. Most studies concerned with metacognitive aspects have not addressed the operations of low-level sub-components (Perfetti, 1985; Stanovich, 1990). Along the same lines, studies that have focused on automatic aspects of reading have rarely addressed the role of metacognitive processing (Perfetti, 1985). Still, an appreciation of how these seemingly independent aspects interact must be achieved before a full understanding of reading is possible.

The *compensatory-encoding model*, on the other hand, is concerned with how automatic and strategic aspects of reading interact under different task conditions (Walczyk and Taylor, 1996). This is an interactive model according to which high- and low-level aspects of reading routinely influence each other. It adds to existent interactive models in that it assigns a central role to compensatory mechanisms in reading. In addition, the model explicates what happens when reading occurs under pressure (time constraints, e.g. in speed reading).

Carrell (1989) examined the reading strategies of L1 and L2 speakers and their effectiveness in comprehending easy and hard text. The students in his study were tested on a reading comprehension test both in their first and second language. The test for each language consisted of two reading passages (controlled for level of difficulty/complexity and textual organisation) followed by ten comprehension questions. All the passages used were on the general topic of language, to control for schematic knowledge. For first language reading Carrell (1989) found no significant correlations between reading comprehension and confidence or repair. For the Spanish L1 participants, there was a negative correlation between some of the effective items and reading ability. Therefore, better L1 readers tended to claim not to use certain strategies. These tended to be local, bottom-up strategies. Students who

claimed to not use bottom-up strategies and who also claimed that bottom-up processing caused them no problems tended to be the best L1 readers.

For second language reading, on the other hand, confidence and compensatory strategies seemed to significantly influence reading comprehension ability.

Specifically, students who felt able to distinguish main and supporting points and to critically question the author tended to be better readers. Students who reported giving up and stopping reading when unable to comprehend tended to have lower comprehension. Also, for L2 readers, focusing on sentence-level syntax seemed to be related to higher reading comprehension. The students were further grouped as having “local” (using bottom-up, decoding) or “global” (using top-down, background knowledge of content) preferences based on their answers relating to both the difficulty and effective items on the questionnaires. For the English L1 group, it seemed that local processing was related to higher comprehension in Spanish reading. For the Spanish L1 group, it seemed that global processing was related to higher comprehension in ESL reading. The researchers attributed this difference to the relatively higher proficiency of the ESL group compared to the Spanish as a second language (SL) group, and to the differences between ESL reading and foreign language (FL) reading. Their findings indicated that the lower proficiency readers who also had little outside exposure to Spanish literacy had to rely more on bottom-up, textual processing, while the higher proficiency readers with extensive English literacy exposure were better able to integrate their world knowledge to make sense of the texts.

It would therefore seem that effective second language metacognitive processing strategies may be dependent both on student proficiency and on the context in which the language is learned. Such a view provides useful implications for metacognitive strategy instruction, suggesting that it is important for L2 teachers to understand that there may not be one set of universally effective strategies, but rather that strategy efficacy can be dependent on other numerous factors. The findings on the differences between SL and FL strategy use are, however, only suggestive and should be interpreted with caution, because the SL and FL groups in these studies, as the researchers point out, were not directly comparable in level.

1.4.14 Reading and writing relationships in L1 and L2

Carson, Carrell, Silberstein, and Kuehn (1990) investigated the relationships between reading in the L1 and in the L2, the relationship between writing in the L1 and in the L2, the relationship between reading and writing in the L1, and the relationship between reading and writing in the L2. 48 native speakers of Chinese and 57 native speakers of Japanese university students completed four tasks in a two-week period: writing a short essay in the L1, writing a short essay in the L2, completing a cloze task in the L1, and completing a cloze task in the L2. Essays were scored based on the 6-point rubric of the Test of Written English (part of the American TOEFL exam). There were significant correlations revealed between L1 reading and L1 writing and between L2 reading and L2 writing for both language groups at all proficiency levels. There was also a significant correlation between L1 reading and L2 reading across language groups and proficiency levels. However, there were only weak or non-significant correlations between L1 writing and L2 writing.

It appears that while first language reading ability may affect second language reading proficiency, first language writing ability may not affect second language writing ability. The above finding would suggest that ESL students may be able to transfer their reading skills from their native language to English, but may be less able to transfer writing skills. It also suggests that students' reading ability in both their first language and in English can be an important influence on their writing ability. Several variables, including educational background in the first language and the length of time students had been studying ESL may have affected students' first and second language literacy skills. Students from both L1 groups scored lower than average on the L1 cloze than they did on the English cloze. This may indicate that the L1 cloze tests were not reliable for measuring L1 reading ability. Possibly, low performance may also be explained by the nature of Japanese and Chinese writing in which there are no defining orthographic characteristics of words in the writing system (such as the spaces preceding and following words in English writing). The study indicates that students can transfer their literacy skills from their first to their second languages. Proficiency levels are an indication of the transfer of reading skills. However, L2 reading proficiency might be built on a separate set of abilities. More direct measures of reading comprehension, such as recall, could be used in

future research to provide a clearer picture of the possible interrelations between L1 and L2 reading and writing abilities of ESL individuals (Carson et al., 1990).

PROPERTY OF STATE COLLEGE

1.5. Spelling

1.5.1. Facts and issues in spelling research

The existing literature on spelling dates back almost a century ago. Spelling has been studied primarily in relation to reading and writing (Brown, 1990). The increased research focus into adult spelling ability over the last years has led researchers to study the process both within the context of reading but also in its own right. One reason for this is that in today's society poor spelling is considered much less of a 'social handicap' than poor reading is given that spelling demands are less frequent than reading demands in everyday life. Another reason is that when studying adults' spelling ability, it is difficult to employ methodologies for testing variables like speed of spelling production time, word frequency, or sound-spelling regularity. Such methodological problems are, however, nowadays being tackled through the use of computer-assisted technologies, both in data collection and analysis, which have enabled researchers to examine in more depth the different factors related to spelling performance. Undoubtedly, new methodologies and research designs have led to considerable progress in spelling research over the last years (Brown and Ellis, 1996a).

1.5.2 The spelling process

To understand how spelling skills are acquired we first need to look at the processes that are involved in spelling. According to Barry (1996) there is a specific pathway that normal spelling follows: first a word is recognised by the auditory/acoustic input lexicon, then by the phonological output lexicon and then to the orthographic output lexicon via the semantic system (through which we are able to recognise semantically inappropriate homophones for instance). According to a different line of thinking (e.g. Patterson, 1986), the transition from the auditory input lexicon to the orthographic output lexicon is direct and not mediated by semantics.

It has been argued that the spelling process involves "directly activating stored lexical-orthographic representations from semantic input" (Link and Caramazza, 1996, p.262). Information is first accessed through the 'semantic lexicon' and passes to the 'orthographic output lexicon'. Then, lexical-orthographical representations determine the identity and order of graphemes that make up a given word.

1.5.3. The spelling stage model (Bryant, Nunes and Bindman, 1997b)

Bryant, Nunes and Bindman (1997b) present a spelling stage model suggesting that learning of the spelling process follows a specific sequence of developmental stages each characterised by distinct types of spelling errors. The first three are distinguished as pre-grammatical and the last two as grammatical. Stage 1, the *pre-phonetic* stage, which is characterised by unsystematic spelling of word endings. Stage 2, the *phonetic* stage, is characterised by inappropriate phonetic transcriptions of (verb) endings as well as failure to produce conventional spellings of morphemes. Stage 3, the *generalisation* stage, is characterised by overgeneralisations in the use of letter-sound spelling rules and inadequate knowledge of syntactic rules. Stage 4, the *specific generalisations only* stage, is characterised by generalising grammatical rules that apply to regular verbs to irregular ones, and finally, stage 5, the *no generalisations* stage, is characterised by producing phonetical spellings of past tense irregular verbs.

1.5.4 The development of spelling ability

Studies with children beginning to learn spelling have provided a source of information about the way spelling develops from an early age. In particular, the point of interest of these studies was the sources of information that are being employed when spelling and the kind of knowledge that is involved in the spelling process.

According to Brown (1990) there are two essential components involved in the development of spelling ability. The one, that is necessary in early stages, is establishing “the phonological relationships between sounds and letters, which enables one to ‘construct’ the spelling of less familiar or new words”, and the other, that is necessary during latter stages, is the development of a “dictionary-like store of whole word units, or the lexical code” memory unit of words (Brown, 1990, p.385). Once an individual reaches adulthood, the “memorization of the correct spelling ‘forms’ is clearly established in lexical memory to remain impervious and unchanged over time” (Brown, 1990, p. 392).

It has been well established that spelling goes through a series of stages the most important of which are the transition from phonological knowledge to orthographic knowledge as well as the integration of several sub-skills. These are, according to Lennox and Siegel (1994), “knowledge of phonological representations, grammatical and semantic knowledge, as well as the formulation of analogies with words in visual memory and the knowledge of orthographic rules and conventions” (p.93).

There are currently two major theoretical viewpoints that help explain how we spell. According to the *rule theory* we spell by using rules which map phonemes into graphemes. According to the *memory theory*, on the other hand, we rely upon visual word-specific memory for spellings, that is, we have a spelling memory store for each word that consists of visual images of whole words. It has been argued that compared to poor spellers, good spellers make effective use of both rules and word-specific memory information for generating correct spellings (Kreiner and Gough, 1990).

Empirical evidence has provided support for both of these theories during the past years (e.g. Read, 1986; Perin, 1983). Using a set of spelling-sound rules to generate correct spellings is partly a successful strategy firstly because one can apply those rules to spell a great number of different words and second because such rule could help spell unfamiliar words. Yet, as Kreiner and Gough (1990) point out, “English is not regular enough to permit a good speller to rely entirely on rules” (p.106) so relying on rule information exclusively does not always help. In cases of homophones (here-hear), for example, although the two words are phonologically identical, different rules need to be applied for correctly spelling each one of them. Consistent with the rule theory is also the idea that we often spell by *analogy*. The analogy model of spelling suggests that novel words can be spelled though accessing “lexical entries which are high in similarity [analogous to] to the phonemic form of the word to be spelled” (Kreiner and Gough, 1990, p.116).

Alternatively, it has been argued that we make use of *visual memory information* to generate or even visualise different possible spellings in order to choose the correct one (Kreiner and Gough, 1990). Consistent with this viewpoint, is the idea that “spelling s may be stored as serial lists of letters” or in the form of a “serial list recall” in which spellers “remember a string of items in some specific order, and spelling

errors might be classified like serial list recall errors (e.g. omission, addition, substitution, inversion) (Kreiner and Gough, 1990, p.107). When relying on visual memory alone however it is difficult to produce spelling of irregular words as well as unfamiliar words or non-words. Current research in spelling emphasises the role and relative importance of using both rules and words-specific memory as sources of information for successful spelling development.

Yet, Goswami (1992) opposes to the view that spelling is mainly a visual skill arguing that “it is phonological rather than visual skills that play the greatest role in spelling development, even though visual memory for spelling patterns will be important for spelling proficiency” (p. 967) during later stages of spelling development.

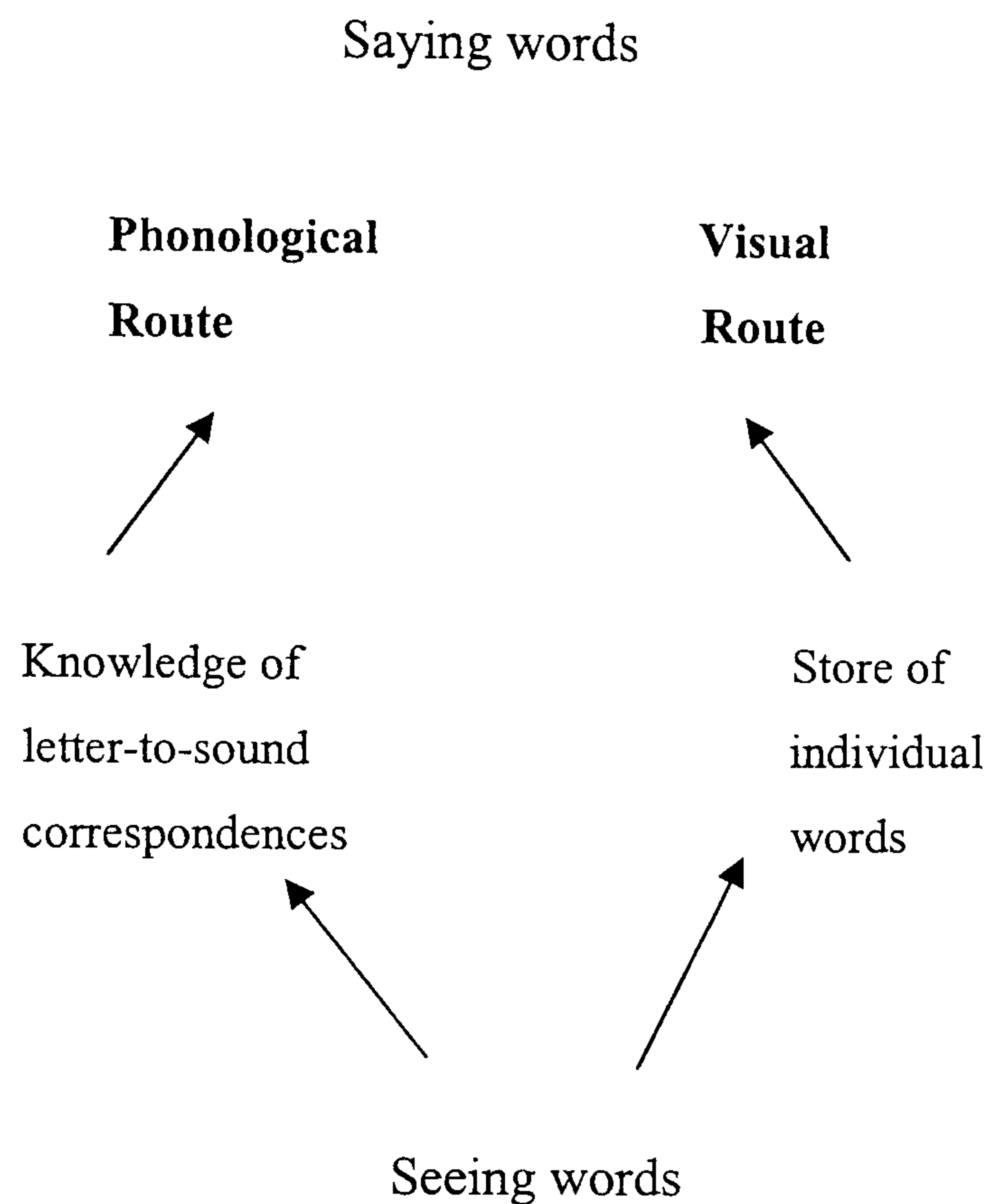
1.5.5. Theoretical models of spelling acquisition

1. Information processing models

The dual-route model

According to the dual-route model there are two ways in which spelling of a word can be produced, via the ‘non-lexical’ or ‘assembled’ route used to encode information about sound and spelling correspondence patterns. Use of this route enables the production of non-words and unfamiliar words. Alternatively, a word can be accessed via the ‘lexical’ or ‘direct’ or ‘word-specific’ route, used to directly access stored information about spelling of familiar words through an orthographic lexicon, a memory storage unit from which knowledge of word spellings is retrieved. These two routes, however, do not always function independently but can work together to produce accurate spelling depending on the information processing demands.

There is now evidence that much of the spelling errors reflect problems with grapheme-phoneme correspondences (Cook, 1997). Such evidence is in the line with the dual route model of spelling and reading acquisition suggesting that written letters are related to spoken sounds through a set of rules, i.e. letter-sound correspondences. There is, however, contrasting evidence that supports the visual route model suggesting that words are accessed from the mental lexicon without passing through phonology (Cook, 1997).



Cook (1997)

2. Computational models of spelling (Patterson, Seidenberg and McClelland, 1990)

The 'connectionist' approach.

Critics of the dual-route model pose against such theoretical claims arguing that the dual-route model does not explain why and how the causal transition between stages is achieved and also exactly how the proposed spelling rules operate or how outputs from the two different routes are combined to produce a single orthographic output. Evidence against the lexical model presented by proponents of the connectionist model defends the possibility of “a single network [that] might be capable of encoding both sound-letter associations and lexical specifics” in which “orthographic units connect via sets of hidden units to sets of phonemic units” (Seymour and Evans, 1996, p.131). Through this ‘single process system’ word spellings are learned on the basis of frequency and regularity. Once learning of frequent and regular words is achieved, unfamiliar non-word spellings can also be learned.

According to the connectionist theoretical framework, therefore, there is one single process that gives rise to different developmental stages and that this mechanism can be used to spell both regular and irregular words. In line with computational models, words are represented in ‘triples’ of letters or phonemes (for example, the word *have* can be broken down into three orthographic units such as *ha*, *hav*, and *ve*).

Connectionist or ‘single-process’ models of spelling suggest that it is the same processing strategies involved at different developmental stages of spelling as opposed to different ones.

Nowadays, however, the theoretical trend in recent models is to adopt a more interactive approach “where several different knowledge sources interact in parallel to constrain the operation of the spelling output mechanisms” (Brown and Ellis, 1996b, p.7). Models like the **multi-source literagraphic lexicon model** (or otherwise named as the **competing resources model**) suggest that spelling develops through a sequence of generating individual letter strings or a set of ‘letter identities’ on the basis of phonological, lexical and morphological structures the interplay of which determines the output word.

The question still remains unresolved, however: should the development of spelling be viewed in terms of a sequential process or as a stage-like sequence, or are all the stages readily available at once? This leads to the following question: what happens with poor spellers then? Do they present problems in this sequence of stages or is it that they use spelling strategies differently from good spellers and we can in this case talk about ‘abnormal’ spelling processes?

1.5.6 Can current models of spelling generalise to different orthographies and writing systems?

According to Cook (1997), the dual-route model “also serves to distinguish the major types of writing system found in different languages” (p. 475). When learning new spellings, learners of different scripts rely on morphology or phonology to a different degree depending on how orthographically shallow or deep the language is. For example, in non-alphabetic languages like Chinese that are more meaning-based than

sound based like English, French, German or Spanish are, learners do not depend so heavily on letter-sound correspondences for their reading or spelling. Instead, they employ more visual spelling strategies rather than phonologically based ones.

Other studies have further used the above model as a starting point to establish the varying degrees to which “L2 users’ knowledge of sound/letter rules and individual visual systems reflects their different L1 systems of spelling” (Cook, 1997, p.475). The underlying hypothesis behind these studies was that users of orthographically deep languages would be more likely to have more problems with the phonological route in their L2 than users of more orthographically shallow languages that would be expected to have more problems with accessing the visual route (Cook, 1997).

One question that still remains unclear, however, is do L2 learners tend to use only the route they are familiar with in their L1 or do they use a different route when asked to spell in an orthographically and phonologically different writing system?

The present research will attempt to address the above question by employing adult L1 and L2 populations (bilinguals) and comparing their spelling performance in both their first and second languages. Additionally, the current study will attempt to investigate the relationship between levels of spelling proficiency, vocabulary knowledge and phonological processing skills across two different scripts (English versus Greek) that have different orthographic conventions.

1.5.7 Spelling systems

According to Frith (1980) there are 3 spelling systems that develop in sequence and spellers employ different spelling strategies in each of these systems. These are: the *logographic* which refers to whole-word knowledge that does not require sound-letter knowledge, the *alphabetic* which refers to a transparent phoneme-grapheme spelling system, and the *orthographic* which refers to a morphophonemic system requiring the combination of morphemic units. The developmental sequence followed by a normal reader is described by Seymour and Evans (1996). According to the researchers, the first stage is the

“logographic word memory, called the ‘logographic store’, which is allowed to lapse when alphabetic writing

using phoneme-grapheme relations, is established. The phoneme-grapheme process survives as a non-lexical translation system during a later orthographic phase when a ‘graphemic lexicon system’ is being established ‘in which each word is noted with proper acknowledgement of the morphological structure’ (Morton, 1980, p.60) (p.130).

Yet, other studies present no clear evidence of the existence of such a progressive developmental pathway suggesting the possibility of “concurrent or parallel developments which jointly contribute to the formation of an orthographic system” (Seymour and Evans, 1996, p.135).

1.5.8 The English orthography and spelling system

Without doubt, spelling in English is more irregular than reading in English. There are many spelling-sound inconsistencies found in the English orthography. Some examples are the homophones, that is words pronounced the same but spelled differently (e.g. *rain*, *rein*, and *reign*), words containing inconsistently pronounced segments (e.g. *cove*, *love* and *move*) and many irregular words (e.g. *head*) as well as exception words (e.g. *yacht*). Miles and Miles (1999) explain such irregularities as the result of the historical changes through which English language spelling evolved: “two centuries of bilingualism in England after the Norman invasion produced even greater complications in English spelling, with the intrusion of French words and Latin phonology” (p.45).

Modern English has around 45 phonemes and over 100 graphemes (Barry, 1996). Typically, in English, the spelling of a word reflects its phonological structure. For example, the word *clean* contains 4 phonemes /k/, /l/, /i/, and /n/. Understanding the phonological structure and the sequence of these phonemes of the word is essential in order to be able to analyze it and use the corresponding phonemes to spell it correctly (Treiman, 1996). Difficulties in analysing spoken words into phonemes (segmenting words into individual phonemes) can lead to spelling problems. For English both letter-name knowledge and orthographic knowledge are essential for being able to spell correctly.

Spelling irregularities in English

English represents a relatively opaque language system; there are many alternatives to spell phonemes and many ways of sounding out graphemes, and in addition, many of the correspondences cannot be predicted on the basis context-dependent information or on grapho-phonemic rules. Perry, Ziegel and Coltheart (2002) report that 72% of all monosyllabic English words are inconsistent, that is they can be phonologically spelled in more than one way. 60% of all words in the English vocabulary are irregular, so there are more irregular than regular words in English. Such irregularities inevitably affect spelling performance (Perry, Ziegel and Coltheart, 2002).

Within English orthography there are, to start with, a number of spelling alternatives for vowels such as /ou/ for which there are as many as 13 different ways in which it can be spelled within different English words. Such spelling irregularities are also referred to as *contingencies*. Some words contain low-contingency spellings (e.g. in the word 'theme' the vowel /i/ is rarely represented with an *e*) and some contain high-contingency spellings (e.g. in the word 'beef' the same vowel is frequently represented both as *ea* and *ee* in the English vocabulary). Similarly, the vowel /u/ is most commonly represented by spelling pattern *oo* and less commonly with spelling patterns like *ou*. Phonological correspondences of vowels can, therefore, be in some cases difficult to find in English spelling (Barry and Seymour, 1994).

Homographs, homophones and homonyms

The English writing system can be a source of confusion for spellers since within the English vocabulary we frequently come across words that either look alike or sound alike or even words that both look alike and sound alike. Words that look-alike (look-alikes) are called *homographs*. These are words that are written with the same spelling but pronounced differently and have different meaning (e.g. the word *bass*, which can mean both a singer and a fish). Words that sound-alike, on the other hand, (sound-alikes) are called *homophones*. These are words that have the same pronunciation, but differ in meaning, spelling and grammatical class (e.g. *allowed-aloud*). Finally, it is sometimes the case that some homographs can also be homophones. Such words that are both written the same and are pronounced the same

but can mean two or more different things are called *homonyms* (e.g. *flatter*). Homographs, homophones and homonyms can often create misunderstandings amongst English (and non-native English) readers and spellers. However, the meaning is almost always inferred from the context, which provides clues as to whether, for example, in the sentence “The *bass* was remarkably good”, the author actually refers to the singer or to the type of fish (Carney, 1997).

Spelling difficulties that L2 learners present have typically been tested through the use of homophone tasks (e.g. *to-too*) where researchers can establish whether spelling errors are sound-linked and whether they involve incorrect use of sound-letter correspondences. They can therefore examine the relative contribution of phonology and morphology in L1, and how these two interact or work separately to assist the development of spelling ability.

There is evidence suggesting that spelling errors originating from confusions over the use of a homonym (e.g. writing *there* instead of *their*) may be the result of the “intervening phonological code and this is simply translated into a graphical code by means of a set of phoneme-grapheme rules” (Morton, 1980, p.125), which help convert a phonological code into letters. Results from studies using homophone tasks have provided evidence for a *pseudohomophone effect* whereby misspellings which sound right are harder to identify than misspellings which both sound wrong as well as being orthographically incorrect (Cohen, 1980). Some studies in which homophones were used to assess spelling report the occurrence of a *homophone frequency effect* and others argue for a *specific word frequency effect* arguing that the homophone frequency effects may be evident in some languages and not in others depending on how transparent or opaque the orthography is (Caramazza, Costa, Miozzo, and Bi, 2001).

There is a debate as to whether homophonic words could be a potential source of spelling problems because they create partially overlapping lexical representations (Jeschniak, Meyer and Levelt, 1994). Gerard and Scarborough (1989) argue that in the case of bilinguals there is a language-specific lexical access of homographs. According to the shared representations model (SRM) homophones share a common lexical-phonological representation, but different semantic and lexical –grammatical

representations (Jeschniak, Meyer and Levelt, 2003). Yet, according to the independent representations hypothesis, homophones are represented independently and do not share a common word form representation (Caramazza et al, 2001).

Given the great degree of irregularity in English orthography, it has been argued that word spellings are frequently accessed by using the lexical route to retrieve the word-specific spelling knowledge and not by using the assembled spelling system (otherwise how does one derive to correct spelling of the word *yacht*, for instance?) For English therefore, the lexical route is both faster and more dependable than the assembled route. The assembled route is used as a secondary resource in cases of producing new words or rare ones. Both routes need to be operating to achieve correct spelling of all English words. (The non-lexical route as already mentioned is on the contrary a system applicable to shallow, i.e. phonologically regular orthographies like Italian or Welsh.). Problems specific to spelling (such as dysgraphia) may arise as a result of impairment in each of these two routes described above.

1.5.9 The Greek spelling system

The Greek language is fairly transparent. Modern Greek spelling, however, is not entirely phonetic as it presents some grapheme-phoneme inconsistencies. Here are some examples of such inconsistencies:

- 1) Some phonemes may be represented by more than one letter symbols, for e.g.
 - the phoneme [i] is written with the letters *ι, η, υ, ει, οι*, for example, *φιλειρηνικός*
 - the phoneme [o] is written with the letters *ο, ω*, for example, *όμως*
 - the phoneme [e] is written with the letter *ε, αι*, for example, *χαίρεται*
 - the phoneme [u] is written with the combination of two letters *ο and υ, ου*, for example, *πού* or
 - the phoneme [s] is written with *σ, σσ, ς*, depending on its position in the word, for example, *συσσωρευτής*.

- 2) Some letters may represent different phonemes depending on the word context:
 - the letter *υ* can be pronounced in three ways: as an *ι* (*χύνω*), a *φ* (*ευχαριστώ*), a *β* (*αύριο*) or silent (*εύφορος*).
 - the letter *τ* is pronounced as a *t* (*τόνος*) or as a *d* if it follows another letter (*πέντε*)

- in some cases some letters are silent , for example, the letter *v* (Εύβοια), the double consonants *λλ*, *κκ* (καλλαίσθητος, λάκκος) or the letter *π* when it is part of a consonant cluster *μπτ* (Πέμπτη).

Porpodas (1981) explains that such inconsistencies in the Greek spelling system are the result of a historical change (from old to Modern Greek) that occurred in the pronunciation of some phonemes, which however, did not follow a change of the letter symbols. There are therefore a number of complicated spelling patterns found in modern Greek language that are reminiscent of ancient Greek spelling. Porpodas (1981) refers to the Modern Greek spelling system it as a ‘historic orthography’, which although largely simplified, depends more on knowledge of derivational rather than the grammatical rules of word spellings. Finally, there are complexities associated with writing that have to do with confusion of graphemes that look alike, for example, theta (θ) and beta (β) (Miles and Miles, 1999).

As Harris and Hatano (1999) point out, the main difficulty presented by Greek spelling lies “in the ambiguity of vowels” which is being tackled only when Greek learners gain “a grasp of the extensive system of morphologically based spelling rules” (p.3). Such rules, in turn, help Greek language learners decide on the correct spelling of “morphological word endings which vary according to the grammatical status of a word” (p.3).

Consequently, as a result of such complexities within the Greek spelling system, learners of the Greek language may find reading easier than spelling. Spelling errors analyses have indicated a frequency effect especially for exception words (for which neither phonological nor morphological rules apply and so need to be learned on an individual basis) suggesting that common Greek words are easier to spell than less common ones. So, one would expect high frequency morphologically regular Greek words to be easier to spell than low-frequency morphologically regular ones (Porpodas, 1989; 1990).

Spelling instruction in Greek schools, however, does not place enough focus on how to teach learners the link between morphology and spelling. This partly explains the finding why at an early age Greek children take long before they are able to apply a

morphological spelling rule after they have gained the necessary experience with leaning of individual word spellings (Harris and Giannouli, 1999).

In Greek orthography different letters are sometimes being used to represent the same sound; η, ι and υ all represent an *ee* sound (as in ‘feet’) within different words. Also, combinations of letters are used to represent the same sounds; eg, that *ee* sound is also represented by ει or οι within different words, while the simpler *e* (as in ‘pen’) sound can be represented by αι as well as ε. The reverse situation, where the same letter can represent different sounds, can also be found. Hence τ can be sounded as t in some instances and d in others. If τ follows ν in the middle of a word, a simple rule is to sound it out as nd (ενταξει), but not in ‘exception’ words such as αντιο, where it should be sounded as d. And there are, of course, to the bane of all poor spellers, examples of letters within words, which remain more or less silent (e.g. the letter υ in ευβοια). Thus, although Greek may not be as obscure in its spelling-sound correspondences as some written forms, such as English or French, it is by no means an entirely shallow orthography.

1.5.10 Phonological and orthographic processing skills: evidence for interrelations

Allyn and Burt (1998) point out that “it is likely that orthographic and phonological skills are inter-related, with some evidence indicating that the development of orthographic knowledge is dependent on phonological abilities” (Allyn and Burt, p.54). In light of such inψονψλθσιωε evidence, one thing is certain: in order to have a clear picture of the relative contribution of both variables, future research in the area will need to “provide an empirical delineation between measures of phonological processing abilities and orthographic knowledge, with a view to elucidating the nature of the linguistic knowledge that is important in adult spelling” (Allyn and Burt, 1998, p. 54). Yet, as Allyn and Burt (1998) point out, using a homophone choice task for this purpose (e.g. choosing the fruit when presented with the words *pair* and *pear*) requires processing of both the words’ sound units and word-specific spelling knowledge. Measures designed for assessing adults’ spelling skills should therefore aim at directly assessing each component skill separately. This is not an easy work,

particularly considering that any difficulties in breaking down the different components associated with spelling may actually reflect the inherent interrelatedness of the two skills under investigation.

Allyn and Burt (1998) have argued that there is a strong positive relationship between phonological processing skills and adult spelling ability and that this relationship was mediated by phonological coding (spelling-sound knowledge). That is, those with higher levels of spelling proficiency presented evidence of superior phonological processing skills compared to those scoring lower in a number of phonological awareness (e.g. Spoonerisms, phoneme deletion) and phonological coding (non-word pronunciation and abstract spelling patterns) tasks. Conversely, the correlation between orthographic processing skills and spelling as assessed by a morphological (legal/illegal spelling patterns discrimination) and a suffixation test was found to be weaker.

1.5.11 Assessing phonological and orthographic processing skills

The orthographic and phonological processing skills of college-level students have been assessed through *word-pseudohomophone choice tasks* (WPC) and *homophone choice tasks* (HCT) (e.g. Olson, Forsberg and Wise, 1994). In the first task, participants were required to choose between a word and its phonological identical pseudohomophone non-word (e.g. *rain-rane*). In the second task, participants were required to choose between pairs of homophone words (e.g. *pair-pear*) only one of which is orthographically correct. Other examples of homophone tasks that have been used were asking participants to identify homophones that either match or do not match the sentence context (i.e. choosing between homophonic words that carried the correct/incorrect tone that fit the sentence context) (Li and Yip, 1998). Finally, bilingual research has used cross-language homophones, that is word pairs that sound the same across two languages (e.g. the French –English word pairs *cite-sit* and *pique-pick*) to assess bilinguals' lexical and phonological processing skills (Li and Yip, 1998).

Such types of tasks have been specifically designed to assess the ability to recognise correct orthographic patterns of the words presented independent from its phonology. It has been argued that “recognition of a homophone is a result of the interactions

among phonological, lexical, and contextual information at an early stage” (Li and Yip, 1998, p. 223). Olson, Forsberg and Wise (1994) explain that in such types of tasks “although subjects may automatically engage in phonological decoding processes when presented with the word and its pseudohomophone, their phonological decoding of the two choices in this task would not yield the correct answer” (p.28).

1.5.12 The role of vocabulary knowledge in spelling ability

Vocabulary knowledge is viewed as an important cornerstone of literacy for L1 and L2 learners alike. Over the last years linguistic research has placed a great focus on the role of vocabulary knowledge in certain aspects of L2 acquisition like reading ability, comprehension ability and spelling ability. Studies into L2 vocabulary have provided evidence that there is in fact a reciprocal relationship between these skills: development of adequate vocabulary influences reading and spelling performance and vice versa. Attainment of vocabulary knowledge is in other words considered to be both a cause and a consequence of reading and spelling skills development.

According to others “vocabulary learning involves the acquisition of a range of skills. More specifically, students must be able to recall meaning, infer meaning, comprehend a text, communicated orally, spell correctly etc” (Huckin, Haynes and Coady, p.30).

It is now well established that beginning L2 learners heavily rely on context for word recognition as well as for inferring the meaning of unfamiliar words whereas more advanced L2 learners do not. It has in fact been argued that the use of contextual definitions facilitates vocabulary acquisition and learning skills to a great extent and that “contextual definition is the most crucial of vocabulary skills” (Stein, 1993, p. 203). Yet, sometimes contextual definitions are not enough for adequate L2 comprehension as they do not always provide sufficient clues for inferring word meaning unless the unknown word has been previously recognised or adequately understood. For example, Dubin and Olshtain (1993) argue that “adjectives, in general, have fewer constraints placed in the text than do nouns and verbs” (Huckin, Haynes and Coady, 1993, p. 194). Nation (1993) finally argues that vocabulary is an indicator of good world knowledge and claims that “this world knowledge enables reading comprehension because the reader must bring as much information to the text as the reader expects to get from it” (p. 116).

1.5.13 Spelling methodologies

Oral and written spelling ability have most frequently been tested through **spelling production time** tasks (Sloboda, 1980). In these tasks participants are presented with printed pairs of items representing possible alternative word spellings, only one of which is spelled correctly. The advantage of this methodology is that it can detect effects of sound-spelling regularity and phonological processing on spelling and that it can look into the cognitive processes involved in normal and impaired spelling. Some argue, however, that this may not be a completely valid or accurate measure of spelling production time, as there are reading processes involved that may impact on correct/incorrect spelling. Other methodologies that have been employed in experiments involve auditory presentation of words where participants had to listen to a set of words and press a key to indicate how many letters there were in the word (letter counting). The ability to count letters was predictive of whether subjects produced correct or incorrect spellings. This technique has too been criticised as reaction times may have been influenced by the automatic processing of the stimulus presented.

Other measures of spelling include *spelling probe* tasks in which participants are visually presented with single probe letters and are being asked to respond to whether or not the particular letter appears in the word presented and *non-word spelling* tasks, in which participants are verbally presented with non-words. These are of two kinds: non-word selection tasks, where participants are asked to select between alternative spellings, and production tasks, where participants are asked to generate their own spelling.

Standardised spelling tests typically involve choosing between right and wrong answers. Tests like the Wide Range Achievement (WRAT-3), the Spelling Production Test, the Graded Word Spelling Test, and the WISC are amongst the most frequently used norm-referenced spelling tests for assessment procedures. Not all tests have the same spelling ages; these differ, typically covering age norms from 7-75. Some of these tests focus on 'phonic spelling abilities', while other ones (for example the Test of Written Spelling-2) focus on testing memory for orthographic spellings by assessing spelling accuracy on phonetic and non-phonetic words. Yet, as it has been

pointed out, few standardised spelling tests can provide detailed analyses of spelling errors and help understand complexity of spelling processes. It has been argued that the most sensitive spelling tests are the written spelling tests as they are able to accurately assess the presence of a language problem (Ott, 1997).

There are inherent problems with all the above tests measurements, however. It is often the case that only from obtaining results from standardised spelling tests like the ones already mentioned *alone* is not sufficient to diagnose the areas of difficulties that poor spellers present. Ott (1997) explains that within the conditions and constraints of a test taking procedure individuals with learning difficulties may “seem to be able to spell a word correctly when their attention is focused on spelling, but when they are doing ‘creative’ writing they may misspell many of these same words” (p. 107). One clear limitation of spelling tests is therefore that they do not reflect the actual ability of test takers as they are mirrored in real life situations. Screening tests need to be short, easily administered (e.g. computerised) and cost-effective.

1.5.14 Characteristics of poor spellers

Poor spellers make use of fewer words in their written repertoire, prefer short rather than long words and words with regular spelling patterns and words containing only the most basic morphemic variations, avoid using common hard-to-spell words and tend to repeat the same words instead of using new ones, put down first two letters of a word and may then guess the spelling of the remaining word. Poor spellers also present evidence of resource limitations, that is, they lack the automaticity of the component sub-skills involved in spelling because of the huge working memory overload (Ormrod, 1985).

Other factors that have been argued to influence spelling performance and distinguish between good and poor adult spellers are also reading experience, exposure to print, vocabulary knowledge and general verbal skills (Burt and Butterworth, 1996). In a series of experiments, the researchers varied the level of orthographic transparency and regularity of words that were either low or high frequency and found a strong interaction between transparency and spelling accuracy of familiar words. Recall and recognition of non-words, that is, unfamiliar words, could also reliably distinguish between good and poor spellers in their study. The results obtained from this study

provide support for the conclusion that spelling ability is related to both the phonological coding of letter strings and spelling-sound correspondences and as well as to accuracy in orthographic processing of words (Burt and Butterworth, 1996).

1.5.15 The spelling strategies of good and poor spellers

a) Visual strategies and the development of a sight vocabulary

Visual strategies and phonological processing strategies are often employed by good spellers. It still remains a debate however whether good spellers have better visual or orthographic imagery for words. Sloboda (1980) argues that visual imagery is not an essential component in spelling performance, instead it is “the *end product* of a spelling process” (p.245). Visual imagery is only useful in spelling phonemically less transparent (i.e. opaque) words. It has been argued that even more important than visual familiarity is orthographic regularity, yet other studies (e.g. Brown, 1970) support the opposite view emphasising the role of visual cues and rote memory in spelling. Burt and Fury (2000) found that reading experience was an important factor that not only predicted reading and spelling accuracy amongst college students but also contributed to the learning of visual codes for specific words and the development of a sight vocabulary consisting of such visual-orthographic codes of previously encountered (familiar) words.

b) Phonemic encoding strategies and spelling by analogy

Yet, despite such converging evidence, researchers agree that “in spelling as in reading the more experienced subject may switch from a phonemic encoding strategy in spelling unfamiliar words to a strategy based on analogy with known words in visual memory” (Marsh et al, 1980). Indeed, it has been found that if spellers are unsure about a particular word spelling they may spell by analogy (Morton, 1980).

Many studies that have found good readers to be good spellers and also poor readers to be poor spellers refer to a “matthew effect”, which suggests that individuals with good decoding skills will also be good at lexical processing (Beech, 2002). As Beech explains, reading improves phonological skills, which turn assists the development of a sight vocabulary. What is more, those that are more familiar with the orthography of a specific language also have more exposure to print and therefore manage to become better spellers.

1.5.16 The role of morphology in different languages

Studies in morphological aspects of spelling acquisition have found that morphosyntactic awareness (the ability to use morphemic units in spelling) has been closely linked to the adoption of morphemes as spelling units at an early age. In fact, morphosyntactic awareness is a strong predictor of children's understanding of when to use morphemes in their spellings, in other words, of their ability to make the right connection between morphology and spelling. Bryant, Nunes and Bindman (1997) argue that it is the development of morpho-syntactic awareness that mediates in the transition from the pre-grammatical to the grammatical levels in their spelling stage model described above. It is therefore an essential component of understanding the grammatical basis of words.

There is evidence for cross-linguistic similarities in the way morphemic processing develops despite the fact that specific morphemes, sounds and spelling patterns vary to a great extent across different languages. The role of morphology in spelling and writing is well established in the following cases:

1. In deciding between two or more acceptable spelling sequences/patterns when there are 2 or more alternatives of acceptable spelling existing for the same sound (e.g. the English sound /ks/ spelled both with 'x' and 'cks'). Choosing the correct spelling in this case in the example of the word fox, one would have to rely both on syntax but also employ his/her knowledge of morphology (if it is a singular noun, an adjective, or verb in 3rd person singular). In Greek, morphemes play a key role in determining the spelling of words and in deciding between alternative spellings. For example, the sound /i/ can be spelled in 5 different ways as [η], [υ], [ι], [οι], or [ει].
2. In spelling silent morphemes in cases where the context determines the word's syntactic status. Morphemic awareness is finally important when faced with words sounding the same when pronounced but are written differently, for example, 'the boys' sail' as opposed to 'the boys sail'.
3. In letter-sound correspondence rule inconsistencies in relation to the way morphemes are spelled. For example, the English *-ed* ending (regular past tense verbs) can be pronounced in three different ways /t/, /d/, or /ɪd/ or the z sound ending which can be found in plural noun verbs like 'cans' or 'tans' (Bryant, Nunes and Aidinis, 1999).

It has been shown that the spelling of many words in English and in other orthographies involves patterns determined by morphology (e.g., *ed* in past regular

verbs) (Nunes, Bryant, and Bindman, 1997). Longitudinal studies have shown that when children first adopt such spelling patterns, they do so with little regard for their morphological basis. They generalise the patterns to grammatically inappropriate words (e.g., *sofed* for *soft*). Later, these generalisations are confined to the right grammatical category (e.g., *keped* for *kept*) and finally to the right group of words (regular verbs). The authors conclude that children first see these spelling patterns merely as exceptions to the phonetic system and later grasp their grammatical significance.

There is evidence to suggest that children learn about the connection between morphology and spelling in strikingly similar ways across different languages (Bryant, Nunes, and Aidinis, 1999). Results from a number of developmental cross-linguistic studies demonstrate that the acquisition of morphological strategies by children is not accomplished in a single step, but rather develops over at least 2 years from the time children start to read and write, and that this process is similar across languages. Yet, the existing links between morphology and writing as well as the understanding of the links between syntax and spelling during later stages of development in both children and adults is an area in need of further research.

1.5.17 The role of morphology in English spelling

Within the English language there are several conventional spelling sequences for morphemes do not conform to letter sound correspondence rules. One such example is the *'-ed'* spelling for the inflectional morpheme at the end of English past verbs. Previous work has shown a close relationship between children's awareness of grammatical distinctions and their success in learning about this spelling sequence. Nunes, Bryant, and Bindman, (1997) investigated this assumption with real verbs and hypothesised that the children's spelling might be influenced by familiarity with the words. They devised a task with pseudo-verbs in which the spellings violated letter-sound relationships and followed a morphological pattern. The participants heard passages with a pseudo-verb in the past tense and in other tenses and had to write the pseudo-verb in the past tense. The task contained both regular pseudo-verbs, whose stem was the same in the present and past tense, and irregular pseudo-verbs, which had different stems in the present and the past tense. Scores in the grammatical awareness task predicted the use of the *'-ed'* spelling sequence over a 21 month period.

Participants also used '-ed' endings significantly more often in regular than irregular pseudo-verbs.

An important, though somewhat neglected, aspect of learning to spell in English and in many other orthographies is that individuals have to learn about the conventional spellings for morphemes which often depart from strict letter-sound principles. There is some evidence that backward readers might have great difficulties with these spellings. Bryant, Nunes, and Bindman (1997a) looked at a group of backwards readers' spelling of "ed" in regular past verbs and "wh" in interrogatives, and also at their grammatical awareness and compared them to one control group matched on chronological age (CA) and to another matched on reading level (RL). The backward readers group was considerably behind the CA controls in producing grammatically based spelling patterns correctly and also in the grammatical awareness tasks, but no worse than the RL controls in either of these domains: in fact they were better with the "wh" spellings. It was concluded that learning the written language makes a significant contribution to the development of grammatical awareness and this interferes with backward readers' progress in grammatical awareness when they are compared to their cohort group. However, there is no evidence of an intrinsic difficulty with grammatical awareness among the group and perhaps this strength could be used to support their spelling.

The way in which children learn about the connection between syntax and spelling (understanding of the syntactic connections between spoken and written language), and the problems that this learning sometimes causes them is another area of research. Nunes, Bryant and Bindman (1997a) point out that more than phonological sensitivity is needed to understand why the similarly pronounced endings of the words *kissed* and *fist*, for example, are spelled differently.

Ravid (2001) investigated children's developing knowledge of a spelling system in view of the idea that language-specific typology affects the rate and the pattern of development of orthographic spelling. Hebrew is an example of a morphologically synthetic language with a phonologically "deep" orthography, on the one hand, and a consistent representation of morphology in the spelling system, on the other. The difference between representing content words versus grammatical words, and roots

versus morphemic and attached function letters in written Hebrew was investigated. Results indicated that grammatical words are spelled correctly before content words, and that within content words, the correct spelling of function letters precedes that of root letters. Such differences were attributed to factors such as transparency, consistency and frequency, coupled with grade-schoolers' growing perception of phonological and morphological patterning in the specific language.

In a cross-sectional study conducted with 1st and 4th graders Mueller and Brady (2001) examined the factors accounting for early reading performance in Finnish, a transparent orthography with a clear mapping of phonemes onto graphemes. Measures for both grades included a reading comprehension, phoneme awareness, and object and digit naming task. Additional measures of skills in morphology, spelling and a screening battery were administered to the 1st graders. The sets of measures accounted for 56% of the variance in reading performance in 1st grade and 64% in 4th grade. Phoneme awareness was strongly related to reading performance and spelling at the end of 1st grade, but only for less-skilled readers in 4th grade. These results provide further support for the importance of phoneme awareness in children's learning of a transparent orthography that has been widely demonstrated in earlier studies. At the same time, listening comprehension contributed more strongly to 1st-grade reading performance than has been reported for children learning to read English.

Arnbak and Elbro (2000) examined the effects of teaching morphological awareness to 10-12 year-old dyslexic children receiving both remediation training and specific morphological awareness training that focused on semantic aspects of morphemes. They found that it was possible to develop dyslexic students' morphological awareness and that awareness of morphemes may support the development of meaning-oriented decoding strategies in reading and spelling of English.

The morpho-phonological nature of the English orthography has been further examined in studies looking at the relation between morphological sensitivity and decoding ability (Mahony, Singson and Mann, 2000). Children in grades 3-6 were asked to distinguish derivationally-related word pairs (e.g., nature-natural) from foil pairs related in terms of their spelling but not in terms of morphology (e.g., ear-earth).

The above items were presented in oral or written form along with tests of reading ability, intelligence, and phonological awareness. The results indicated that children's recognition of derivational relationships improved with age. Also, there was a significant association revealed between sensitivity to derivational relatedness and decoding ability, which remained significant even when the word pairs were orally presented and even when phonological awareness ability was controlled for. Both phonological awareness and sensitivity to morphological structure continued to emerge as important predictors of decoding skill in later grades.

Senechal (2000) finally examined whether primary school children represent morphological information when spelling French words that have silent-consonant endings (e.g., chat). Fifty-seven children (mean age 7.5 years) in grade 2 and 55 children (mean age 9.6 years) in grade 4 spelled regular, morphological, and deep words. The morphological and deep words differed in the presence or absence of derivatives that revealed the nature of the silent-consonant ending. As expected, it was found that regular words were the easiest to spell and morphological words (for which the silent consonant could be derived) were easier to spell than were deep words (for which the silent consonant must be memorised). The results of this study demonstrate that children's linguistic knowledge of morphology made separate contribution to their spelling of morphological words that was independent of reading experience, vocabulary, spelling ability (i.e., spelling regular words), and phoneme awareness.

Poor spelling has a number of educational implications and may pose a threat to the academic achievement of otherwise educated and intelligent individuals throughout their adult life. Appropriate assessment of spelling problems is therefore necessary for purposes of intervention at any stage of spelling development.

1.5.18. Summary of the literature review

This review has provided an overview of many of the issues related to dyslexia and bilingualism that can be found in the literature. One fact that it has highlighted is that current definitions of dyslexia and bilingualism are still inconclusive and further research is necessary to specify and characterise both concepts and the individuals that will be classified by these terms. Such research may be informed by work that considers issues that are common to both concepts. One of the issues that will be

considered in the present work is the overlap between dyslexia and second language learning. Research into bilingualism indicates that ESL individuals who have learned to read and write in their first language will, at some stage of L2 learning, present difficulties in reading and writing English, yet given that they have learnt to read and write in their L1, it seems inappropriate to classify them as dyslexic during this period of English language acquisition - this may be particularly problematic when dealing with adults in educational contexts. Yet both groups (dyslexics and ESL individuals) may be considered to have language-related literacy problems that maybe specifically related to certain features of English (eg, its level of transparency). The extent to which dyslexic and ESL individuals show common elements and characteristic differences should inform views about dyslexia (eg, as a language-based phonological deficit) and bilingualism (as a process of acquisition of literacy in a second language). Research that identifies similarities and differences in measures such as literacy should inform procedures for identifying individuals who would be classified as dyslexic rather than those acquiring a second language and may help in the development of tools to identify those individuals struggling with literacy in a second language who may be dyslexic. Evidence from the literature review certainly suggests that both dyslexic and ESL individuals will show some level of literacy deficits. If their performance is comparable on typical measures of English reading and writing, then these measures may not be adequate to distinguish such individuals and further test procedures will be necessary. If the same is true of other areas of language functioning often used in assessment of dyslexia (eg, phonological processing), then again further developments in assessment procedures are called for. Data comparing dyslexic and ELS individuals on such measures should also inform views about the influence of phonology on literacy acquisition. Comparisons across groups that have learnt to read and write using a more transparent orthography should inform views on the influence of orthography on literacy acquisition. Language characteristics, such as orthography and phonology, have been shown to influence reading and spelling ability. Therefore, ESL individuals may show problems with learning English literacy that are different from those presented by dyslexics in their L1. If the difficulties presented by these two groups are different, then measures should be identifiable that distinguish the performance of these two groups. This possibility was assessed the initial investigation presented in this thesis. It focused on a comparison of adult dyslexic and ESL students as groups that can be clearly distinguished in terms of

background but who may or may not be distinguishable in terms of scores on measures of literacy and phonological ability. The focus on adults provided additional opportunities in the research to further inform views about dyslexia amongst adult students and allowed contrasts to be made between ESL individuals with a wide range of English language experience. The present thesis aimed to investigate these issues and bring these ideas together within a framework that considered theoretical, practical and cross-linguistic implications.

CHAPTER 2

Study 1: Initial comparisons between adult ESL and dyslexic students against E1L controls. Assessment of literacy and phonological skills: same or different?

2.1 Introduction

2.1.1 Dyslexia in adult students

The attainment of adequate literacy skills forms an essential component of success in education and academic life. Yet, within the UK, large numbers of individuals fail to attain the necessary literacy skills to a satisfactory level (Brooks, Pugh and Shagen, 1996; Murray, Kirsch and Jenkins, 1998). The 1998 International Adult Literacy Survey reported that 20% of the adult British population, compared to 10% of the rest of Europeans, has problems with reading and writing. Recent surveys from other adult education institutions and authorities in the UK also raise concerns that the percent of adult college-level students identified with dyslexia is growing during recent years (Singleton, 1999).

Research suggests that reading and writing problems amongst dyslexic individuals, as evidenced by poor spelling and poor performance on reading and on reading comprehension tasks, often persist into adulthood (Felton, Naylor and Wood, 1990; Miles, 1993; Patton and Polloway, 1996). In fact, it is often the case that many dyslexic students are first identified at college or at university as reading, writing and academic demands become increasingly complex (Singleton, 1999). In particular, adult dyslexics have been found to present difficulties in a number of areas of literacy and phonological processing. Evidence suggests that they are poor in reading and spelling of non-words, in processing regular and irregular words (Hanley, 1997), in word recognition (Bruck, 1993), in text reading and text comprehension (Oakhill and Cain, 1997), in their ability to make inferences from text (Simmons and Singleton, 2000), as well as in numerous phonological processing and phonological awareness tasks (Stanovich 1988; Stanovich and Siegel, 1994).

2.1.2 Distinguishing between literacy and phonological skills

Despite the fact that current definitions of dyslexia focus on problems with literacy (see British Psychological Society, 1999) and, in particular, literacy learning at the word level (i.e. problems in word reading and word spelling), it has been recognised that dyslexics often present underlying difficulties that can be found in tasks that do not require reading or spelling. Much of this evidence is found in tasks that require the processing of phonological forms. This notion is in line with the phonological processing deficit hypothesis that has found strong support from a number of researchers in the area (Snowling, Nation, Moxham, Gallagher, and Frith, 1997; Stanovich, 1988; 1998) and is currently the dominant theory in the dyslexia literature. According to the above theory, the main hypothesised cause of dyslexia centres on problems in processing basic sounds within words, commonly referred to as phonological processing problems (Stanovich, 1988; Snowling, 2000).

Measuring performance in both literacy and phonological processing areas would seem, therefore, essential for the assessment of dyslexia and may also be vital for the implementation of appropriate intervention methods for learning disabled individuals. The term literacy refers to the attainment of basic language-related skills (e.g. cognitive, intellectual or academic) required for reading and spelling. In assessment terms, this usually involves the measurement of single word reading and spelling accuracy, although measures of reading rate and text processing may also be included. Phonological skills, on the other hand, involve the ability to recognise, process, store, and manipulate phonological information. In assessment procedures, this typically requires processing of sounds at the level of the individual phoneme (individual sound units found in a language). Wagner and Torgesen (1987) argue that phonological processing can be considered as comprised of at least three distinct, though interrelated, areas: phonemic awareness, phonological recoding in lexical access, and short-term verbal memory skills. Based on such views, the assessment of phonological processing skills often includes measures requiring the awareness of sounds within words (phonological awareness), the storage of phonological forms (verbal short-term memory) and the fluent accessing and production of verbal labels (such as rapid naming).

The area of phonological processing that has been studied most extensively is phonological awareness. Phonological awareness is typically measured in tasks requiring the identification or manipulation of single phonemes (sounds). Moreover, the awareness of syllables, onsets (e.g. *s* is the onset for *set*, *sat*, etc.) and rhymes (e.g. *at* is the rhyme for *cat*, *sat*, etc.) has also been associated with reading ability, especially in younger children (Goswami and Bryant, 1990; Gough, Ehri and Treiman, 1992), and therefore may play a part in the assessment of phonological awareness skills. Phonological awareness is causally related to subsequent word reading (e.g. Wagner, Torgesen and Rashotte, 1994), although word-reading skills influence phonological awareness as well (Morais, Cary, Alegria and Bertelson, 1979).

The second area of phonological processing related to reading is phonological recoding during lexical access, which involves the ability to use symbols or pictures to access a spoken representation or word meaning (Wagner and Torgesen, 1987). This skill has typically been measured through different naming tasks in a number of studies which have demonstrated that dyslexic readers' naming speed ability for objects, letters, colours and numbers was slower when compared against matched controls (Wagner and Torgesen, 1987; Wolf and Bowers, 2000). Others have found that poor readers, compared to good readers, experience confusions in accessing the meanings of words that are spelled differently but sound the same (such as pseudo-homophones), which also reflects problems with phonological recoding and lexical access of information (see Rayner and Pollatsek, 1989 for a review).

The third area of research on phonological processing is related to the use of written symbols to access lexical referents and maintain them in working memory. Tasks measuring this ability (e.g. digit span task) focus on short-term verbal recall - the ability to process verbal items, store them for a short period and reproduce those verbal items. It has been found that good readers perform better than poor readers in recall of a wide range of verbal material, including words, digits and sentences (see Catts, 1989, for a review of this area).

The current research will draw upon the above areas of phonological processing by assessing the phonemic awareness, phonemic recoding, and short-term recall ability

of adult dyslexics and contrasting these skills with those of non-dyslexic ESL and ELL individuals. Such research is important since although the association between phonological processing skills and word reading is well established in the psychological literature (Adams, 1990; Goswami and Bryant, 1990; Gough, Ehri and Treiman, 1992) and, indeed, the phonological processing skills outlined above may be vital for the decoding of letter strings into verbal forms (non-word reading) which may aid the acquisition of literacy, the phonological deficit viewpoint is not without its problems. According to a different line of evidence, it is argued that some dyslexic individuals may present poor literacy skills despite presenting evidence of good phonological processing skills, but others may present underlying phonological deficits and still manage to be good readers and spellers (Goswami and Bryant, 1990).

2.1.3 The phonological skills of dyslexic, bilingual and monolingual individuals

Studies in the area of biliteracy have concluded that as bilingual individuals become familiar with two different phonological systems, their phonological awareness skills develop over time, and as a result they become good decoders. However, despite good phonological awareness skills and improvements in making grapheme-phoneme correspondences, a bilingual's ability to access meaning in second language texts may be impaired because of different or unfamiliar cultural schemata experienced in their first language learning. With dyslexic monolinguals, though, the opposite pattern may be predicted. Although dyslexics may be relatively good at accessing meaning from text (see Nation and Snowling, 2000), they should still show evidence of poor decoding skills and, typically, weaknesses in measures of phonological processing. Therefore, a common source of confusion for teachers working with individuals with reading difficulties is "when a learner who appears to be an expert decoder also experiences comprehension difficulties" (Deponio, Landon, Mullin and Reid, 2000, p.31). According to Cummins (1984), "in monolingual pupils discrepancies between performance for example in reading/written work and verbal skills are recognized as possible indicators of dyslexia. However, discrepancies in bilingual pupils, especially in the early stages of L2 acquisition, are viewed as part of normal development, since verbal skills require five to seven years to reach monolingual norms" (Deponio, Landon, Mullin and Reid, 2000, p.38). The present research aims to determine whether such literacy and phonological measures can reliably distinguish between adult bilinguals and monolinguals.

The relationships between literacy and phonology may be further complicated by issues of language background. Given that the impact of phonological processes on literacy has been found to vary across languages, in some languages phonological skills may play a more significant role than in others depending on the transparency of the orthography used to represent the language (Goswami, 1999; 2000). As such, it would be expected that individuals from different orthographic backgrounds will present different kinds of phonological processing and literacy problems and that individuals from different L1 language backgrounds learning literacy in a second language might be likely to present different problems from dyslexics experiencing phonological and literacy problems in their first language (Wimmer, 1993; Smythe, Everatt and Salter, 2004).

Individuals who have learnt to speak a different language from that in which they are expected to be literate will, at least for some period of their second language learning, show evidence of poor literacy skills (Alderson, 1998). In fact, reading difficulties are common sources of problem in the process of second language learning for many individuals. Particularly, difficulties that bicultural readers present are often slow reading rate and lower comprehension ability (Alderson, 1998). Research suggests that like dyslexics, bilingual individuals take considerably longer to read text in their second language than they would in their first language and that they have difficulty understanding text in a second language despite sufficient grammatical and syntactic knowledge as well as adequate vocabulary (Alderson, 1998). It would seem, however, that poor reading comprehension in a second language is not solely dependent on the above factors as it is a complex issue that may have other causes, which will be investigated in more detail in a later study.

2.1.4 Issues and problems in the assessment of L2 reading and writing difficulties amongst bilinguals

A common problem within the bilingual literature is in which language the assessment of literacy difficulties should be performed. Should it be in the first language that the individual will be most likely to feel more comfortable with, or should it be in the second language where the difficulties are actually manifested? And if there are reading or writing problems evident during any stage in the process of

second language learning, then do such problems reflect problems in one's L1 as well? Some have argued in favor of performing "dual language assessment" (i.e. in both languages), yet others argue that assessment of reading and writing difficulties should be "differential"(in one language only) (Ocampo, 2002). Evidence as to which assessment approach needs to be employed appears to be inconclusive. Yet, according to some researchers in the area, assessment in L1 is of paramount importance for identifying literacy deficits in the L2 (Ocampo, 2002), particularly if the aim of an assessment is to identify potential causes for literacy deficits.

Another equally important question that needs to be addressed is what kind of skills should be assessed to identify literacy deficits in the second language. Consistent with the evidence outlined above, Ocampo (2002) reports that phonological processing deficits were common amongst children who were monolingual English poor readers and those who were Filipino-English bilingual poor readers. Such phonological deficits were more often and more easily detected than any other deficits. However, despite this being a good initial starting point for assessments, it is still not clear whether other measures need to be included in such assessment procedures. Should we, for example, assess non-verbal abilities or general language abilities? Selecting the most appropriate tests to identify literacy deficits and determine their potential cause(s) in specific L1 and L2 populations is vital for providing meaningful results and reducing the burden of test taking. Despite the availability of screening/assessment tools that have been developed to aid the process of identification of deficits and potential cause(s) in monolingual groups (for example, in the UK, see: Fawcett and Nicolson, 1996; Frederickson, Frith and Reason, 1997; Miles, 1993; Newton and Thomson, 1976), there is a lack of appropriate procedures for use within a multilingual context (see discussions in Cline and Shamsi, 2000). At present, no purpose-made 'bilingual' tests have been developed. Indeed, such tests would seem to be almost impossible to envisage given our current level of understanding. Two of the main obstacles to the development of such procedures have been the difficulty of assessing across different languages (including suitably trained testers who are able to administer procedures in the language of assessment) and the effects that second language learning may have on literacy skills independent of (and potentially obscuring) any assessment of dyslexia (see Cline and Reason, 1993; Peer and Reid, 2000; Smythe and Everatt, 2002).

2.1.5 Aims and questions

This initial study incorporated adult dyslexic, ESL and E1L monolingual populations and contrasted their performance across different areas of literacy and phonological processing. It sought to determine whether different literacy and phonological measures that have been widely used for assessment of learning disabled individuals can distinguish between dyslexics and ESL performance as well as identify specific areas of strengths and weaknesses between the two groups.

For the purpose of this research individuals who have learnt English-as-a-Second-Language (ESL) were distinguished from individuals for whom English was their L1 (E1L dyslexic and non-dyslexic). The specific research question that formed the basis for the present study was do ESL individuals present the same sort of literacy and phonologically-based difficulties with dyslexics or are they different?

The aim of this initial assessment study was therefore to contrast the performance of adult students with English-as-a-second-language (ESL) with English-as-a-first language (E1L) adult students with and without specific literacy difficulties on a number of literacy and phonological measures. A secondary aim was also to test whether standardised measures of literacy and phonological processing used to distinguish between adult dyslexics and non-dyslexics are also able to distinguish between dyslexic individuals and those with English-as-a-Second-Language (ESL). More specifically, the study aimed to compare these three groups across different areas of literacy, including spelling, reading comprehension and proof-reading ability, as well as on their underlying phonological abilities using tasks like non-word reading, rapid naming, pseudo-homophone and digit span.

2.2 Method

2.2.1 Participants

Thirty-eight ESL individuals were compared with 22 E1L dyslexics and 36 E1L non-dyslexics. All participants in this study were adult Higher Education (HE) college-level students who were undertaking undergraduate or postgraduate courses within the institutions at which they were studying. All completed a self-report questionnaire,

which was used to determine background details and to ensure appropriate classification to groups.

Participants comprising the E1L dyslexic group were recruited via special needs units within the institutions where the study was performed. All were receiving special needs support within their higher education institution and had a record of prior assessment for dyslexia. Of these 22 individuals, 11 were female and 11 were male. They had a mean age of 24.09 (SD 5.63). All E1L dyslexics reported having a history of literacy problems on the self-report questionnaire and indicated that they were still experiencing such problems.

Participants from the E1L non-dyslexic control group were an opportunity sample taken from the same institutions as the previous group. All reported that English was their first language and that they did not have a history of learning difficulties or learning support. Of the 36 individuals in this group, 20 were female and 16 were male. They had a mean age of 23.92 (SD 6.72).

ESL individuals were recruited via advertisements in language units specifically for those from non-English backgrounds within the same institutions as the two groups above. The self-report questionnaire indicated that this group comprised students from various first language backgrounds (including German, Italian, Greek, Chinese and Arabic) and therefore formed a mixed first language group. All reported that they had learnt English as a second language. The majority (32 participants) stated that they had been learning and/or using English over a period of at least seven years prior to the study. All the participants had spent a minimum of one year studying in an English language Higher Education institution, even those who were recruited from first year undergraduate courses. The group comprised 18 males and 20 females and had a mean age of 24.47 (SD 5.21).

2.2.2 Measures

All individuals from the three groups were assessed in terms of their literacy skills and underlying phonological abilities. All the measures used to determine these

abilities were in English and were developed for the purposes of this study after they were piloted on a group of Higher Education monolingual/bilingual students.

A. Measures of literacy

2.2.2.1 Reading comprehension task

Participants were given seven fictional passages to read silently to themselves. After reading each passage, the participants were required to read and answer five comprehension questions. These questions required an understanding of specific details contained within the passage and to make inferences based on those details (e.g. 'Think of an appropriate title for the passage'). Responses were written by the participant but required one word, typically yes/no, or a short phrase (two or three words) answers. Passages and questions were developed based on those used in the NFER Reading Comprehension Test (1975). Responses were marked correct or incorrect based on their appropriateness in answering the question. Yes/No answers were simply coded as correct/incorrect. Short phrase answers were marked as correct if they were considered to be an appropriate/acceptable answer to the question by the researcher. Scores were based on the number of comprehension questions out of a total of 35 correctly answered.

2.2.2.2 Single-word spelling task

In this task participants were verbally presented with a list of 25 English words, both in isolation and within a sentence context, and were asked to spell the words as accurately as possible. Written responses were required and no time limit was imposed on this task. Scores were obtained based on the total number of words spelt correctly (out of 25). The test items for this task were from the Helen Arkell Spelling Test battery (Brooks and McLean, 1998).

2.2.2.3 Proof-reading task

In this task participants were given 2 fictional passages to read each with 10 errors. They were presented with one sentence at a time rather than with the whole passage. The spelling errors included in each sentence comprised incorrect syntax/grammar (e.g. 'Brian's mother asked him to helped her clean the cupboard'). Participants were asked to identify the errors and correct them by changing one or two words within the

sentence. Scores were based on the total number of errors (out of a maximum of 20) corrected across the two passages. The items included in this task (some were eliminated in order to reduce the total number of items) were from Brook's (2003) spelling test battery (personal communication with author).

B. Measures of phonological processing

2.2.2.4 Pseudohomophone task

In this task participants were presented with a series of letter strings and were asked to choose which of the 2 words within each word pair sounded like a real word or not (e.g. in the pair 'splab phocks', the correct answer is 'phocks' because it sounds like the word fox). Scores were based on the number of letter strings (out of a total of 14 pairs) correctly chosen. The test items were also from Brook's (2003) spelling test battery.

2.2.2.5 Auditory short-term memory task

This task followed the typical procedure for digit span tasks used in the literature (e.g., Miles, 1993). Participants were verbally presented with sequences of digits that they were instructed to repeat. Sequences started with two digits and increased by one digit after every two items unless two errors were made at that sequence length, in which case the test was stopped. Scores were based on the number of sequences correctly reproduced.

2.2.2.6 Non-word reading (decoding) task

In this task participants were presented with a sheet of paper containing a list of 25 novel letter strings developed by the researcher that were pronounceable using English grapheme-phoneme conversion rules but which were not in the English language (e.g., 'jint' 'strale' 'tegwop' 'bemonthrate'). Participants were required to read through the list as quickly as possible, pronouncing each letter string aloud to the tester. The time taken to complete the list of 25 non-words was used as the measure for this task. Although the dyslexics would be predicted to show deficits in non-word reading accuracy, time was used as an assessment measure given the likelihood of ceiling effects on accuracy scores amongst the E1L control participants and the possibility of similar effects amongst the ESL students. Such ceiling effects may

obscure differences between these groups. However, time measures were less likely to lead to such problems.

2.2.2.7 Rapid naming task (objects)

This task requires participants to retrieve familiar phonological codes from long-term memory. Participants were visually presented with line drawings of four familiar objects (house, ball, clock and elephant) (Smythe, 2002). Familiarity with the objects and their common English names was checked prior to testing. These were randomly arranged on an A4 size paper with each object being represented several times to produce 25 line drawings in total. Participants were required to name the items as quickly as possible, with scores being based on the time taken to name all the objects. Errors in naming were noted, but uncorrected errors comprised only a small number across all three groups and were not incorporated into the assessment measure.

2.3 Results

Table 2.1 presents the average performance of the three groups on the measures of literacy and phonological processing. One-way analyses of variance (ANOVA) were performed on each of these measures to investigate any significant effects of group on these scores (see Table 2.1). Post-hoc pairwise comparisons were then performed to identify which individual groups differed from which when a significant Anova was found (see Table 2.2). Figures 2.1, 2.2 and 2.3 provide graphical representation of these results.

Table 2.1 Mean scores (with standard deviations in parentheses) for each group on each of the measures, with the results of the analyses of variance

	E1L Control	E1L Dyslexic	ESL	ANOVA (df=2,93)
Comprehension	24.25 (5.02)	19.82 (5.93)	16.11 (7.86)	F=14.61 p<.001
Spelling	20.81 (2.82)	15.50 (4.82)	17.76 (3.57)	F=15.53 p<.001
Proof-reading	16.53 (2.68)	10.09 (4.16)	12.84 (4.31)	F=21.48 p<.001
Pseudohomophone	11.86 (2.27)	7.82 (2.82)	11.00 (2.64)	F=17.94 p<.001
Auditory STM	11.28 (2.17)	7.27 (2.51)	10.29 (2.30)	F=21.25 p<.001
Non-word reading	24.75 (7.77)	44.91 (16.86)	28.39 (8.58)	F=25.46 p<.001
Rapid naming	25.83 (7.22)	32.36 (6.73)	35.76(11.59)	F=11.16 p<.001

Table 2.2 Post-hoc pairwise comparisons for each of the measures

	Control vs Dyslexic	Control vs ESL	Dyslexic vs ESL
Comprehension	p<.05	p<.05	NS*
Spelling	p<.05	p<.05	NS
Proof-reading	p<.05	p<.05	p<.05
Pseudohomophone	p<.05	NS	p<.05
Auditory STM	p<.05	NS	p<.05
Non-word reading	p<.05	NS	p<.05
Rapid naming	p<.05	p<.05	NS

*P values >.05 are marked as non-significant

Figure 2.1 Average performance of the three groups on the measures of reading comprehension, spelling and proof-reading

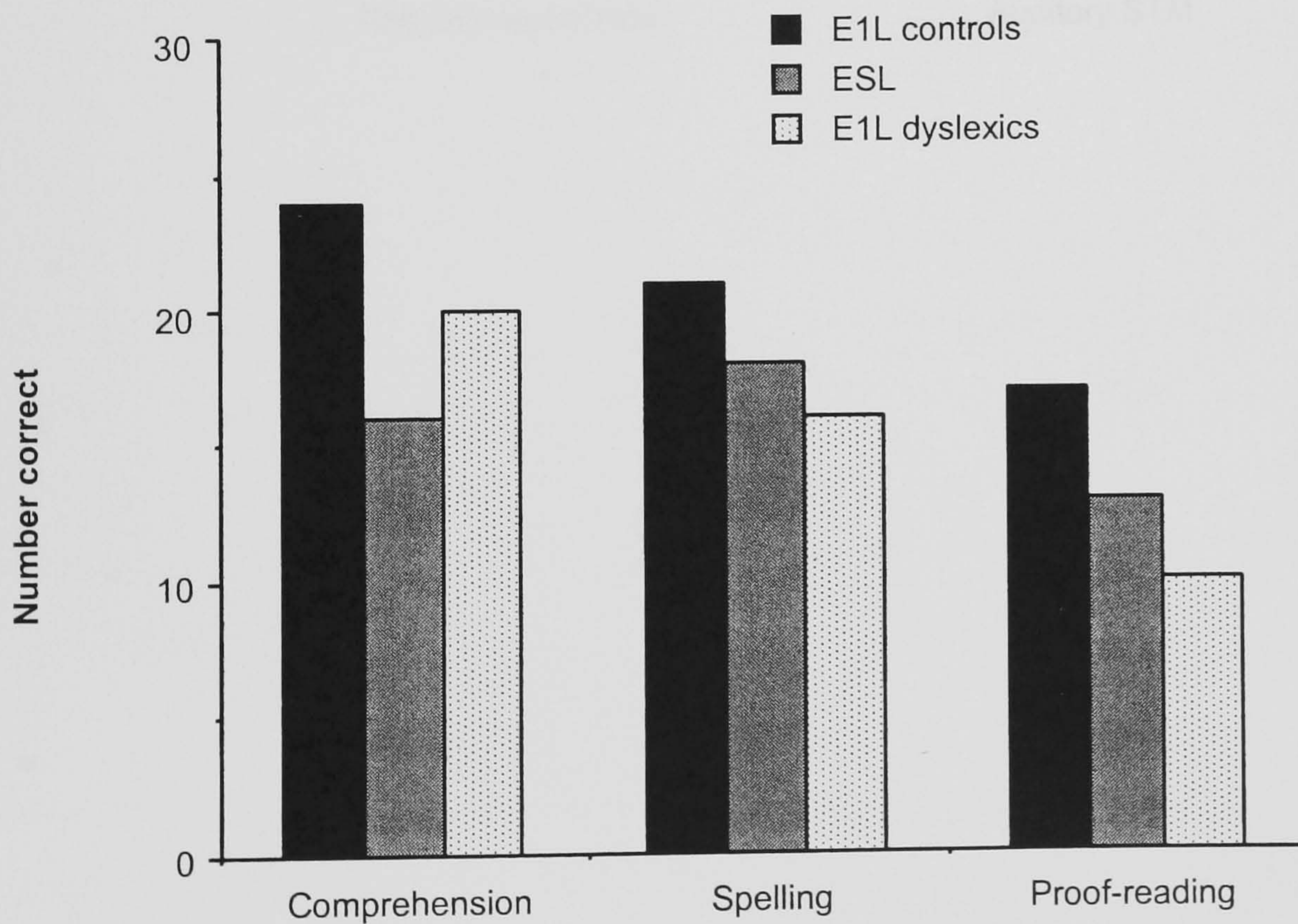
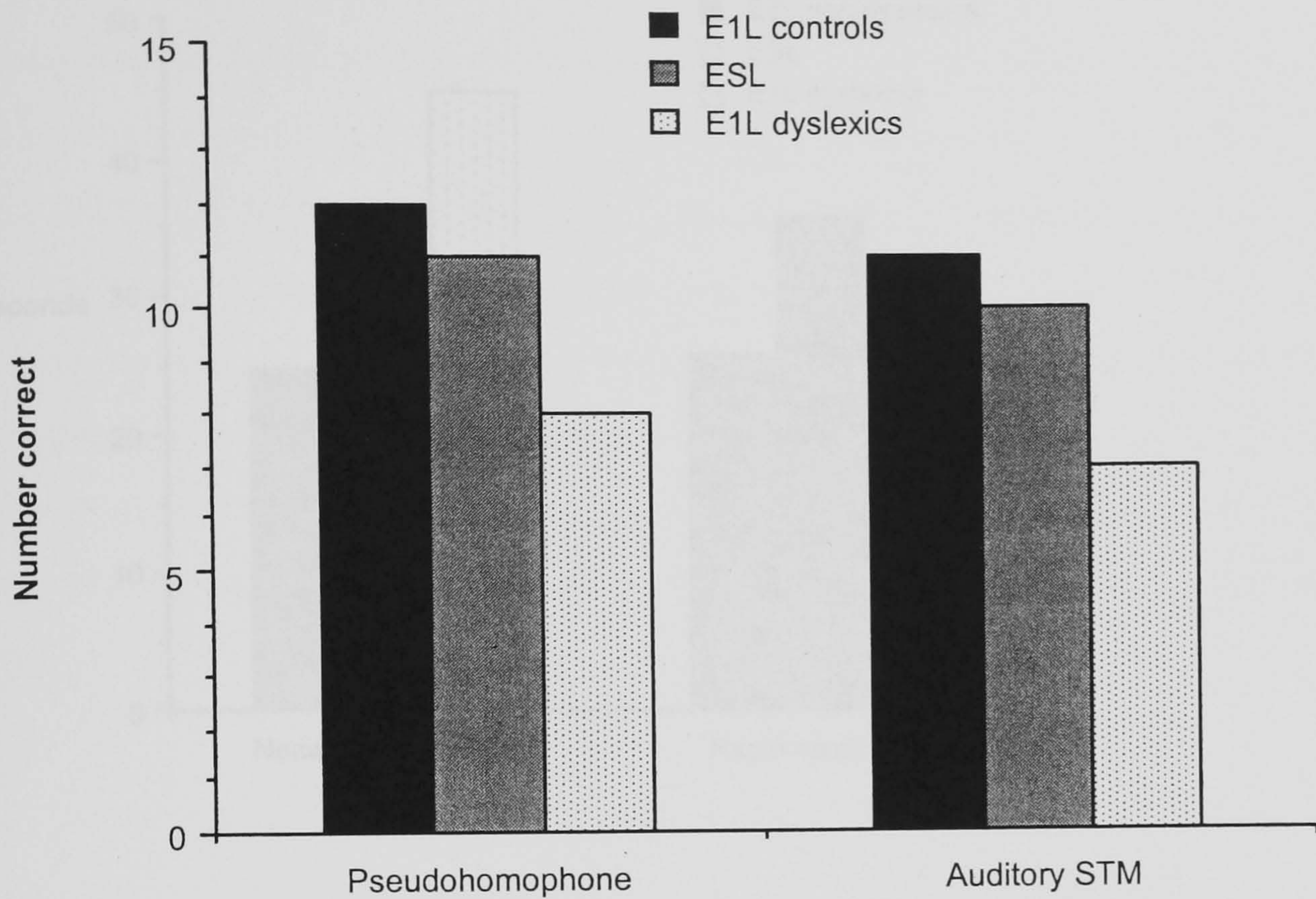


Figure 2.2 Average performance of the three groups on the pseudohomophone task and the auditory short-term memory (STM) task

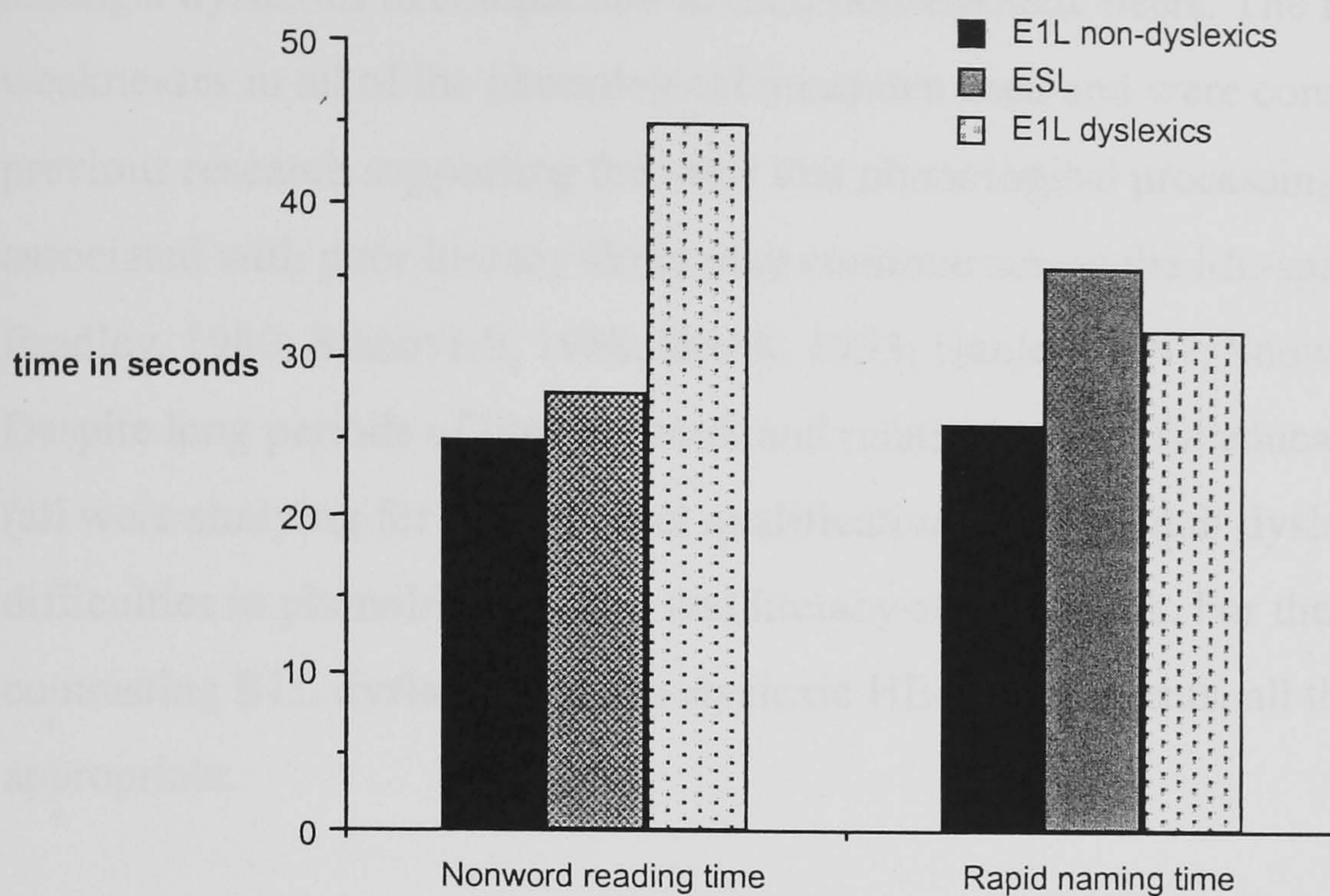


Overall, these findings indicated that the ESL individuals performed at a similar level to the E1L dyslexics in most of the phonological measures (although the ESL students were slightly better pseudo-readers than the dyslexics), but performed worse than the E1L controls in most of the measures of phonological ability. The exception to this general pattern was that of rapid naming of familiar objects. Here the ESL and dyslexic groups were significantly worse than the E1L controls.

2.4 Discussion

The findings of this study indicated weak links between the ESL controls and E1L dyslexics on all measures of phonological ability. There were significant differences from the E1L controls on the orthographic, orthographic-phonological, and phonological measures between ESL students and E1L dyslexics on most of the phonological measures (in the exception of rapid naming of familiar objects) and on the orthographic measures, although in the pseudo-reading task the ESL students performed slightly better than the E1L dyslexics as indicated by the orthographic-phonological measures.

Figure 2.3 Average times of the three groups in the non-word reading and rapid naming tasks



Overall, these findings indicated that the ESL individuals performed at a similar level to the E1L dyslexics in most of the literacy measures (although the ESL students were slightly better proof-readers than the dyslexics), but performed more like the E1L controls in most of the measures of phonological ability. The exception amongst the measures was that of rapid naming of familiar objects. Here the ESL and dyslexic groups were significantly worse than the E1L non-dyslexics.

2.4 Discussion

The findings of this study indicated significant differences between the E1L controls and E1L dyslexics on all measures, whereas the ESL students differed significantly from the E1L controls on the literacy measures and rapid naming. Differences between ESL students and E1L dyslexics were identified on most of the phonological measures with the exception of rapid naming, but less so on the literacy measures, although in the proof-reading task there was evidence for the ESL students to be better than the E1L dyslexics at identifying syntactic/grammatical errors.

The results supported previous research with reading disabled adults in demonstrating low levels of phonological awareness, auditory short-term memory, speeded naming, non-word reading, spelling syntactic understanding and reading comprehension ability amongst dyslexics in comparison to their non-dyslexic peers. The findings indicated weaknesses in all of the phonological measures used and were consistent with previous research supporting the view that phonological processing deficit being associated with poor literacy skills may continue across the life-span (Bryant and Bradley, 1980; Stanovich, 1988; Bruck, 1993; Hanley, 1997; Snowling, 1995). Despite long periods of literacy work and relative successful educational experiences (all were studying for degree-level qualifications), these adult dyslexics still presented difficulties in phonological tasks and literacy-related skills. For the purposes of contrasting E1L dyslexic and non-dyslexic HE-level students, all these measures seem appropriate.

However, the specific comparisons of interest were those involving ESL students. In the literacy measures assessing spelling ability, reading comprehension and an understanding of syntax/grammar, the ESL students performed significantly worse than the E1L controls and were not significantly better than the E1L dyslexics in spelling nor comprehension. Only when the task required the identification/correction of syntactic/grammatical errors were the ESL students significantly better than the E1L dyslexics. Such evidence would suggest that the two groups cannot be distinguished simply in terms of their reading comprehension and spelling ability. Indeed, the ESL students' comprehension scores were marginally less than the dyslexics, possibly due to a weakness in fully understanding the context of the passages (which could have been culturally biased towards UK born individuals) or second language weaknesses leading to limited inference making strategies. Future studies may need to better control for text complexity and cultural bias in reading comprehension tests as a way of establishing whether ESL individuals may have found the passages which were in their L2 hard in terms of language content/vocabulary or familiarity of theme - these possibilities will be considered further in subsequent studies in this thesis. Whatever the reason for these potential difficulties amongst the ESL population, the findings of this study indicate that distinguishing ESL students from dyslexics may require assessment procedures that rely on more than simple literacy measures.

In contrast to the findings obtained for the literacy measures, the ESL students performed better than the E1L dyslexics and roughly at the same level as the E1L controls across most of the phonological tasks used in this study. In comparison to the ESL students, the dyslexics were poorer in the areas of phonological awareness (pseudohomophone task), auditory short-term memory ability (digit span task) and decoding (non-word reading time) and these measures would seem to be ideally suited to distinguish these groups of individuals. It was only in the measure of the rapid accessing of familiar names from long-term memory (i.e., rapid naming of objects) that the performance of the ESL students indicated weaknesses compared to the E1L controls and at a level comparable, if not worse, than that of the dyslexics.

Problems with the rapid accessing of English words may indicate that the ESL individuals have not yet fully developed the automaticity skills required for automatic access of words from their L2 verbal lexicon. This may be due to inadequate English language experience or level of L2 proficiency and may reduce or disappear with increased exposure or improved language skill. Further work is necessary to determine the reason for this specific area of deficit amongst the ESL students, but accessing names in an L2 may be a relative slow process even for those with good experience of the second language. The thesis will return to this issue in later studies where naming of digits will be added to this task to test whether the effect of rapid naming is specific to objects. Retrieval of the names of specific objects involves a whole set of names that need to be accessed from the lexicon, which is not expected to be true for digits where access is restricted to only nine names. Yet, an important point is that this ESL naming deficit identified may be qualitatively different from that experienced by the dyslexics whose relatively slow performance on the rapid naming task was more likely the result of their underlying phonological deficits consistent with the poor performance in the other phonological measures used in the study. The same causal hypothesis can be speculated upon in the case of the literacy measures.

Consistent with the proposed cause of literacy weaknesses amongst dyslexic individuals discussed in the general introduction (Chapter 1), weaknesses in underlying phonological processing skills manifest in poor pseudoword/nonword processing and these are associated with poor literacy skills in general. Difficulties

with non-word reading reflect problems with the ability to make the correct grapheme to phoneme conversion processes, namely problems with translating a written symbol or grapheme into its corresponding phonological form or phoneme (see also Hanley, 1997). Such deficits may not be experienced by ESL students who have appropriate phonological skills (possibly developed during first language acquisition) to map graphemes and phonemes in their L2. As such, it may be that poor phonological skills are related to literacy deficits even for those whose language skills are not greatly developed, a view that has been derived from work involving younger cohorts of participants (see Frederickson and Frith, 1998; Everatt et al, 2000; Geva and Seigel, 2000).

In terms of assessment procedures, the findings suggest that an appropriate procedure for distinguishing dyslexic students from non-dyslexic with English as a first or second language is to combine literacy ability assessments with measures of underlying phonological skills. Measures of literacy ability can clearly distinguish dyslexic and non-dyslexic individuals with English as their first language; however, it is only when these literacy deficits were combined with weaknesses in phonological skills that the dyslexics could be distinguished from those with English as a second language. This study highlights the importance of identifying appropriate and reliable assessment procedures that can be used as evidence for the underlying reasons for literacy difficulties amongst adults, so that the correct support programmes can be implemented (see discussion in Everatt et al, 2002).

However, further investigation of other areas of literacy and phonological processing is needed to gain a deeper understanding of the nature of difficulties presented by ESL and dyslexic individuals and establish whether the specific deficits identified in this initial assessment study actually reflect reading-related or language-related problems for ESL individuals. If such deficits were found to be language-related, then would the degree of language experience be likely to impact on the ESL phonological abilities and literacy skills? If on the other hand, the deficits identified in this initial assessment were to be reading-related, then would we expect that certain reading sub-skills (or certain skills related to reading) would be more likely to impact on literacy in the same group of individuals? The studies that follow attempted to answer the above questions.

CHAPTER 3

Study 2: Assessment of high and low-proficiency ESL and dyslexic students on measures of literacy and phonological processing

3.1 Introduction

3.1.1 Literacy and bilingualism

Study 1 provided an initial assessment of dyslexics and ESL adult students' literacy and phonological abilities and identified literacy deficits specific to each group. To further identify the nature of such deficits study 2 was carried out, which aimed to more closely investigate reading and phonological skills with a particular focus on the role that language experience may play in the performance on reading and phonological-based tasks.

Research suggests that reading skills and phonological awareness, the ability to manipulate sounds within words, develop with language experience, by gaining adequate vocabulary knowledge and exposure to print (Lieberman, 1997). Yet, it has been shown that phonological processing deficits amongst dyslexic individuals may carry across their life span and can impede the process of normal reading development as well as the different stages associated with this process. The reading skills of ESL individuals, however, are said to develop as their L2 proficiency increases (Alderson, 1998) (see discussion in the general introduction of the thesis).

Adults' first and second language abilities and disabilities have been studied in the context of different kinds of skills. These are listening, speaking, reading and writing, and possibly a fifth general cognitive skill, thinking. The first two are named oracy skills, whereas the latter two literacy skills. Listening and reading are viewed as receptive skills, whereas speaking and writing are considered to be productive skills. Distinguishing between these different language skills is important for bilingual populations especially for assessment purposes. Some may speak a language, for example, but not be able to read and/or write. Others may be able to understand a language spoken in specific contexts (for example, academic or during social interactions), and read yet they cannot speak or write in that particular language

(Baker, 1993). Research has further focused on bilinguals' specific language sub-skills that develop together or as a result of attaining the above skills like pronunciation, vocabulary knowledge, grammar knowledge etc.

Some bilinguals may be competent in one language, but still be in the process of learning the other language, that is still being in the process of becoming a bilingual ('semilingualism'). The above idea is illustrated in the following:

“it appears crucial to distinguish between language learners in an academic setting who do not usually interact socially with their two languages and who therefore are not really bilingual (at least yet), and people who are acquiring a language in a natural environment and who are using both languages on a regular basis. The former should be characterised as “language learners”, and maybe not as “novice” or “non fluent” bilinguals, at least until they start using both languages on a regular basis” (Grosjean, 1998, p. 136). Others may be able to understand a language spoken in specific contexts (for example, academic or during social encounters-interactions) and read, yet they cannot speak or write in that particular language (Baker, 1993). Research has further focused on bilinguals' specific language sub-skills that develop together or as a result of attaining the skills such as pronunciation, vocabulary knowledge, grammar knowledge, etc. The level of competence across each one of the four different language skills may therefore vary across time and as a result of changing or adapting to a new social context/linguistic environment (Grosjean, 1998). What we always have to keep in mind is that bilinguals are also "bicultural" individuals (Grosjean, 1998, p.133). The cultural context in which our ESL populations were attaining their L2 literacy skills was therefore taken into account for this research programme. Although the ESL individuals recruited for the studies had not attained those skills within a 'natural' environment, i.e. in the U.K but in their country of origin, it was assumed that they were using English as part of their social and academic requirements and were subsequently engrossed at the specific cultural context at the time of testing.

Ideally, studies with bilingual readers should directly compare first and second language reading ability using the same group of individuals. Another issue has to do with matching groups. While it is possible to draw inferences about the second language reading of each individual group, it is difficult to make direct comparisons

between ESL and E1L learners, since the proficiency levels of the groups are often disparate. However, having participants from a broad range of proficiency levels and using sensitive second language proficiency measures in order to more clearly relate language proficiency, first language reading, and second language reading comprehension are ways in which such methodological concerns can be overcome.

Studies in the area of biliteracy have concluded that as bilingual individuals become familiar with two different phonological systems, their phonological awareness skills develop, and as a result, they become good decoders. Although bilinguals typically present no problems with their phonological awareness skills or problems in making grapheme-phoneme correspondences in their L2, their ability to access meaning in L2 texts can be impaired because of different or unfamiliar cultural schemata experienced in their first language learning. With dyslexic individuals, though, we find the opposite pattern; although they are good in accessing meaning from text they are poor in decoding and in phonological awareness skills (Kroll et al, 2002).

3.1.2 Rapid naming

Research has demonstrated that dyslexic individuals present difficulties in rapidly naming letters, digits and objects when compared to controls matched for reading age. This naming speed deficit is, according to some researchers, characteristic of phonological awareness and decoding deficits and does not seem to be influenced by the amount of exposure to print or to reading level (Adams, 1990; Wolf and Bowers, 1999). A number of studies have investigated the role of phonological awareness and naming speed in reading development, but the evidence is rather inconsistent as there is no clear support for the claim that naming speed develops independently from phonological awareness skills and whether the two variables make independent contributions to the development of reading ability in normal and reading disabled individuals (Cronin and Carver, 1998).

Research has indicated that group differences between normal and disabled readers in rapid naming lie in the time interval between the response to one stimulus and the response to the next. This time interval involves a number of processes like: a) inhibiting the response to the previous stimulus, b) shifting the system to anticipate

and respond to the current stimulus, c) perceiving the current stimulus, and d) accessing and retrieving a verbal label (Wolf and O'Brien, 2001).

Cross-language similarity of lexical features seems to facilitate naming performance when there is a straightforward correspondence between orthography and phonology between the two languages (Kroll et al, 2002). Kroll et al (2002) discuss the view that "when bilinguals had to switch between languages in naming numbers, there were larger switch costs into L1 than into L2" (p. 165). They explain that L1, which is more active, becomes inhibited at the cost of L2 production, so that when L2 readers need to switch from one language to the other, this can lower their actual processing speed.

3.1.3 Aim and rationale for research

This study aimed to explore whether the level of language experience impacts on the literacy and phonological skills of ESL individuals. The study focused on literacy and investigated the role of language experience on reading both at the word and text level as well as reading comprehension. Areas of reading that were of interest in this study were, in particular, the different ways individuals of different language proficiency levels process single words as well as how well they are able to comprehend easy and hard text.

For the purposes of this study, the ESL students were selected on the basis of their language experience, that is, how many years they had been speaking English as a second language. For inclusion in the high-experience of English language group, the rather conservative criterion of 7 years or more of L2 experience was used, according to which L2 readers should have reached an appropriate level of L2 acquisition (see Cummins, 1979). Half of the ESL individuals that participated in this study formed a high-experience of English group (with more than 7 years of English language experience) and half formed a low-experience of English group (with less than 7 years of English language experience).

The performance of adult high and low-experience ESL students was compared with E1L monolingual adult students with and without specific literacy difficulties (dyslexia). In particular, the main focus of this study was to assess the four groups

across different areas of reading, text reading accuracy, text reading speed, text comprehension and a single word reading test. A secondary aim was to test whether the four groups, namely English dyslexic, non-dyslexic and high and low-experience ESL individuals differ in terms of the rapid naming of digits.

3.2 Method

3.2.1 Participants

Groups of E1L non-dyslexic (N=60), E1L dyslexic (N=26) and ESL (N=55) adult students were tested in this study. All participants were adult college-level students studying for a range of qualifications up to and including postgraduate level - the same colleges were used to sample participants for all groups. Similar sampling procedures were used in this study as in Study 1. All participants completed a self-report questionnaire to ensure appropriate classification into groups.

Participants in the E1L control group comprised an opportunity sample and were all first language English speakers who reported no history of literacy difficulties. Of the 60 participants in this group, 20 were male and 40 were female. The average age of students in this group was 21.98 (SD 5.45).

Dyslexic individuals were obtaining special needs provisions in the additional learning support unit within the institutions where they were studying. All reported past and current literacy difficulties. Of the 26 participants in this group, 9 were male and 17 were female. The average age of students in this group was 22.35 (SD 7.37).

ESL individuals came from a range of language backgrounds (Spanish, Italian, Greek, German, Chinese, Malay and Farsi) and therefore comprised a mixed first language group. All reported learning English as a second language and had spent at least one year studying in an English language Higher Education institution. None reported having any history of literacy difficulties. These 55 ESL individuals were divided into those with 7 or more years of English language use (high experience of ESL group, N=27) and those with less than 7 years of English language use (low experience of ESL group, N=28). Of the 27 high experience ESL students, 8 were male and 19 were

female. The average age of these participants was 22.22 (SD 3.69). Of the 28 low experience ESL students, 9 were male and 19 were female. The average age of these participants was 21.68 (SD 4.48).

3.2.2 Measures

All four groups of individuals were assessed on their reading skills and rapid naming ability in English. Reading was assessed by measures of single-word reading and text reading, with accuracy being determined in both cases. In addition to accuracy, text reading was also measured in terms of rate of reading and reading comprehension. Digit naming was used in the rapid naming task.

A. Measures of reading

3.2.2.1 Single-word reading task

The British Abilities Scale (BAS; Elliot, Smith and McCulloch, 1996) reading measure was used to assess participants' reading accuracy and decoding skills at the single word level. Procedures and scoring was taken from the test manual. In the test, participants were presented with a list of 90 low and high-frequency single words of increasing difficulty (both in terms of meaning and vocabulary) and were asked to read them aloud as accurately as possible. Scores were obtained based on the time taken and the total number of words read correctly (out of 90).

3.2.2.2 Text reading task

The Adult Reading Test (ART; Brooks, Everatt and Fidler, 2004) was used to assess participants' text reading and procedures and calculations of test measures were taken from the test manual. In this task participants were asked to read 7 fictional passages aloud so that reading errors could be recorded. Reading errors were used to assess text reading accuracy. This was calculated for each passage as 15 (the maximum number of errors permitted in a passage before testing is stopped) minus the number of errors produced. The totals for each passage completed were then combined to produce a single measure for each student. There was no time limit imposed on reading of the texts, although time was recorded to look for differences in speed of reading. Again the number of words read per minute of time was calculated across all the passages completed, giving a single score for each participant.

After reading each passage, participants were asked a series of comprehension questions about the text. Participants were not allowed to re-read the passage while answering the questions. The total number of comprehension questions answered correctly across all passages completed was used as a single score for each student. However, for the purposes of this study, the 7 passages were divided into two sets. This distinction was made based on the Simmons and Singleton (2001) finding that a significant effect is more likely to occur in inference and recall type questions when readers were reading hard text but not easy text. So, based on this argument, the first four passages were categorised as easy (these were generally shorter passages with reading levels of grade 7 or below) and the final three were categorised as hard (these were longer passages with reading levels equivalent to grades 11 or 12). The different types of comprehension questions included in the test were therefore considered separately in the analysis. These questions were designed to assess participants' memory for specific details in the text, recall of factual/literal information from the text, and ability to make inferences about the text. The difference between the first two types of questions was that memory questions required a specific answer and no other answer could be correct, whereas factual questions required recall of information in the text but could be answered in several ways as long as the fact was imparted in the answer. Exact memory is required in the first case whereas memory of an idea stated in the text is required in the second. The differences between these questions and the final type of question was that, unlike the factual and memory questions, the inference questions were not explicitly stated in the text and, therefore, had to be inferred from information contained in different phrases within the passage (See appendix 2 for full text excerpts and examples of the different types of comprehension questions).

B. Rapid naming measure

3.2.2.3 Rapid naming (digits)

Rapid naming was assessed using the digit naming task from the Phonological Assessment Battery (PhAB; Frederickson, Frith and Reason, 1996). In this task participants were asked to read out two rows of 50 randomly ordered digits. Responses were timed to produce a rapid naming speed score.

3.3 Results

Table 3.1 presents the average performance of the three groups on the measures of single-word and text reading and rapid naming of digits. One-way analyses of variance (ANOVA) were performed on each of these measures to investigate any significant effects of group on these scores (see Table 3.1). Post-hoc pairwise comparisons were then performed to identify which individual groups differed from which when a significant Anova was found (see Table 3.2). Figures 3.1 to 3.5 provide a graphical representation of these results.

Table 3.1 Mean scores (with standard deviations in parentheses) for each group on each of the measures with the results of the analyses of variance

	E1L Control	E1L Dyslexic	ESL (high)	ESL (low)	ANOVA (df=3,137)
Single-word	85.40 (6.03)	78.12 (13.07)	84.59 (4.03)	79.14 (8.75)	F=7.36, p<.001
Text accuracy	91.22 (15.07)	64.12 (25.81)	80.89 (25.27)	59.00 (30.88)	F=16.29, p<.001
Text rate	153.02 (37.83)	124.08 (40.49)	146.41(28.84)	119.96 (20.89)	F=8.37, p<.001
Comprehension	39.63 (9.63)	33.69 (13.15)	35.33 (10.81)	30.57 (10.79)	F=5.05, p<.05
Rapid naming	34.62 (8.34)	41.85 (10.84)	39.78 (9.15)	42.79 (10.19)	F=6.04, p<.001

Table 3.2 Post-hoc pairwise comparisons for each of the measures

	Contr vs Dysl	Contr vs ESLh	Contr vs ESLl	Dysl vs ESLh	Dysl vs ESLl	ESLh vs ESLl
Single-word	p<.05	NS	p<.05	p<.05	NS	p<.05
Text accuracy	p<.05	NS	p<.05	p<.05	NS	p<.05
Text rate	p<.05	NS	p<.05	NS	NS	p<.05
Comprehension	NS	NS	p<.05	NS	NS	NS
Rapid naming	p<.05	p<.05	p<.05	NS	NS	NS

On the literacy measures, ESL students with more than 7 years of English language experience performed at a level consistent with the E1L non-dyslexics, whereas those

ESL individuals with less than 7 years experience were similar to dyslexics. Yet, both ESL groups performed as poorly as the dyslexics on the rapid naming task.

Further analyses concentrated on potential differences between the groups in terms of the type of comprehension questions and passage difficulty. Two types of comprehension questions were compared in these analyses. Comprehension questions were separated depending on whether they required memory of facts or details (factual and memory questions--see Method section 3.2.2.2 above) or whether they required inferences to be made about the text. Additionally, as described in the Method section (see section 3.2.2.2), the seven passages were divided into relatively easy and hard categories, following the procedure outlined in Simmons and Singleton (2001). The different number of questions in these categories of comprehension question meant that the proportion of correctly answered question types was used as the dependent variable in the analyses. Separate ANOVAS were performed on the two categories of passages, one for easy texts and one for hard texts (the results are presented in Table 3.3). Mixed analyses of variance were also performed, treating group (four levels) as a between subject factor and type of comprehension question (two levels) as a repeated measures factor.

Table 3.3 Mean proportions (with standard deviations in brackets) for each group on the different categories of comprehension questions

	Easy text		Total (recall & inference)	Hard text		Total (recall & inference)
	recall	inference		recall	inference	
E1L Control	0.45 (0.10)	0.55 (0.08)	0.49 (0.69)	0.43 (0.10)	0.45 (0.10)	0.44 (0.69)
E1L Dyslexic	0.42 (0.15)	0.48 (0.16)	0.45 (0.11)	0.39 (0.16)	0.31 (0.13)	0.34 (0.97)
ESL(high)	0.42 (0.11)	0.53 (0.10)	0.47 (0.69)	0.36 (0.12)	0.37 (0.13)	0.36 (0.92)
ESL (low)	0.36 (0.10)	0.45 (0.09)	0.40 (0.59)	0.31 (0.14)	0.32 (0.08)	0.31 (0.81)
Total average score	0.42 (0.11)	0.51(0.10)		0.38 (0.13)	0.38 (0.12)	

The mixed analysis of variance for the easy texts indicated main effects for group ($F(3,137)=10, p<.001$) and question type ($F(1,3)=52, p<.001$), but no evidence of an interaction ($F(3,137)=0.51, p=.67$). The equivalent analysis of the hard texts, however, did produce a significant interaction ($F(3,137)=2.76, p=.04$) together with a main effect of group ($F(3,137)=19, p<.001$) but no evidence of an effect of question type ($F(1,3)=0.09, p=.77$). Figures 3.6 and 3.7 present these interactions. Paired comparisons of type of comprehension question from hard passages for each group of participants indicated that the only group to show a difference in performance between recall and inference questions was the dyslexic group ($t(25)=2.17, p=.04$).

Figure 3.1 Average performance of the three groups on recall and inference comprehension questions in easy texts

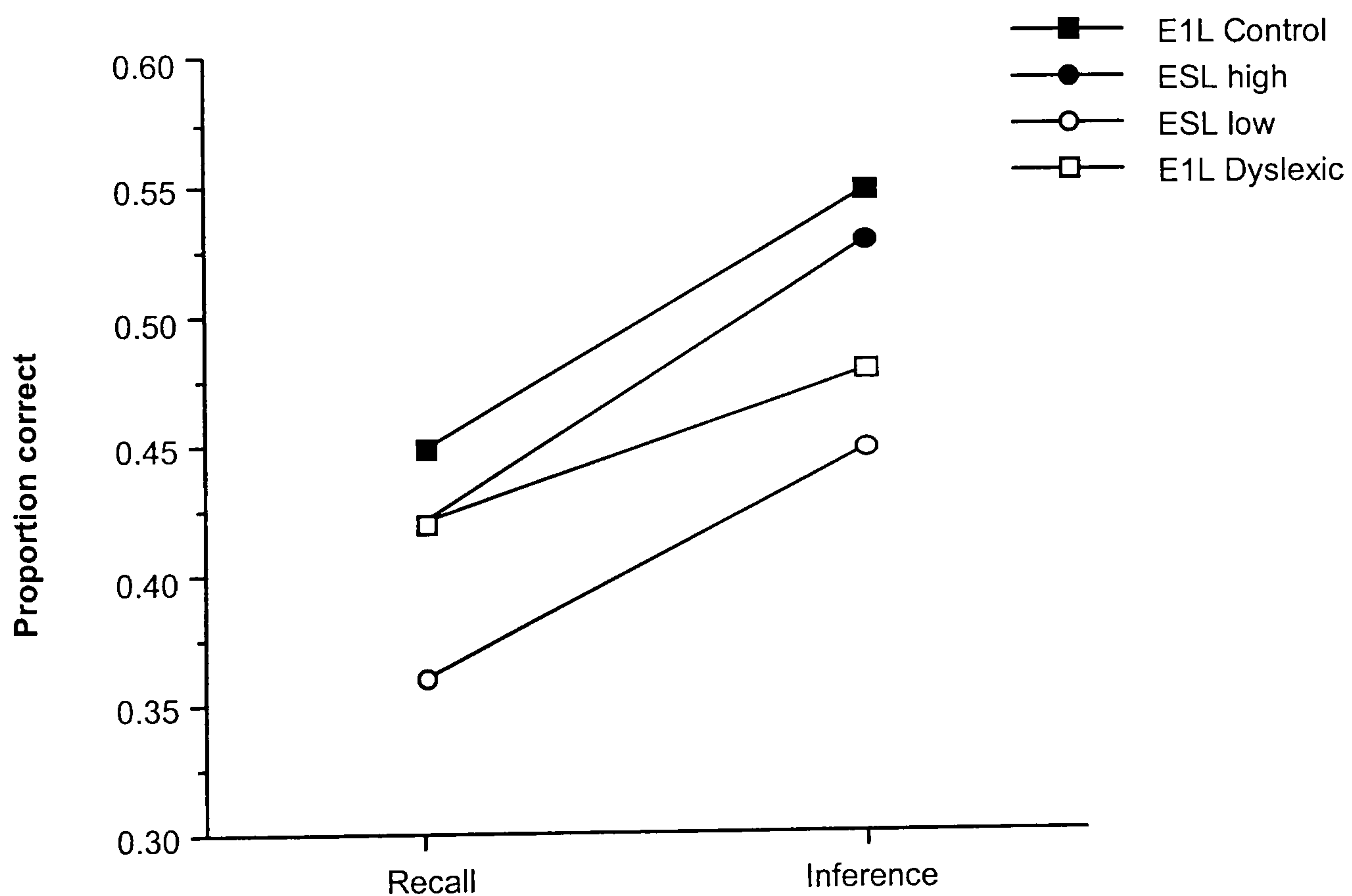
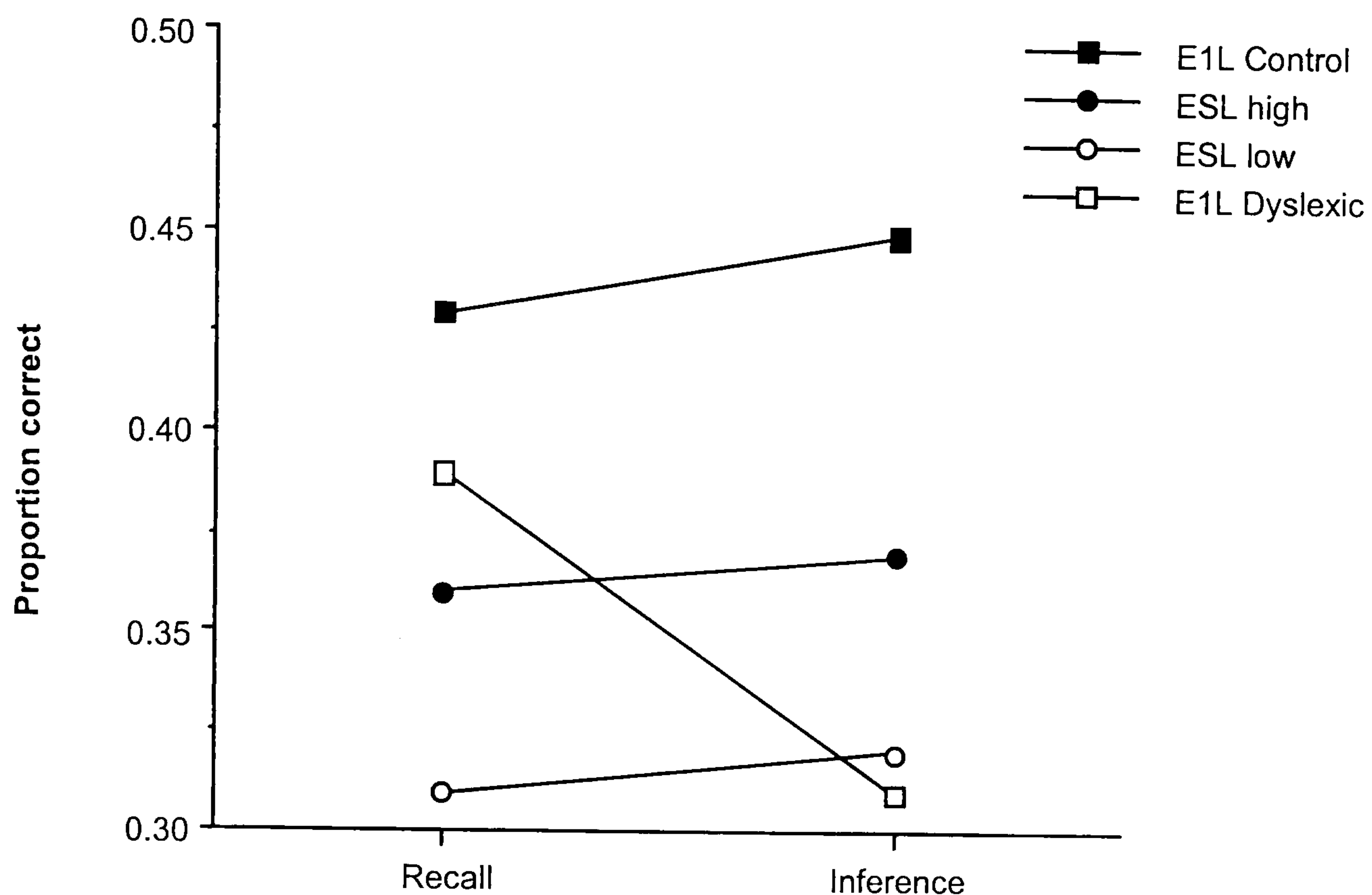


Figure 3.2 Average performance of the three groups on recall and inference comprehension questions in hard texts



3.4 Discussion

The results indicated differences between E1L controls and E1L dyslexics and ESL low experience students across most measures, the exception being the lack of a significant difference between E1L controls and E1L dyslexics on the text comprehension measure. Overall, the performance of the E1L dyslexic and ESL low experience students was comparable, with no significant differences identified. However, there was little evidence for differences between the E1L controls and ESL high experience groups across the measures; the only measure where a difference was apparent was in the rapid naming of digits. Additionally, E1L dyslexic and ESL high experience students could be significantly differentiated in terms of their word reading accuracy. These findings suggest that ESL students and E1L dyslexics can be distinguished from E1L individuals in terms of their literacy skills, although such differences may only become apparent when the ESL student has had enough English language experience (i.e. of seven years or more). Those ESL students with less

English language experience performed more like the E1L dyslexics than the E1L controls. The only area where differences between these groups became apparent was when a more detailed analysis of scores on different types of comprehension questions was considered. When harder texts were considered, there was evidence that dyslexics perform worse on inference type questions than recall type questions, whereas there was no evidence for a similar trend across the other three groups.

Findings from study 1 indicated that adult dyslexics and ESL individuals cannot be distinguished on literacy measures as they presented similar pattern in their performance. The present study demonstrated that literacy measures could reliably distinguish between dyslexics and ESL individuals only when language experience was considered. Although the ESL groups presented evidence of literacy problems, the results obtained from this study suggest that these are related to language proficiency, and should increase with experience. As predicted, the level of L2 experience was indeed found to be a discriminating factor that distinguished the reading performance of the two ESL groups in this study. Similarly, high-experience ESL individuals (with 7 years or more of L2 language experience) are better able to perform certain literacy tasks in their L2 than dyslexics are in their L1.

The dyslexic group's scores on the literacy measures more closely resembled the low-experienced ESL students, although the same factor cannot explain their poor scores given that all dyslexic individuals had English as their first language and it is unlikely that they would have had low levels of English language experience equivalent to that of ESL students with seven or less years of experience. Given the findings of Study 1 and the existing evidence in the literature (see Chapter 1), a more likely explanation would focus on the dyslexic adults' continued phonological processing problems. The findings of Studies 1 and 2, therefore, are consistent with the view that ESL literacy difficulties are language experience related, whereas the same difficulties amongst dyslexics are more likely related to phonological processing deficits. The ESL students' language experience related literacy deficits are more likely to be relatively short-lived compared to the continued phonological deficits experienced by dyslexics that seem to lead to literacy problems throughout the life-span. Such differences in the probable underlying causes of literacy difficulties experienced by dyslexic and ESL

students should inform procedures for assessing literacy problems amongst adult students and procedures to support their learning.

Although the findings of Study 2 were again consistent with continued literacy deficits amongst dyslexic students, even at the supposed basic level of simple single-word ability, the findings were not entirely negative about the literacy skills of dyslexic students. The findings of this study suggested that text understanding, as measured by comprehension, could be as good amongst dyslexics and amongst their non-dyslexic peers. However, this level of understanding seems to come at the cost of time. The dyslexics' rate of reading is considerably slower than that of the non-dyslexic controls. This may be because more time is required to process words in isolation or because more time is required to derive the meaning of the text when certain individual words are missing or incorrectly processed due to reading errors. Either way, these results seem to suggest that single-word reading problems lead, in general, to a slowing in text processing to allow understanding to be derived. This style of text processing may, however, lead to problems in text understanding when the passage is difficult and inferences across different parts of the text.

The comprehension questions used in Study 1 required inferences to be made about the text read, and the performance of the dyslexic adults was found to be weaker than that of their non-dyslexic peers. When inference comprehension questions were separated from recall comprehension questions in Study 2, the dyslexics performed at a level that was as good as their peers on recall type questions, but weaker on inference type questions, and these effects were more apparent as text complexity increased. These results can be contrasted with those of the ESL students. Low-experienced ESL students' ability to access meaning from the passages also presented evidence of weaknesses. However, again, these may be due to different reasons from those that led to weaknesses amongst the dyslexics. Whereas, the dyslexics' weaknesses may be the result of problems with word processing and text inferencing, the ESL students may have found the text difficult due to unfamiliar cultural schemata presented in the passages. The fact that they presented weaknesses across both levels of text complexity suggests that this may not have been the main cause of their comprehension problems. However, further research is necessary to determine the

most likely reasons for these deficits. The evidence within the present data, though, again suggests that similar levels of task performance may be due to different causes.

Finally, poor rapid naming skills were found to be indicative of both dyslexics and ESL individuals, a finding which is consistent with the results obtained in study 1. The findings of differences between E1L dyslexics and non-dyslexics further support the contention that rapid naming is an area of deficit for dyslexic individuals across the life-span (see discussions in Wolf and O'Brien, 2001). Similarly, the continued evidence of difficulties amongst the ESL students suggests that this is not simply a factor of language experience that will disappear with relatively large levels of exposure. Either even larger levels of L2 exposure are necessary for the accessing of L2 names to be rapid as well as accurate or alternative factors are playing a part in the difficulties experienced by the ESL students.

Problems with rapid naming of digits amongst the ESL groups may lie in the time interval between the response to one stimulus and the response to the next and in the sequence of processes involved such as: inhibiting the response to the previous stimulus, anticipating and responding to the next stimulus, perceiving the stimulus, accessing and retrieving its verbal label. It could be argued that naming speed deficits amongst the ESL may lie in the last stage of the rapid automatised naming process. The access and retrieval of the verbal label of each digit may inhibit the process and could therefore be responsible for the time delays as it is the only one directly linked to language ability. However, further evidence is required before firm conclusions can be made, particularly as there was little evidence of a language experience effect in that rapid naming differences between E1L controls and ESL students reduced as English language experience amongst the ESL students increased. Rapid naming will form part of the measures taken in subsequent studies in this thesis and further discussion will follow the reporting of findings in this area. Similarly, other phonological-based skills will be further investigated such as the role of verbal fluency, which will constitute the focus of the next study, as well as any relations between the phonological skills that may influence the ability for phonological processing.

CHAPTER 4

Study 3: Assessment of verbal fluency and phonological skills amongst adult dyslexics and ESL students

4.1 Introduction

Studies 1 and 2 indicated that, with the exception of rapid naming measures, dyslexics can be distinguished from ESL students by measures of phonological processing, but could only be distinguished in measures of literacy when language experience was relatively high. The latter finding suggests that language experience may be the factor that leads to poor test performance amongst ESL students. This conclusion was further investigated in Study 3 focusing on verbal fluency skills amongst ESL students and comparing these with those of E1L dyslexic and non-dyslexic students. Language experience would be expected to impact on verbal fluency and this may lead to potential deficits in certain test areas, such as rapid naming. Therefore, groups of ESL, E1L dyslexic and non-dyslexic students were compared on their performance on measures of verbal fluency and these were compared with scores on rapid naming measures. Given the potential importance of phonological skills measures in differentiating ESL and dyslexic students, Study 3 also incorporated another measure of phonological processing, the Spoonerisms task, that has been used in phonological assessment procedures. The Spoonerisms task was chosen as it may be considered a more complex phonological task than the ones used in Studies 1 and 2, leading to it being more appropriate as an assessment of adult ability.

4.1.1 Measures of fluency and their relationship to reading

Verbal skills, as well as reading and writing skills, are an essential component of literacy. However, problems with speech production and speech processing have been commonly reported amongst dyslexics (Scarborough, 1990; Frith, Landerl and Frith, 1995). The underlying assumption of all these studies was that difficulties in these areas reflect problems with phonological processing and that according to Frith, Landerl and Frith (1995) "dyslexics may not have an instantaneous access to certain phonological forms" (i.e. the names of letters) (p.3).

It has also been demonstrated that fluency plays a critical role in reading development (Frith, Landerl and Frith, 1995; Meyer and Felton, 1999). There are two kinds of

fluency of interest to the present research work: verbal fluency and reading fluency. Reading fluency has been defined in terms of "the ability to read connected text rapidly, smoothly, effortlessly, and automatically with little conscious attention to the mechanisms of reading such as decoding" (Meyer and Felton, 1999, p.7). A fluent reader is therefore someone who has developed automaticity and good word decoding skills. Other definitions of the term emphasise the role of rate and accuracy in oral reading (Torgensen, Rashote and Alexander, 2001). Katzir-Cohen and Wolf (2001) offer the following comprehensive definition of reading fluency:

'In its beginnings, reading fluency is the product of the initial development of accuracy and the subsequent development of automaticity in underlying sub-lexical processes, lexical processes, and their integration in single-word reading and connected text. These include perceptual, phonological, orthographic, and morphological processes at the letter-, letter-pattern, and word-level; as well as semantic and syntactic processes at the word-level and connected-text level. After it is fully developed, reading fluency refers to a level of accuracy and rate, where decoding is relatively effortless; where oral reading is smooth and accurate with correct prosody; and where attention can be allocated to comprehension' (p. 8).

Verbal fluency, on the other hand, which is the main focus of the present study, refers to the accuracy and speed by which one is able to generate (i.e. verbally produce) words based on phonemic or semantic cues (Frith, Landerl and Frith, 1995). Verbal fluency therefore depends upon a number of phonological processing skills like accessing the names of letters or accessing words by sound.

Three areas of verbal fluency that have been studied extensively are semantic, alliteration and rhyme fluency (Wimmer, Landerl and Schneider, 1994; Frith, Landerl and Frith, 1995). Semantic fluency refers to the ability to efficiently retrieve word meanings and generate words from semantic cues (e.g. semantic categories) and, therefore, is said to also reflect the ability for semantic categorisation. It reflects the ability to locate and retrieve semantic codes, semantic information and specific word meanings from long-term memory and is therefore argued to provide an index of the size of phonological storage lexicon. Alliteration fluency on the other hand, refers to the ability to effectively generate words from phonological forms and codes, (e.g. single language units or sounds). It reflects the ability to use such codes to retrieve

information (i.e. phonological codes based on alliteration) from long-term memory. Rhyme fluency, finally, refers to the ability to generate rhyming words based on phonological cues like common sound endings between words. It reflects the ability to use phonological codes to retrieve information (i.e. phonological codes based on rhyme) from long-term memory.

Fluency has further been studied in relation to the specific sub-skills and processes that underlie it. It has been argued, for example, that reading fluency involves not only the use of lower-level reading skills and phonemic awareness skills but also higher-level lexical processes and other reading sub-skills, such as accuracy and comprehension. Berninger et al (2001) argue that fluency is influenced by a number of factors such as: a) the characteristics of stimulus input (e.g. rate and persistence of a visual signal or speech signal), b) the efficiency and automaticity of internal processes (e.g. the development of phonological, orthographic, and morphological systems), and c) the coordination of responses by the central executive.

There is evidence to suggest that there is a strong relationship between early rapid naming skills and later reading fluency (Wolf and O'Brien, 2001). In fact, because rapid naming involves many of the very same processes employed during fluent reading (i.e. visual, auditory, orthographic, phonological, and morphological), the two skills are often inter-dependent. As Wolf and O'Brien (2001) put it, "a breakdown in any of them can also impede the acquisition of fluent reading" (p.11).

4.1.2 The development of lexical fluency in L1 and L2

The way adult L2 readers acquire lexical representations for L2 and the way in which they then connect them to existing representations of L1 words within the cognitive network (or 'mental lexicon') for words and their meanings in L1 is a key issue in the development of L2 lexical fluency. It is an area that has been typically measured through a number of verbal production tasks, such as simple word reading or object naming tasks that require the use of cognitive and conceptual processing skills. Naturally, the more fluent the L2 learner, the more easily he or she should be able to access meaning directly for L2 words. In study 2 of the present thesis it was found that the number of years of English language experience reported by an individual significantly correlates with reading speed and reading accuracy. Likewise, L2

learners' performance in rapid naming (both accuracy and speed) is likely to be improved with increasing L2 proficiency as they manage to acquire a richer lexical network for words in L2, as shown in study 2. Less proficient L2 learners, on the other hand, seem to depend more on external cues to language when performing the same naming tasks (Kroll, Michael, Tokowicz and Dufour, 2002). Rapid naming performance then is likely to indicate how easily bilinguals' lexical information is accessed in each of their languages under study (Kroll et al, 2002). For L2, it has further been argued that "the naming task also provides a measure of the difficulty of accessing and producing the phonology" of a particular language (Kroll et al, 2002, p. 144).

The process of naming of objects or words in a second language is often facilitated in cases where there is L1 and L2 word similarity or when there is absence of unknown L2 vocabulary. Cross-language similarity of lexical features also seems to facilitate naming performance when there is a straightforward correspondence between orthography and phonology between the two languages (Kroll et al., 2002). As far as digit naming is concerned, it has been found that "when bilinguals had to switch between languages in naming numbers, there were larger switch costs into L1 than into L2" (Kroll et al., 2002, p. 165). They explain that L1, which is more active, becomes inhibited at the cost of L2 production, so that when L2 readers need to switch from one language to the other, this can lower their actual processing speed (Kroll et al., 2002). Given the evidence obtained from previous data (Studies 1 and 2) suggesting that the differential performance of ESL individuals and dyslexics may differ between rapid naming of digits and rapid accessing of object names, this study will assess ESL and dyslexics' skills in naming speed of both objects and digits.

4.1.3 Research on verbal fluency and dyslexia

Research has indicated that both children and adults with dyslexia perform poorly in verbal fluency tasks compared to age-matched controls (Frith, Landerl, and Frith, 1995). There are two theories that may explain poor performance in verbal fluency amongst dyslexics: their verbal fluency may be impaired either (i) because there is a problem with the phonological storage of words or (ii) because access to that store is impaired. This means that dyslexics either have few words stored in their mental lexicon from which to select from, or that they have difficulty finding these words

(Shallice, 1988). There is further a possibility that there are several routes in the process of trying to access a word in the mental lexicon and that dyslexics may have problems in one of these routes. However, a clear explanation of exactly where or in which of these routes the problem lies within the phonological system has not been yet provided. Finally, it has been suggested that dyslexics may present problems with verbal fluency because of their poor verbal short-term memory ability. The inability to produce enough words may, according to the above hypothesis, be attributed to the fact that they have problems remembering what words they have already mentioned and therefore take longer for fear of repeating the same ones (Frith, Landerl and Frith, 1995).

4.1.4 The role of experience in verbal fluency ability

If reading skills improve with experience (e.g. through exposure to print), the same may be the case with verbal skills leading to dyslexics (and possibly L2 individuals) becoming more verbally fluent with age and amount of experience. If that is the case, then we would expect adult dyslexics to perform better than dyslexic children on verbal fluency tasks. A number of studies have tested this hypothesis (e. g. Elliot, Murray, and Pearson, 1978). Frith, Landerl, and Frith (2001) compared the data obtained from a group of 12-year-old reading disabled children with a group of compensated adult dyslexics matched for IQ on a number of verbal fluency tasks, like generating words from a given sound (i.e. a particular letter name) or from general word categories (i.e. food, animals etc). It was found that there were no significant differences between the two groups in the time taken to generate words, which provides further evidence that phonological processing problems can persist into adulthood despite evidence suggesting that fluency increases with age (e.g. Elliot, Murray and Pearson, 1978).

Interestingly, both groups of dyslexics presented difficulties in accessing words by sound, but not from meaning, suggesting that it is probably the ability to spontaneously generate words from phonemic cues which is impaired in dyslexic individuals, not the ability to generate words from semantic cues, and that it is therefore the phonological code, not the semantic code that is impaired in dyslexics. They are, in other words, significantly slower and, therefore, significantly less fluent than non-dyslexics at generating words from phonemic cues (e.g. produce a word

starting with a particular phoneme), but no worse in generating words from semantic cues (e.g. produce words with a particular meaning) (Frith, Landerl, and Frith, 1995). The above argument provides further evidence for the phonological deficit hypothesis that has been widely supported by a number of researchers (e.g. Pennington, Van Orden, Smith, Green, and Haith, 1990). However, it may not only have been poor reading skills amongst the dyslexics that impacted on their weak phonetic fluency performance. To ascertain this hypothesis, the researchers undertook a follow-up study in which they further compared a group of 8 adult dyslexics against a matched control group of 12 normal readers on a WRAT reading, a WRAR spelling, and a Spoonerisms test. Again, they found that adult dyslexics were still showing phonological impairments similar to those of the group of 12-year-olds in the semantic fluency task, but were significantly worse in the phonemic fluency task, which provided further evidence that poor literacy was impacting on phonology or vice versa.

However, despite the evidence above that verbal fluency may be related to the acquisition of language and literacy skills, a relatively small number of studies have tested these fluency skills amongst experienced and inexperienced L2 populations, with even fewer studies attempting to compare these L2 groups with the fluency skills of dyslexics.

4.1.5 Assessing phonological skills using the PhAB: the applicability of the test battery to ESL populations

As a screening and diagnostic tool, the Phonological Assessment Battery (PhAB, Frederickson, Frith, and Reason, 1996) has been used extensively in the assessment of phonologically based literacy skills of individuals with literacy difficulties. It has also been argued to be an appropriate assessment technique for individuals with English-as-a-Second-Language who present difficulties of a phonological nature (p. 57). (For details please refer to special studies results in appendix 3 of the test battery).

A study conducted by the developers of the test battery (Frederickson, Frith and Reason, 1996) compared ESL (Bengali-English speaking) children against age-matched monolingual English speaking children. The results indicated that the area

that ESL children's performance significantly differed most from the standardisation sample group was the on the Spoonerisms task, a test of complex phonological skills. Significant differences were also found between the two groups on reading accuracy and reading comprehension tests with the ESL children scoring on the middle of the average range in reading accuracy and on the lower half of the average range in comprehension compared to the controls who scored on the high average range in both. It has therefore been argued that bilingual children may be less accomplished in using semantic or contextual cues than their monolingual counterparts. The findings of the study further indicated that the phonological skills assessed by the PhAB are almost equally developed in bilingual and monolingual English children, when the bilingual children had at least four years of formal English language education. The relationship between phonological awareness skills and reading accuracy was found to be similar across the two groups despite the ESL children's reading comprehension ability and reading accuracy scores being poorer than those of the monolingual children. Clearly, more than phonological processing skills appear to be involved in reading connected prose passages and it may be that the higher-order literacy skills that ESL children performed poorly at (e.g. vocabulary, use of semantic cues and drawing inferences from text) were the cause of such differences found in terms of text reading ability.

The findings of this study are consistent with Cummins' (1984) argument that it is likely to take much longer (five to seven years) before L2 learners "develop native-like levels of proficiency in the higher order cognitive academic linguistic areas than in surface level skills including phonological processing" (PhAB, p. 106).

4.1.6 Research questions and aims of the study

Having established in previous studies that dyslexics and ESL individuals can be distinguished in terms of their phonological processing skills, with the dyslexics performing overall worse than the ESL, the present study aimed to investigate whether the two groups also differ in terms of their verbal fluency skills and in terms of more complex skills of phonological processing (Spoonerisms). The Spoonerisms task was chosen due to the complexity of the phonological processing required to complete the task: the individual has to hear the differences between initial word sounds, be able to recognise and retain words without their initial sounds and

recombine initial and remaining word sounds to form a novel word. The combination of awareness, deletion, retention and addition means that the task included many of the processes that have been found to distinguish dyslexics and non-dyslexics (see Chapter 1, General Introduction) and hence it has been used in a number of phonological assessment procedures (particularly the PhAB). In addition, previous findings demonstrating that ESL individuals perform slightly better than dyslexics in rapid naming of digits (study 2) but slightly worse in rapid naming of objects (study 1), led to this study assessing the two groups on both rapid naming tasks to ascertain whether rapid naming ability is different in the two groups and whether the specific ability to rapidly access words is related to fluency. Overall, the study covers a range of phonological assessment measures that should further inform work in identifying differences between dyslexic and ESL students.

The primary aim of this investigation was to test whether verbal fluency tasks, such as semantic, alliteration and rhyme fluency, and complex phonological processing tasks, such as the Spoonerisms task, would be able to distinguish between adult ESL, dyslexic and E1L individuals. A secondary aim of the present investigation was to ascertain whether there is a relationship between verbal fluency and the rapid naming ability amongst ESL and dyslexics.

4.2 Method

4.2.1 Participants

Groups of 22 E1L dyslexic (mean age 25 years, SD 4.54; 11 female and 11 male), 22 E1L non-dyslexic (mean age 27 years, SD 3.49; 10 female and 12 male), and 20 ESL adult students (mean age 27 years, SD 5.16; 16 female and 4 male) matched for age and sex took part in this study. Participants from all groups were an opportunity sample of postgraduate degree-level students undertaking different English courses and were recruited from the University of Surrey (age range for all groups 19 to 41).

A self-report questionnaire was administered to all individuals prior to testing to ensure appropriate allocation to groups. This preliminary questioning indicated that the E1L dyslexic and non-dyslexic groups were all native English speakers. Non-dyslexic E1L students indicated no evidence of previous literacy/learning difficulties.

All dyslexic individuals were obtaining special needs provisions from the learning support unit in the University where they were studying and reported a history of literacy problems. The ESL individuals came from a wide range of language backgrounds and, therefore, represented a mixed L1 group from ten different language backgrounds (including Arabic, Greek, German, Italian, Spanish, and Malay). All participants from this group reported having English as a second language with a minimum of 7 years of English language formal instruction and an average of 14 years of English language experience ($SD=2.29$). They all had spent at least one year studying in an English language Higher Education institution as part of their degree requirement. None reported having any history of literacy difficulties.

4.2.2 Measures

All individuals were assessed in terms of their phonological abilities in English. The measures used in this study were all adopted from the Phonological Assessment Battery (PhAB; Frederickson, Frith and Reason, 1996).

A. Measures of fluency

4.2.2.1 Semantic Fluency task

In this task participants were verbally presented with two general semantic categories, for example, things to eat, and animals and were asked to verbally produce as many words as they could that related to this category. Participants were given 30 seconds for each category and scores were obtained based on the total number of different words produced. Scores for the two categories were further combined for the purposes of analyses.

4.2.2.2 Alliteration Fluency task

In this task participants were verbally presented with a single letter sound, for example, /m/ and /b/, and were asked to verbally produce as many words as they could that started with that sound within 30 seconds. Scores were the total number of different correct words produced. Scores for the two beginning sounds were further combined for the purposes of analyses.

4.2.2.3 Rhyme Fluency task

In this task participants were verbally presented with two one-syllable words, ‘*more*’ and ‘*whip*’, and were asked to verbally produce as many words as they could that rhymed with the given word. Again, 30 seconds were allowed for each of the words presented and scores were obtained for the total number of different words (acceptable rhymes) produced. Scores were obtained based on the total number of correct words produced. Scores for both rhyming words were combined in the analyses that follow.

B. Measures of phonological ability

4.2.2.4 Spoonerisms task

This is a test of phonological awareness that requires ability for perception and manipulation of phonemes, ability to decode non-words and use of grapheme-phoneme correspondences knowledge. It therefore requires higher-order phonological awareness skills as well good knowledge of grapheme-phoneme correspondences. The task incorporates two parts. In the first part (semi-spoonerisms), participants were verbally presented with a list of ten words, each of which was followed by a letter and were asked to replace the initial sound of each word with the specific letter sound given to create a new word (e.g. cat with an f gives fat). Scores were obtained based on the number of words produced correctly.

In the second part (full spoonerisms), participants were verbally presented with a list of ten pairs of words and were asked to exchange the first sound from each word pair to produce two new words (e.g. sad cat gives cad sat). The word pairs produced were either real words or non-sense words. Scores were obtained based on the number of pairs of words produced correctly.

4.2.2.5 Rapid naming task (objects and digits)

This is a test of phonological speed that requires fast and automatic retrieval of phonological coding from long-term memory. It has two parts:

Part A. Rapid naming of digits

Participants were presented with two A4 size cards containing a sequence of digits and were asked to read each of the digits out loud as quickly as possible. Digits were

presented in a random order to avoid the possibility of having two identical sequences at any one time. Scores were obtained based on the time taken to read all the digits.

Part B. Rapid naming of objects

Participants were presented with two A4 size cards containing a series of line drawings of familiar objects (i.e. hat, table, ball, and door). Line drawings were repeated several times on the cards producing a total of 50 objects. Participants were required to name each of the objects as quickly as possible. The line drawings were presented in a pseudo-random order that avoid the possibility of having any two identical sequences at any one time. Scores were obtained based on the time taken to name all the objects.

4.3 Results

4.3.1 Group differences

One-way analyses of variance were performed on the data to compare the three groups' performance across the different measures used in the study. Significant effects of group were found across all of the phonological tasks used in the study (see Table 4.1). These analyses were followed by pairwise post-hoc comparisons (see Table 4.2) to identify which groups significantly differed from which.

Table 4.1 Mean scores (with standard deviations in parentheses) for the three groups of students on the phonological tasks, together with the results of the analyses of variance for each measure

Tasks	Dyslexic (N=22)	Non-dyslexic (N=22)	ESL (N=20)	F df=2,63	p value
Spoonerisms	30.04 (8.06)	35.72 (3.90)	31.35 (3.29)	6.248	<.05
Rapid Naming – Objects/secs	36.70 (6.10)	29.7 (2.85)	35.20 (6.47)	10.126	<.001
Rapid Naming- Digits/secs	21.20 (4.73)	15.02 (3.44)	19.55 (4.14)	13.072	<.001
Verbal Fluency- Semantic	15.34 (3.86)	19.13 (3.93)	13.97 (3.42)	10.789	<.001
Verbal Fluency- Alliteration	8.22 (2.66)	10.72 (2.88)	9.72 (2.66)	4.630	<.05
Verbal Fluency- Rhyme	7.17 (3.02)	8.97 (2.64)	3.80 (3.42)	15.574	<.001

Table 4.2 Post-hoc pairwise comparisons between the three groups on the phonological tasks

Tasks	Dyslexic vs non-dyslexic	Dyslexic vs ESL	ESL vs non-dyslexic
Spoonerisms	<.05	NS	<.05
Rapid Naming – Objects/secs	<.001	NS	<.05
Rapid Naming- Digits/secs	<.001	NS	<.05
Verbal Fluency - Semantic	<.05	NS	<.001
Verbal Fluency - Alliteration	<.05	NS	NS
Verbal Fluency - Rhyme	NS	<.05	<.001

The results indicate that the ESL group was particularly poor on the rhyme fluency task, scoring significantly worse than both E1L dyslexic and non-dyslexic groups. However, the performance of the ESL students was much better on the alliteration task (no different from the E1L non-dyslexics) and also not different from that of the dyslexics on the semantic fluency task. This profile suggests a specific problem in the rhyme task that cannot be explained by problems in vocabulary or phonological processing. The average performance of the three groups on the Spoonerisms task revealed that the ESL group performed at a level almost equivalent to that of the dyslexics, and that both of these groups were significantly worse than the EL1 non-dyslexics. The results for rapid naming tasks indicated that the average performance of the ESL group was similar level to that of the dyslexics, with both dyslexics and ESL students being significantly worse than the EL1 non-dyslexics. As in the previous studies, naming speed was found to be an area in which ESL individuals performed at a similar level to that of dyslexics, but significantly poorer than E1L non-dyslexics. All three groups were quicker at naming digits than naming objects.

Overall, across the phonological measures used in Study 3, ESL individuals performed at a level more consistent with that of the dyslexics than the non-dyslexics.

However, differences between dyslexics and ESL individuals emerged in two areas of fluency: the ESL group was relatively superior at alliteration and significantly poorer at rhyme. Contrary to previous findings (see introduction above, section 4.1), dyslexics were significantly worse than non-dyslexics on the semantic fluency task but not significantly worse than non-dyslexics on the rhyme fluency task. Dyslexics and non-dyslexics differed on the alliteration task consistent with predictions based on the work presented in the introduction of the study.

4.3.2 Correlations

Overall, there were significant relationships between all of the phonological-based measures used in the study when scores from all three groups were combined in the analysis (see Table 4.3).

Table 4.3 Pearson's correlations between the phonological measures for the three groups – p-values are also presented for each analysis

Tasks	Rapid naming (digits)	Semantic fluency	Alliteration fluency	Rhyme fluency	Spoonerisms
Rapid naming (objects)	r=.424, p<.001	r=-.456, p<.001	r=-.226, NS	r=-.310, p<.05	r=.460, p<.001
Rapid naming (digits)		r=-.461, p<.001	r=-.298, p<.05	r=-.304, p<.05	r=-.453, p<.001
Semantic fluency			r=.407, p=.001	r=.475, p<.001	r=.329, p<.05
Alliteration fluency				r=.448, p<.001	r=.413, p<.001
Rhyme fluency					r=.451, p<.001

Correlations between the fluency and rapid naming measures were further run separately for ESL, and for EIL dyslexic and non-dyslexic groups (Tables 4.4, 4.5 and 4.6).

Table 4.4 Correlations between rapid naming, semantic and alliteration fluency for dyslexics

Tasks	Rapid naming (digits)	Semantic fluency	Alliteration fluency	Rhyme fluency
Rapid naming (objects)	$r=.294$, NS	$r=.524$, $p<.05$	$r=-.053$, NS	$r=-.272$, NS
Rapid naming (digits)		$r=-.612$, $p<.05$	$r=-.430$, $p<.05$	$r=.475$, $p<.05$
Semantic fluency			$r=.411$, NS	$r=.431$, $p<.05$
Alliteration fluency				$r=.384$ NS

Note: correlations significant at the .05 level are highlighted in bold

Table 4.5 Correlations between rapid naming semantic and alliteration fluency for E1L non-dyslexics

Tasks	Rapid naming (digits)	Semantic fluency	Alliteration fluency	Rhyme fluency
Rapid naming (object)	$r=.177$, NS	$r=-.415$, $p=.05$	$r=-.184$, NS	$r=-.258$, NS
Rapid naming (digits)		$r=-.211$, NS	$r=-.077$, NS	$r=-.072$ NS
Semantic fluency			$r=.452$, $p<.05$	$r=.227$, NS
Alliteration fluency				$r=.586$, $p<.05$

Note: correlations significant at the .05 level are highlighted in bold

Table 4.6 Correlations between rapid naming semantic and alliteration fluency for ESL

Tasks	Rapid naming (digits)	Semantic fluency	Alliteration fluency	Rhyme fluency
Rapid naming (objects)	r=.131, NS	r=-.076, NS	r=-.052, NS	r=-.087, NS
Rapid naming (digits)		r=.031, NS	r=.145, NS	r=.077, NS
Semantic fluency			r=.171, NS	r=.224, NS
Alliteration fluency				r=.614 p<.05

Note: correlations significant at the .05 level are highlighted in bold

Overall, the correlations between rapid naming and fluency measures were non-significant for non-dyslexic students (both E1L and ESL groups), but showed some evidence for relationships between these variables amongst the dyslexic participants. In the case of the dyslexic students, semantic fluency was related to both rapid naming tasks, although the direction of the relationship varied (high levels of semantic fluency were related to fast digit naming times but slow object naming times). Similarly, the dyslexics' digit naming scores were related to both alliteration and rhyme fluency, but again the direction of the relationship varied (fast naming speeds were related to high alliteration fluency levels but low rhyme fluency levels).

4.4 Discussion

The results of this study indicated no evidence of significant differences between ESL and dyslexic students in the Spoonerism and rapid naming tasks, with both groups showing deficits compared to the E1L controls. Significant differences between ESL and dyslexics did emerge in the fluency measures with both dyslexics and ESL students performing worse than the E1L controls in the semantic fluency.

Specifically, the dyslexics performed at a level consistent with the controls and better than the ESL students in the rhyme fluency task and ESL students performed like the E1L controls and better than the dyslexics in the alliteration fluency task.

Overall, these findings indicate that the conclusions of the preceding studies need to be treated with caution. Not **all** phonological measures will distinguish dyslexic and ESL students. In addition, these data indicate that high levels of English language experience may not always lead to ESL students achieving levels of performance comparable to this of E1L peers.

The correlations add to the need for caution. Although it was hypothesised that phonological deficits such as rapid naming may relate to the level of L2 fluency amongst ESL students, there was no evidence for such a relationship in this group. This pattern of low association between rapid naming and fluency was consistent with that found amongst the E1L non-dyslexic participants. It was only amongst the dyslexics that significant relationships were found between rapid naming and fluency scores. This seems to indicate that poor rapid naming times found amongst the ESL students may not be due to the size of the word lexicon that these individuals have access to. Additionally, deficits in rapid naming and fluency amongst ESL and dyslexics may not be related to the same underlying problems. These correlational analyses also indicated dyslexics showed relationships between rapid naming and fluency such that high semantic fluency was related to fast naming of digits but not to slow naming of objects. There could be a number of possible interpretations for this finding. One explanation might be that those dyslexics with vocabularies that are relatively large for a dyslexic (as indicated by high verbal fluency scores for the group) may find it difficult to access specific units of information embedded in their lexicon. Hence, the naming of individual objects would be slower amongst these individuals than in those dyslexic peers with low vocabularies and low fluency scores.

Different effects may occur for digits if we consider that the lexical process responsible for accessing digits is different for that for objects. The organisation of a digit-based lexicon may be different from an object-based lexicon due to the number of items available for storage in these lexicons. Digits provide a restricted set of symbols that are combined to form number units (much like letters), whereas objects

form a much larger, potentially infinite set of units. As such, organisation and access of these lexicons may be very different. A dyslexic with problems accessing items from a large set of units would not necessarily have the same problems with a more restricted set.

Whatever the possible explanation, however, the findings need to be treated with caution and certainly need further evidence to be able to draw firmer conclusions. Further research could specifically focus on the relations between semantic fluency and the ability for rapid accessing of pictures and digits separately and throw more light into how the two can be related as well as why such relations are likely to occur.

The data reported in this study present further evidence for a retrieval time deficit amongst dyslexic adults. Such deficits are consistent with problems with phonological recoding in lexical access, as Wagner and Torgesen (1987) have argued, and consistent with the findings of Wolf and Obregon (1992). These findings could be accounted for by a general deficit in phonological processing as suggested by the findings in the fluency and Spoonerisms task (Snowling, 2000) or as a specific speed of processing deficit as argued by Wolf and O'Brien (2001). The potential interrelationship between phonological measures found amongst dyslexic participants and the three groups combined seems consistent with a common phonological factor underlying all the measures in this study. However, this conclusion needs to be considered in the light that such relationships were much less evident amongst the ESL students who also showed evidence of deficits in rapid naming, Spoonerisms and fluency measures. It seems that for dyslexics there may be the same underlying processing factor leading to deficits in these phonological tasks, whereas a different cause seems to be leading to similar deficits amongst the ESL students. Different factors might also account for differences in the reading ability of the two groups. Study 4 was an attempt to investigate how reading sub-skills such as accuracy, speed and comprehension, areas that the two groups have been found to present deficits in, can impact on word and non-word reading performance.

CHAPTER 5

Study 4: Non-word reading and reading comprehension ability in adult dyslexic and ESL students

5.1. Introduction

Findings from studies 1, 2 and 3 indicated that persistent difficulties for adult dyslexics emerged in non-word reading whereas for ESL in reading comprehension. These two areas will constitute the focus of the present study, which will assess the specific deficits that the two groups are likely to present in these two areas of reading.

5.1.1. The non-word reading deficit in dyslexics

An essential component of successful reading is, as already mentioned in the extensive review of the reading literature in the introduction section, the ability to deal with novel, unfamiliar words presented either individually or within a text. This ability involves acquiring adequate word recognition and phonological decoding skills (see introduction). It has been demonstrated that dyslexic individuals have problems decoding unfamiliar words, which in turn impacts on their word recognition skills (Rack, Snowling and Olson, 1992). They have further been found to demonstrate evidence of less accurate and efficient reading of low-frequency exception words as well as non-words (pseudo-words). This problem often highlighted in the reading literature is referred to as the *non-word reading deficit* amongst dyslexics.

A number of studies have investigated dyslexics' non-word reading skills, incorporating either single non-word tests or reading tests including non-words within sentence or text contexts. Evidence from these studies seems to suggest that when presented with unfamiliar information, i.e. non-words or pseudo-words, adult dyslexics are significantly *slower* than their age-matched non-dyslexics, although this is not the case when they are presented with familiar words, possibly due to several compensatory strategies they have adopted over the years. Dyslexics, therefore, do not only under-perform in non-word reading accuracy tests, but also in tests of non-word reading speed (Rack, Snowling and Olson, 1992). It has been argued that this non-word processing deficit may be due to a failure in the orthography-to-phonology

conversion process, that is, during the process of translating graphemes to phonemes (Rack, Snowling and Olson, 1992).

Given that evidence for a non-word deficit within our sample of dyslexic individuals has already been obtained in study 1, the present study aimed to investigate how this difficulty might relate to, and possibly influence, the reading comprehension ability of adult dyslexic and ESL individuals.

If we were to incorporate non-word reading tasks within a comprehension measure such as the recall of novel non-word information within text, then we would expect dyslexic and ESL individuals to present difficulties with non-word based comprehension tasks. One of the primary aims of this study was to test the above hypothesis.

5.1.2 Reading comprehension ability in dyslexics

Reading comprehension is one of the most important predictors of reading ability in literate adults. However, adult dyslexics often present difficulties in *reading accuracy* and *reading speed*, which may in turn influence their ability to comprehend text (Beaton, McDougall and Singleton, 1997). So although dyslexic adults may perform almost as well as non-dyslexics in single-word measures of reading (although see Hanley, 1997), there is evidence to suggest that their performance is significantly slower in speed of word reading as well as in speed of text reading when compared against controls (Everatt, 1997). Dyslexics significantly under-perform the non-dyslexics not only in single-word reading but also in picture naming and in phonological awareness tasks (Hanley, 1997). Weak decoding skills are often considered the main reason for dyslexics' slower word processing skills. This same weakness may also be the underlying cause of poor *reading comprehension* (Hanley, 1997).

However, contrasting evidence argues against weak decoding skills being the main reason for poor reading comprehension ability (Coltheart and Coltheart, 1997), given that no direct link between the two skills has been established. For example, current reading research has distinguished between 'poor comprehenders' and dyslexic individuals, with the former being seen as a sub-group of individuals who manifest a

specific comprehension deficit in the absence of a weakness in decoding skills (Nation and Snowling, 1998). The difference that the researchers found between these two groups of 'reading disabled' individuals was that dyslexics used context to compensate for their poor decoding skills, whereas the group of 'poor comprehenders' did not seem to be able to benefit from contextual cues.

Short-term working memory ability has further been identified as an important component of the reading comprehension process. Researchers in the area have found that the ability to parse a sentence relies on the temporary storage and concurrent processing of complex text information (Daneman and Carpenter, 1980). Problems in storing text information can impact on text information processing, which, inevitably, impacts on comprehension. There is a debate in the literature, however, as to whether reading comprehension is mediated by a general or domain specific processor within STM.

5.1.3 Models of reading comprehension

Reading comprehension refers to the extraction of meaning from text that requires both the recognition of individual words (within a sentence or text context) as well as knowledge of their meaning (Hoover and Gough, 1990).

According to the simple model of reading (Gough and Tunmer, 1986), reading comprehension is a skill that is predominantly dependent on the speed and accuracy with which individual words are decoded as well as on language comprehension.

Chen and Vellutino (1997) have argued that the relationship between language comprehension and reading comprehension is mediated by reading ability. Language comprehension only facilitates reading comprehension once word recognition skills have reached a certain level of proficiency. This is particularly important when studying the reading comprehension skills of L2 learners.

The above view is also consistent with the *verbal efficiency hypothesis* (Perfetti, 1985) postulating that word recognition accuracy and speed are fundamental to reading comprehension. Further research on reading comprehension has demonstrated that individual differences in word reading and passage reading rate predicted a considerable percent of the variance in reading comprehension of children (Kitz and Nash, 1992). The researchers found that it was decoding accuracy that facilitated

automatic word recognition, which in turn facilitated reading speed, thus confirming the link between the two skills. It would therefore seem that higher-level reading skills, such as reading comprehension skills are based on having already attained adequate decoding and phonemic awareness skills.

Further research in the area has indicated that text comprehension ability can also be influenced by general language skills and other verbal and cognitive abilities, including word knowledge, efficient use of metacognitive strategies and exposure to print. Stanovich et al (1996) argued that proficient readers engage in the act of reading to a greater extent than poor readers because they are more frequently exposed to sources of linguistic material (i.e. printed text). Such an exposure, they argue, facilitates the development of verbal skills and reading comprehension ability. Exposure to print, in particular, has been found to enhance automatic word recognition processes and vocabulary knowledge.

Reading comprehension ability is often viewed as a combination of word identification and listening comprehension skills. In fact, it has been found that both skills seem to predict the majority of variance in reading comprehension ability of both children and adult dyslexics (Gough and Tunmer, 1986; Gough, Ehri and Treiman, 1992). Reading comprehension problems may, therefore, often reflect general language problems in certain reading disabled individuals such as poor listening comprehension and verbal reasoning skills as well as weaknesses in vocabulary and grammar that may manifest themselves in the absence of underlying phonological deficits. Such a view would indicate that speech comprehension deficits or weak word identification skills could lead to poor reading comprehension.

5.1.4 Measuring reading comprehension ability

There are currently few standardized measures available for assessing adults' reading comprehension ability. Existing tests of reading comprehension ability like the NFER Reading Comprehension Test (1975) lack the appropriate adult norms needed for accurate assessment of adult populations (i.e. normed for up to 15.1 years). There is clearly a need for developing valid and reliable reading and reading comprehension tools suitable for assessing adult reading ability.

Typically, reading comprehension tests include a reading accuracy and a reading rate (speed) component. Other issues that are of relevance when assessing reading comprehension ability are the length of the passage or text, the reading mode (silent reading or reading aloud), the type of questions included in the comprehension test (multiple choice, cloze or yes/no type answers), and finally, the type of responses to comprehension questions (verbal or written). Choosing between single-word reading tasks versus text reading tasks is another key issue in the assessment of participants' reading skills. It has been argued that text or passage reading tasks are easier than single word measures of reading because the semantic or contextual information provided in the text can often aid comprehension. It would therefore be more suitable to assess word reading through single item lists of words rather than through a whole body of text in adult readers. Yet, using text reading tasks can provide valuable information about readers' higher-order reading skills, such as the ability to process, integrate, recall and infer information from text that cannot be otherwise tested using single-word procedures. So, text reading measures can arguably be viewed as more complex literacy tasks than single- word tasks as they can vary conceptually.

5.1.5 Reading comprehension and the ability to construct inferences from text

Last, but not least, another important component of reading comprehension is the *ability to make inferences from text* (Oakhill and Cain, 1997). Research suggests that normal readers routinely and quickly construct inferences that elaborate causal antecedents of explicit events in the text, but not inferences about causal consequences. The process of forecasting lengthy causal chains into the future is taxing on working memory, so these inferences are either not constructed or their construction consumes a fairly large amount of reading time. Graesser and Bertus (1998) collected self-paced sentence reading times from younger and older adults who read expository texts on science and technology related themes. In their study, readers were also tested on working memory, general world knowledge, verbal reasoning, and reading frequency. Multiple regression analyses on the reading times revealed that (a) causal consequence inferences were more time consuming than causal antecedent inferences and (b) elaborate non-causal inferences were not constructed. The pattern for inference variables was remarkably similar for younger and older adults and was unaffected by other measures of individual differences. The

researchers, therefore, concluded that the process of constructing causal inferences is stable and predictable across different groups of readers.

Although ESL readers are no less competent in phonological awareness skills and in making grapheme-phoneme correspondences when compared against monolingual controls, their ability to extract meaning from second language texts may be impaired because of different or unfamiliar cultural schemata experienced in their first language learning. With dyslexic monolinguals, however, we find the opposite pattern; although they may be competent in accessing meaning from text they are often poor in decoding and in phonological awareness skills. Research suggests that dyslexic individuals find it particularly difficult to construct inferences when processing hard text or use relevant general knowledge to support their understanding of hard text (Simmons and Singleton, 2000). They are also worse in their ability to determine the gist of a text and to pick out one statement from several that describe a passage, and finally, in their ability to resolve conflicts in text, that is the ability to comprehend ambiguous statements that could be disambiguated by a previous one. It has been found that although dyslexic students perform at a similar level to non-dyslexic students on literal or factual type of comprehension questions, their performance on inferential questions (that typically require higher-level information processing) is poorer. Such reading comprehension difficulties are not only due to their inability to decode individual words in the text, but to other possible reasons such as poor lexical automaticity or impaired working memory problems (Simmons and Singleton, 2000).

To investigate the above hypothesis, two types of *inference* questions have been included in our reading comprehension test: a) inference type questions that can be answered using information found directly in text (extracting meaning from a single sentence) and b) inference questions that can be answered by combining pieces of information (extracting meaning from more than one sentence or from a single paragraph) from the text or using general knowledge about the world to answer. Unlike in studies 1 and 2 of this thesis, yes/no type of questions as opposed to open-ended ones was used for the purposes of this study in order to limit the range of possible choices. Yes/no type answers would not be likely to interfere with language

knowledge or language use and would therefore simply elicit information about much individuals have actually understood of the text.

5.1.6 Research questions and aims of the study

The main research questions addressed in this study were the following: Do ESL and dyslexic individuals present the same kind of difficulties across the three domains of text reading (namely reading accuracy, speed and comprehension) or does their performance differ? Focusing on the area of reading comprehension, the present study will be testing whether any difficulties in reading comprehension suggest an underlying comprehension deficit amongst ESL individuals as well as whether their ability to make inferences from text is influenced by text complexity as in dyslexics. Additionally, the study will be assessing whether ESL individuals, like dyslexics, present difficulties in non-word reading speed, accuracy, as well as in recall of non-words within easy and hard texts. Last but not least, the present study aimed to test whether non-word reading would be related to and possibly predict reading comprehension ability.

5.2 Method

5.2.2 Participants

An opportunity sample of 15 E1L non-dyslexics (mean age 20.8 years, SD 1.44; 7 males and 8 females), 15 E1L dyslexics (mean age 20.6 years, SD 1.26; 4 males and 11 females) and 20 ESL individuals (mean age 26.9 years, SD 5.20; 4 males and 16 females) took part in this study. Dyslexic participants were obtained via the special needs support units in the higher education institutions where they were studying. All participants completed a questionnaire in which they had to report whether they are currently experiencing or had experienced any literacy problems and, if so, to specify what kind of reading difficulties they faced as well as the kind of assessment and support they had received or were currently receiving at the time of testing. Background demographic questions also included information on the level and course of study, sex, age, first language, and also the length of time spoken English as a second language. Participants with English-as-a-Second-Language were from

different language backgrounds, with 10 having Greek as their first language and the remaining having Italian, German, Hungarian, Rumanian, Persian, Malay or Spanish as their first language. All the participants from this group reported having English as their second language. The majority of participants were psychology students undertaking undergraduate or postgraduate courses who were offered one course credit in return for their participation to the study. All ESL individuals in this group satisfied the criterion of more than 7 years of English language proficiency (mean of 14.1 years of ESL experience). They were proficient English language speakers who were regularly exposed to English as part of the taught courses they were attending at the period of testing. None of the ESL or the E1L non-dyslexic individuals finally reported having any history of literacy difficulties.

5.2.2. Measures

A. Reading measure

5.2.2.1 Text reading accuracy and speed

Participants were administered passages 5 and 6 in English from the ART used in study 2 to read aloud followed by twelve yes/no comprehension questions that they were required to answer from memory after the reading of each passage. The first passage (“Film”), which was selected as easy (grade 6 reading level, 250 words), included information about a fictional character, namely a film critic. The second passage (“Gases”), which was more complex in terms of content, meaning and vocabulary (grade 10 reading level, 303 words), included information about chemicals. Both passages also contained a number of non-words. Participants were encouraged to read at their normal rate although time was recorded to examine any differences in speed of reading. Scores obtained from both passages were combined to produce a single measure of reading accuracy (number of errors made), reading speed (time taken to read passages), and reading comprehension (number of questions answered correctly).

Half of the comprehension questions included in the passages intended to test participants’ memory for specific details and half of them required ability to make inferences from the text. These were, specifically, four types: a) factual (that aimed to assess the ability to recall information of specific events or words found within the

passage), b) non-word based factual (that aimed to assess the ability to recall certain non-words found within the passages), c) text-specific inference (that aimed to assess the ability to make inferences using information stated explicitly in the text), and d) inference from general knowledge (that required participants to combine one or more pieces of information from the text and use their general knowledge about the world to answer). Below are some examples of comprehension questions that were included in the test:

Excerpt from passage 1 (‘Film’)

Maria Tilsot is, perhaps, the best-known female film director of the last century. Her films include “The Unbearable Darkness of Living”, “The Shrinking Violet” and “A Portrait of a Jealous Man”. She studied at the Vienna School of Film and Drama for five years under the great master of avant-garde film, Sam Green. Many believe that she developed her own unique style of filmmaking by absorbing the theoretical teachings of Green, and then re-interpreting them by using her own cultural influences. This has led to the film critic Stephen Vergot to describe her as “an individual who has broken the conventional barriers of modern film-making”.

Examples of four different types of comprehension questions from passage 1

(easy):

Question	Type	Answer
Was the name of the female director Maria <i>Tilsot</i> ?	(Fn)	Yes/No
Did she study in <i>Berlin</i> ?	(Fw)	Yes/No
Did she admire the work of Sam Green?	(Is)	Yes/No
Do you think her films would be described as fringe or alternative?	(Ig)	Yes/No

Fn=Factual non-word, Fw= Factual word, Is=Inference from story, Ig= Inference from general knowledge.

B. Non-word reading measure

5.2.2.2 Non-word reading (decoding) task

A bespoke English non-word reading task was developed, based on the work of Everatt (1997) and on the work of Rack, Snowling and Olson (1992). The task required participants to decode letter strings using grapheme to phoneme conversions.

It was specifically designed to provide an index of participants' ability to translate a written symbol into its corresponding phonological form. The task presented participants with a list of 20 non-words that varied from one syllable to multi-syllable pronunciations and from single grapheme-phoneme correspondences to multiple graphemes producing a single phoneme. The complexity of the task was established based on a consideration of the appropriate literature (Rack, Snowling and Olson, 1992; Everatt, 1997; Hanley, 1997) and pilot work conducted prior to testing. Participants were asked to read each letter string aloud as quickly as possible. Scores were obtained based on the time taken to read the words and the number of errors made.

5.3 Results

5.3.1 Non-word reading

One-way analyses of variance were initially conducted to compare the three groups' performance on the non-word reading task. Analyses indicated a significant main effect of group both in non-word reading accuracy ($F(2,49)=4.24, p=.020$) and non-word reading speed ($F(2,49)=5.67, p=.006$). Dyslexics produced significantly more reading errors ($p=.018$) and were significantly slower ($p=.015$) than non-dyslexics. ESL individuals were no less accurate compared to non-dyslexics, yet, like the dyslexics they took considerably longer to read non-words ($p=.015$). The results are presented in tables 5.1 and 5.2.

Table 5.1 Mean scores for the three groups on non-word reading accuracy and speed together with an analysis of variance and significance levels

Non-word reading measures	Dyslexic (N=15)		Non-dyslexic (N=15)		ESL (N=20)		F value df=2,49	P value
	Mean	sd	Mean	sd	Mean	sd		
Accuracy (total number of words correct out of 20)	17.80	2.67	19.7	0.59	18.5	1.66	4.24	<.05
Speed (time in seconds)	32.0	12.66	17.38	4.54	31.1	17.9	5.67	<.05

Table 5.2 Post-hoc comparisons between the three groups on non-word reading accuracy and speed

Non-word reading measures	Dyslexic vs non-dyslexic	Dyslexic vs ESL	Non-dyslexic vs ESL
accuracy	.05	NS	NS
speed	.05	NS	.05

5.3.2 Text reading

Composite scores from easy and hard passages of the reading comprehension task were combined to produce a single comprehension score. Initial analyses of the scores produced by the three groups on passage 1 (easy) of the reading task indicated significant differences both in text reading accuracy ($F(2,49)=3.78, p=.030$) and reading speed ($F(2,49)=11.32, p<.05$) but not in reading comprehension ($F(2,49)=0.22, p=.807$). The same pattern of results was evident in the analyses of passage 2 (hard) (see table 5.3). Post-hoc comparisons (table 5.4) indicated that for both passages, dyslexics performed significantly worse than the non-dyslexics on reading accuracy and speed, but were only marginally worse on reading comprehension. The ESL group was also significantly slower than the non-dyslexics in text reading speed, but was not significantly worse in text reading accuracy. The only significant difference revealed between dyslexics and ESL individuals was in the hard text, where dyslexics produced significantly more reading errors than the ESL group.

Table 5.3 Mean scores of dyslexics, non-dyslexics and ESL individuals on text reading measures

Reading measures	Dyslexics (N=15)		Non-dyslexics (N=15)		ESL (N=20)		F value df=2,49	P value
	Mean	sd	Mean	sd	Mean	sd		
Easy Passage accuracy (total number of reading errors)	4.13	2.85	1.93	1.48	2.15	2.70	3.78	<.05
speed (time in seconds)	112.97	30.13	82.8	14.08	116.4	19.48	11.32	<.001
comprehension (total number of questions correct/12)	10.20	3.09	9.80	1.47	9.70	2.10	.215	NS
Hard Passage accuracy (total number of reading errors)	6.93	2.98	2.86	2.55	4.25	2.75	8.41	<.001
speed (time in seconds)	139.1	33.17	97.84	11.27	146.35	22.37	19.44	<.001
comprehension (total number of questions correct/12)	9.66	2.41	10.66	1.79	9.80	1.88	1.105	NS

Table 5.4 Post-hoc pairwise comparisons between the three groups for measures of reading accuracy and speed

Reading measures	Dyslexic vs non-dyslexic	Dyslexic vs ESL	Non-dyslexic vs ESL
Easy Passage accuracy	<.05	NS	NS
speed	.001	NS	<.001
Hard Passage accuracy	.001	<.05	NS
speed	<.001	NS	<.001

5.3.3. Reading comprehension

The effect of each type of comprehension question from the reading passages was also examined using further one-way analyses of variance. Easy and hard passages were analysed both separately and combined. Post-hoc multiple comparisons between the groups' scores across the 4 different types of comprehension questions from easy and hard passages (combined) revealed that ESL individuals performed consistently significantly worse than non-dyslexics and dyslexics. The E1L dyslexics' performance, on the other hand, was found to be consistently very similar to this of E1L non-dyslexics, which suggests that, unlike ESL individuals, dyslexics do not seem to have difficulties in non-word recall information or in making inferences from easy or harder text. The results are presented in the table below:

Table 5.5 Mean number of correct responses produced by E1Ldyslexic, ESL, and E1L non-dyslexics on the 4 types of comprehension questions from easy and hard passages

Type of question	E1L dyslexic (N=15)		E1L non- dyslexic (N=15)		ESL (N=20)		<i>F value</i>	P value
	<i>Mean</i>	<i>sd</i>	<i>Mean</i>	<i>sd</i>	<i>Mean</i>	<i>sd</i>	<i>df=2,49</i>	
Word-based facts (Fw)	4.40	1.72	4.73	1.53	2.10	.967	25.62	<.001
Non-word based facts (Fn)	4.53	1.13	5.60	1.68	2.50	1.10	18.79	<.001
Text-specific inferences (Is)	5.00	1.85	4.80	1.70	2.85	.988	11.14	<.001
General knowledge inferences (Ig)	5.20	1.82	5.47	1.46	2.25	.85	29.96	<.001

Table 5.6 Post-hoc pairwise comparisons of the three groups' performance on the 4 types of comprehension questions from easy and hard passages

Type of question	E1L dyslexics vs E1L non-dyslexics	E1L Dyslexics vs ESL	ESL vs E1L non-dyslexics
Word-based facts (Fw)	NS	<.001	<.001
Non-word based facts (Fn)	NS	<.001	<.001
Text-specific inferences (Is)	NS	<.001	<.001
General knowledge inferences (Ig)	NS	<.001	<.001

5.3.4 Relationship between non-word reading and reading comprehension

To examine the last hypothesis, whether non-word reading ability could predict reading comprehension performance amongst dyslexics and ESL individuals, Pearson's correlations were performed. The only significant correlations revealed were in non-word reading accuracy. For dyslexics and non-dyslexics non-word reading accuracy was found to significantly correlate with non-word reading speed (both $p < .05$), whereas for ESL individuals it correlated with reading comprehension ($p < .05$). The findings are presented in the correlation tables below.

Table 5.7 Pearson's correlations between non-word reading and reading comprehension (easy and hard passage) measures for E1L dyslexics

Tasks	Non-word reading speed	Reading comprehension (easy passage)	Reading comprehension (hard passage)
Non-word reading accuracy	$r = -.532$, $p < .05$	$r = -.167$, NS	$r = -.066$, NS
Non-word reading speed		$r = .126$, $p = .654$	$r = -.310$, NS
Reading comprehension (easy passage)			$r = .344$, NS

Table 5.8 Pearson's correlations between non-word reading and reading comprehension (easy and hard passages) measures for E1L non-dyslexics

Tasks	Non-word reading speed	Reading comprehension (easy passages)	Reading comprehension (hard passages)
Non-word reading accuracy	r=.532, p<.05	r=.343, NS	r=-.156, NS
Non-word reading speed		r=-.366 NS	r=-.095, NS
Reading comprehension (easy passages)			r=.269, NS

Table 5.9 Pearson's correlations between non-word reading and reading comprehension (easy and hard passages) measures for ESL.

Tasks	Non-word reading speed	Reading comprehension (easy passage)	Reading comprehension (hard passage)
Non-word reading accuracy	r=-.097, NS	r=.544, p<.05	r=-.097, NS
Non-word reading speed		r=-.188, NS	r=.222, NS
Reading comprehension (easy passage)			r=.183, NS

For both dyslexics and non-dyslexics, non-word accuracy was significantly negatively correlated with non-word reading speed ($r=-.532, p<.05$). The more accurate the two groups were the faster they were in their non-word reading. For ESL individuals, however, non-word reading accuracy was only significantly positively correlated with reading comprehension of the easy passage ($r=.544, p<.05$).

5.4 Discussion

Consistent with findings obtained from study 1, **non-word reading** (accuracy and speed) was found to be an area of persisting difficulty for dyslexics in this study, which lends further support for the non-word deficit hypothesis (Snowling, 2000).

It could be argued that as far as the non-word reading ability amongst the ESL is concerned, successful word recognition can be achieved through processes other than phonological decoding, for example, through developing a sight vocabulary (although not the case with non-words like ‘Tipsot and ‘Vergot’). Sight vocabulary is a common compensatory mechanism that many adult dyslexics use during reading. Also, recall of non-word information within text, as assessed by the inclusion of memory for non-words type of comprehension questions, was an area where the two groups did not significantly differ either.

As far as **text reading** is concerned, a major finding of this study was that speed of processing text information was not related to poor reading rate scores in ESL or in dyslexics. Again, like with non-word reading, this finding provides evidence for a time deficit within the ESL group as revealed by their slow reading rate scores. It would seem that speed of reading is a skill that we would expect to develop in ESL individuals as L2 experience increases and after which they would be able to reach a level equivalent to that of E1L controls.

When the passages were combined in the analysis, no significant differences emerged between dyslexics and non-dyslexics on the **reading comprehension** task, where the three groups produced very similar scores. This result could suggest that text complexity did not significantly impact on the performance of text reading accuracy (number of reading errors) and reading speed (time) of the dyslexic individuals. Text complexity was not found to be a discriminating factor for dyslexics and non-dyslexics’ reading comprehension performance. Contrary to results of previous study, the dyslexics did not have a particular difficulty in making inferences from hard text. There was no inference effect found, which might be due the fact that this time yes/no type of questions were used instead of open-ended ones used in previous study. The E1L controls performed significantly better in total in factual questions within the harder passage than they did in the easier one, which might suggest the possibility of a

learning effect as they progressively gained familiarity with what the task required. ESL individuals may, on the other hand, have been weak in reading comprehension due to culture-specific information contained in the passages.

5.5 Some final conclusions about reading

Unraveling the relations between reading accuracy, speed and comprehension is important because it helps in the understanding of the reading process itself as well as the nature of difficulties individuals present during the reading process (Fidler, 2004). A major finding obtained in this study was that speed of reading appears to be a significant indicator of reading problems amongst adults with reading difficulties for both dyslexics and ESL alike. Dyslexics may be likely to use of contextual clues to aid their overall comprehension and to comprehend text more effectively, and this can sometimes happen to the detriment of their reading speed performance. They therefore often sacrifice reading speed to maintain reading accuracy and/or comprehension. Therefore, dyslexics often have good reading accuracy scores, are slightly above average in comprehension, but significantly lower when it comes to reading speed. This may happen because during their reading some may be re-reading words and/or phrases from text in their effort to decode words correctly and to maintain accuracy. Their low reading rate scores may also be a result of weaknesses in short term memory and speed in which they are processing text information. Although they are found to be more accurate on easier passages, their performance seems to deteriorate when it comes to reading harder text. Likewise, their speed of reading seems to deteriorate with text complexity.

To conclude, what these findings seem to suggest is that adults with reading difficulties may develop compensatory strategies such as slow reading rate to improve their reading comprehension or accuracy. It is more possible that dyslexics use text context to support their decoding as suggested by Nation and Snowling (1998). Interestingly, our evidence indicates that it is possible that ESL students also trade speed and accuracy such that slower rates of reading are related to fewer reading errors (see data in tables 5.3 and 5.4). However, the two groups may overall adopt different reading strategies to aid their comprehension of text information. We can only speculate as to the kind of strategies that the two groups are likely to use.

Perhaps future research could investigate the reasons why ESL and dyslexics use the same or different strategies for text understanding as well as the strategies that enable them to read both fast and accurately under specific test conditions.

Studies 1, 2, 3 and 4 investigated how dyslexics and ESL adult students can be found to be similar and different in terms of their literacy skills and phonological abilities. The two groups were compared on the basis of their different levels of language background. Subsequent studies will compare the two groups and will look beyond the level of language attainment to investigate how certain educational and language-specific characteristics may be influencing the reading and spelling performance of the two groups.

CHAPTER 6

Study 5: Greek and English measures of literacy and phonological processing: same or different predictors of reading ability?

6.1 Introduction

6.1.1 Literacy: the role of culture and educational background

Literacy is attained differently in different languages. It is a result not only of language-related abilities but also of numerous cultural and educational influences on the individual (Tureba, Guthrie and Au, 1981; Cline and Shamsi, 2000). Similarly, the attainment of phonological processing skills cannot be viewed in isolation from the type of education offered to students and certain socio-cultural factors related to their educational backgrounds. Even more importantly, in the study of special populations such as those with ESL, these factors need to be accounted for with more caution. Cross-linguistic research is also cross-cultural research because it takes into account the environment into which literacy and phonological skills have been attained. Accordingly, the selection of the assessment procedures as well as the assessment itself, need to consider such factors so that they are not only fair to individuals but also to avoid affecting the outcome of such procedures.

6.1.2 The importance of assessing L1 ability in cross-linguistic research

Ideally, studies with bilingual individuals should involve direct comparisons of first and second language reading ability using the same group of individuals. Another issue is administering reading tests with a reading difficulty that corresponds to participants' chronological age (i.e. administering more advanced text to older students), not only to their reading age. A third issue has to do with matching groups. While it is possible to draw inferences about the second language reading of each individual group it is impossible to compare the ESL and L1 English learners, since the proficiency levels of the groups are often so disparate. Last but not least, it is essential to select individuals from a broad range of proficiency levels and use sensitive second language proficiency measures in order to more clearly relate language proficiency, first language reading, and second language reading comprehension. Surprisingly, given their potential importance, sensitive second language proficiency measures seem to be rarely used in research referred to in the

psychological literature. There is clearly a need for developing appropriate assessment tools for measuring L1 and L2 ability not only within bilingual groups, but also for comparing their language skills to these of other groups (e.g. monolinguals).

Ocampo (2002) argues that “assessment in both languages is of utmost importance because the processes involved in literacy development in one language are also involved in the development of literacy in the other” (p. 183). However, using monolinguals as the point of reference for comparisons with bilinguals may be problematic in itself. Some have argued that it would be more appropriate-- and fair-- to compare bilinguals against other bilinguals or against ‘balanced’ bilinguals (Baker, 1993). Again, however, appropriate criteria need to be applied to determine the ‘type’ of bilingual one is comparing against.

One distinction one needs to draw, for example, is between *conversational fluency* (ability to be fluent in different social contexts), which can be attained depending on individuals’ experience and degree of oral exposure to the L2. Another criterion, especially relevant to the study of bilingual student populations, is *cognitive/academic fluency*, which may take 5-7 years of instruction to master (Baker, 1993). Finally, bilinguals and ESL need to be distinguished in terms of *simultaneous bilingualism*, (attained up to age of 3), which refers to the case when two languages are being acquired at the same time, and *sequential bilingualism*, which refers to the idea that bilingualism was attained later in life through formal or informal education and/or instruction. In the present study our monolingual and bilingual groups were selected on the basis of the above criteria.

6.1.3 Measuring bilingualism and level of language proficiency

Research into bilingualism has long employed the use of tools like self-rating scales and questionnaires to assess bilinguals’ actual use and level of L1 or L2 competence. Yet, there are inherent problems and limitations often evident with the use of such methodologies. One such limitation, for example, is the ambiguity in answering the questions or even in obtaining socially desirable answers. The use of self-rating scales as a tool for acquiring background information on bilinguals’ language abilities is therefore not without problems as some individuals may sometimes tend to over-

rate themselves and others may under-rate themselves when asked to provide a self-evaluation of their linguistic competence (Grosjean, 1998).

Questions included in self-rating scales and questionnaires assessing bilinguals' linguistic background need to take into account different domains of life like social and academic and should be able to discriminate between language ability and language usage in different contexts. They should also be designed to tap into the four language abilities (speaking, reading, writing and listening), depending on which is under investigation by the researcher at any one time (e.g. 'How many years have been speaking English-as-a-Second-Language?' is clearly a question referring to the ability to speak the L2).

According to Cline (2000), individual differences, as well as emotional, social and cultural factors are other important variables that need to be controlled for when doing research with bilinguals. Apart from the degree of expertise in L1 and L2 within the bilingual group (degree of proficiency in each language), we need to consider factors like *affiliation* (affective relationship with a language), and *inheritance* (membership, by birth, of a family or community with a particular language tradition).

6.1.4 Making (fair) cross-language comparisons

Cummins (1979) asserts that L1 proficiency plays a key role in L2 proficiency, both cognitive and academic. He argues those who are already good readers in their L1 are more likely to become proficient readers in the second/foreign language. This assertion was tested in an English-French bilingual study by Carey and Cummins (1979) where the researchers found strong positive correlations between participants' reading ability in the first and second/foreign language as measured in by the *Canadian Test of Basic Reading Skills* and in cloze type tests. Although there have been contradictory findings suggesting a lack of association between reading ability in their first and second language (e. g. Lapkin and Swain, 1977), the Cummins viewpoint would argue that "the same ability underlies both languages" and that "a reading ability learned in the second language transfers to the first language and that there is no evidence that bilingual reading behaviour is different in kind from native-speaker reading behaviour" (Alderson, 1998, p.9) (See Chapter 1.2 for further discussion of bilingualism and L2 reading).

6.1.5 Aims and rationale of the study

Study 5 was carried out to investigate whether the same measures of phonological processing as those used in previous studies can equally predict variability in English and Greek literacy ability in the two languages. Based on evidence obtained from previous studies indicating that L2 phonological measures do not predict L2 literacy skills in the same way as in L1, the present study looked for any differences or commonality in predictors of Greek and English literacy ability. Also, the finding that phonological measures do not equally predict literacy skills in L2 and L1 would be further evidence against the simple use of L2 predictor variables as screening tools that might be used to distinguish dyslexics from ESL students. As suggested by the data of previous studies in this thesis, such evidence would indicate the need to derive more appropriate assessments of the kind of difficulties presented by L2 students, perhaps by including L1 testing.

Additionally, the study aimed to investigate whether the same measures of reading fluency, verbal fluency and complex phonological processing as those used in previous studies would be able to differentiate between L1 (monolingual) and L2 (bilingual) groups, although direct comparisons of the two groups' performance were avoided given that the tests used in the two languages and on which the groups were assessed were, arguably, not directly comparable themselves.

The main focus of this cross-linguistic study was therefore to compare Greek and English measures of phonological processing and examine whether they can predict Greek and English reading ability to the same extent in two different groups of individuals, a monolingual group of Greek speaking students (G1L), and a group of Greek-English bilinguals with English-as-a-Second-Language (ESL).

Assessments in this study were carried out in different areas of reading such as non-word, word and text reading accuracy, reading speed and reading comprehension, verbal fluency (semantic, alliteration and rhyme) and phonological processing (rapid naming and spoonerisms).

6.2 Method

6.2.1 Participants

An opportunity sample of 20 Greek monolinguals (**G1L**) (10 males, 10 females; mean age 22 years, SD 3.35) and 20 Greek-English bilinguals adult students (**G-ESL**) (10 males, 10 females; mean age 25 years, SD 3.25) was employed for this study. After obtaining formal consent, participants from both groups were asked a few brief background questions in order to obtain some demographic information (e.g. age, sex, first language, course of study, the number of years of English language, whether or not they had regular exposure to English at the time of testing and whether they had experienced or were currently experiencing any learning difficulties). None of the participants from the two groups reported any history of literacy difficulties in their first language.

Participants from the Greek-English group (G-ESL) were all Greek native speakers who reported having more than 10 years of English language experience (mean number of 12 years of experience in English language learning). This group therefore, constituted a high-experience English language group. The Greek monolinguals, on the other hand, reported having English language experience only as a language course as part of their compulsory level school curriculum. Participants from the Greek monolingual (G1L) group reported having no regular exposure to English at the time of testing, as they were attending Greek public or private universities or higher education technical institutions of different areas of study, none of which included English in their curriculum.

These differences in their background meant that the two groups were likely to vary in terms of English language *ability* (general level of language proficiency), *function* (current language usage, oral exposure and verbal fluency), *competence* (experience specific to underlying language skills such as reading and writing), and *achievement* (experience specific to amount of language education previously attained).

The monolingual (**G1L**) group was assessed on the Greek version of the literacy and phonological tasks whereas the Greek-English (**G-ESL**) group was assessed on the English version of the same tasks.

6.2.2 Measures

6.2.2.1 Literacy measures

1. Text reading

A Greek version of the English text reading test used in study 4 was produced for the purpose of this study. The same two passages ('Film' and 'Gases') and the comprehension questions following each passage that were used in study 4 were translated and back-translated in Greek by the translation department in the University of Surrey. The English versions of these same passages were used with the G-ESL group, following the same procedure as in previous studies. The test was used to provide an assessment of reading ability, in terms of reading accuracy, reading speed and reading comprehension across easy and hard text.

Scores were obtained based on the time taken to read the passages aloud (reading speed), on the total number of reading errors made (reading accuracy) as well as on the total number of comprehension questions answered correctly (reading comprehension).

6.2.2.2 Phonological measures

1. Non-word reading task

As with the text reading, the English version of the non-word reading task was also the same as the one used in study 4. A Greek version of the non-word reading task was also produced which included 20 Greek polysyllabic pseudo-words or letter-strings. These were generated by adding 2 to 4 phonemes at varying positions (i.e. beginning, middle or end of word) in each of high-frequency Greek words (e.g.

χασμα [noun]-ρώνω [a common verb ending], σγου [a noun onset]- δι- κι [a common noun ending], στραπ [a noun onset]-ολα [a common adjective].

The first five non-words were adopted from Kasviki (1992), the rest were devised by the experimenter following the procedure described above.

Scores were obtained based on the number of words read correctly (non-word reading accuracy) as well as the time (non-word reading speed) taken to read the non-words aloud.

2. Semantic fluency task

The same semantic fluency task used in study 3 which was administered to the G-ESL group was translated into Greek for use with the G1L group. Greek participants were verbally presented with two general semantic categories, i.e. *things to eat* (πράγματα που τρώγονται) and *animals* (ζώα) and were asked to come up with as many Greek words as they could that related to this concept/category in 30 seconds. The two semantic categories used were the same ones as those found in the original English version of the test. Scores were obtained based on the total number of related words produced.

3. Alliteration fluency task

The same alliteration task used in study 3 with G-ESL individuals was also translated into Greek for use with the G1L monolingual group. The latter was verbally presented with a single letter, e.g. /β/ and /μ/ and was asked to produce as many Greek words as they could come up with that started with this letter in 30 seconds. The letters used were the same ones with the English alphabet letters used in the original English version of the test (i.e. /b/ and /m/). Scores were obtained based on the total number of correct words produced.

4. Rhyme fluency task

The same rhyme fluency task used in study 3 was used with the G-ESL participants and was also translated into Greek for use with the G1L monolingual group. The latter was verbally presented with two-syllable words e.g. /βή-μα/ (v/i/m/a literally meaning *step*) and /σώ-μα/ (s/o/m/a literally meaning *body*) and were asked to come up with (i.e. verbally produce) as many words as they could that rhymed (sound same towards the end) with these words in 30 seconds. These Greek words were chosen on

the basis of having common Greek sound (noun or verb) endings *-ήμα* (i/m/a), *-ώμα* (o/m/a). Scores were obtained based on the total number of correct words (acceptable rhymes) produced.

5. Spoonerisms task

The same Spoonerisms task as the one used in study 3 was used with the G-ESL students. As with all the phonological measures in this study, a Greek version of the spoonerisms task was also produced. This incorporated words adapted from the work of Kasviki (1992) and Mavrommati (1995) which had assessed the single word and non-word reading ability of Greek children. As with the English version of the task, the Greek spoonerisms test comprised of two parts that were analogous to those of the English version. In part 1 of the task (semi-spoonerisms) participants were verbally presented with 10 two-syllable and polysyllable Greek words and a single letter sound and were asked to replace the first sound of the word with the letter sound given (e.g. */μέλι/ με χ* gives */χέλι/*). (An equivalent procedure of first phoneme substitution as the one in the English version of the test was used). In part 2 (full spoonerisms) participants were verbally presented with 10 pairs of two-syllable and polysyllable Greek words and were asked to exchange the first sound from each word pair to produce two new words (e.g. */χώρα/- /δώρο/* gives */δώρα/-/χώρο/*). (An equivalent procedure of first letter substitution in each word pair as the one in the English version of the test was used). Participants' scores were obtained based on the number of pairs of words produced correctly (accuracy) and the time taken to answer (speed).

6. Rapid naming task

This task had two parts:

Part A. Rapid naming of digits

Participants were given cards containing a series of Arabic digits and were asked to read the digits out loud as quickly as possible. Students from the G-ESL group were asked to name the digits in English. Participants from the G1L group named the same sequence of digits in Greek. For both groups scores were obtained based on the time taken to read the digits. Scores from the two digit cards were combined to produce a single average digit naming score.

Part B. Rapid naming of pictures

In the second part of the task, participants were presented with two cards that contained a series of line drawings of 4 familiar objects hat, table, ball, and door (καπέλο, τραπέζι, μπάλα, πόρτα). Items were repeated several times on the cards producing a total of 50 items on each card. Participants were asked to identify (name) the objects as quickly as possible. Participants from the G-ESL group were required to use English names for the objects, whereas participants from the G1L monolingual group used Greek names for the same sequences of objects. For both groups, scores were obtained based on the time taken to name the objects. Scores from the two picture cards were also combined to produce a single average picture naming score.

6.3. Results

Means and standard deviations were initially obtained for the two groups average scores across the different tests used in the study. Table 6.1 presents the differences in the two groups' average performance across the literacy and phonological tasks only at a descriptive level as the data were not subject to any further analysis to provide direct comparisons between the two groups.

Table 6.1 Average mean scores produced by G1L and G-ESL groups (with standard deviations in parentheses) for all of the reading and phonological tasks

Tasks	G1L (N=20)	G-ESL (N=15)
Reading accuracy, p1 (number of errors)	1.20 (1.39)	1.26 (1.75)
Reading accuracy, p2 (number of errors)	1.90 (1.25)	3.23 (2.18)
Reading speed, p1(seconds)	100.2 (8.82)	103.66 (12.65)
Reading speed, p2 (seconds)	115.25 (10.74)	136.66 (14.07)
Reading comprehension, p 1 (number of questions correct/12)	9.8 (1.76)	10.20 (1.82)
Reading comprehension, p2 (number of questions correct/12)	11.5 (1.67)	10.66 (1.79)
Non-word reading accuracy/20	19.6 (0.67)	19.13 (0.91)
Non-word reading speed (seconds)	19.40 (4.08)	26.6 (3.58)
Semantic fluency (words produced)	15.42 (2.63)	14.80 (4.07)
Alliteration fluency (words produced)	9.69 (2.63)	10.46 (2.03)
Rhyme fluency (words produced)	3.75 (1.84)	3.93 (2.52)
Spoonerisms, parts 1&2(number correct/30)	25.45 (2.6)	22.00 (3.54)
Rapid naming, digits (seconds)	15.02 (2.73)	17.3 (2.76)
Rapid naming, pictures (seconds)	35.4 (7.53)	35.86 (6.32)

6.3.1 Correlations

Pearson's correlations were further carried out to investigate whether the measures of phonological processing can equally predict variability in English and Greek reading ability in the two language groups. Correlations were therefore produced for English and Greek measures separately. These are presented in the tables below.

Table 6.2 Pearson's correlations between Greek phonological and reading measures for the G1L group

Tasks	RS p1&2	RC p1&2	Sp (parts 1&2)	Fl (semantic, alliteration & rhyme)	NWRA	NWRS	RNp	RNd
RA p1&2	r=.061 p=.797	r=.007 p=.97	r=.171 p=.471	r=-.011 p=.962	r=.291 p=.213	r=.463 p=.055	r=.458 p<.05	r=.241 p=.307
RS p1&2		r=.083 p=.72	r=.103 p=.66	r=.186 p=.43	r=-.120 p=.61	r=.486 p<.05	r=.117 p=.624	r=.770 p<.001
RC p1&2			r=.518 p<.05	r=.627 p<.05	r=-.200 p=.399	r=-.225 p=.341	r=.435 p=.055	r=.221 p=.349
Sp (parts 1 & 2)				r=.215 p=.362	r=-.405 p=.077	r=.040 p=.866	r=.057 p=.812	r=.317 p=.173
Fl (semantic, alliteration & rhyme)					r=-.233 p=.324	r=.221 p=.350	r=.326 p=.160	r=.026 p=.912
NWRA						r=.023 p=.923	r=.245 p=.299	r=.196 p=.408
NWRS							r=.014 p=.954	r=.682 p=.001
RNp								r=.194 p=.412

Note: RA= reading accuracy, RS= reading speed, RC= reading comprehension, Sp= Spoonerisms, Fl= fluency, NWRA= non-word reading accuracy, NWRS= non-word reading speed, RNp= rapid naming of pictures, RNd= rapid naming of digits.

Table 6.3 Pearson's correlations for English measures for the G-ESL group

Tasks	RS p1&2	RC p1&2	Sp (parts 1&2)	Fl (semantic, alliteration & rhyme)	NWRA	NWRS	RNp	RNd
RA p1&2	r=.223 p=.425	r=-.283 p=.307	r=.343 p=.211	r=-.239 p=.391	r=.084 p=.765	r=.237 p=.396	r=.096 p=.733	r=.094 p=.738
RS p1&2		r=.133 p=.636	r=.077 p=.784	r=-.114 p=.685	r=.685 p<.05	r=.153 p=.586	r=.052 p=.855	r=.000 p=.999
RC p1&2			r=.627 p<.05	r=.192 p=.493	r=.276 p=.319	r=.014 p=.961	r=.134 p=.634	r=.003 p=.992
Sp (parts 1&2)				r=.244 p=.382	r=-.132 p=.639	r=.022 p=.937	r=.143 p=.610	r=.051 p=.857
Fl (semantic, alliteration & rhyme)					r=.352 p=.198	r=.160 p=.568	r=.221 p=.429	r=.632 p<.05
NWRA						r=.061 p=.829	r=.090 p=.751	r=.160 p=.570
NWRS							r=.217 p=.437	r=.180 p=.521
RNp								r=.117 p=.678

Note: RA= reading accuracy, RS= reading speed, RC= reading comprehension, Sp= Spoonerisms, Fl= fluency, NWRA= non-word reading accuracy, NWRS= non-word reading speed, RNp= rapid naming of pictures, RNd= rapid naming of digits.

For the G1L group text reading accuracy significantly correlated with rapid naming of pictures, whereas text reading speed with rapid naming of digits and non-word reading speed. Finally, reading comprehension significantly correlated with phonological measures of fluency and Spoonerisms. For the G-ESL group on the other hand, reading speed significantly correlated with non-word reading accuracy, whereas reading comprehension only with Spoonerisms. Other inter-correlations that emerged between phonological measures were only between fluency and rapid naming of digits.

6.3.2 Regressions

Two sets of regression analyses were performed, one for the G1L group and the other for the G-ESL group. In both sets of analyses, the reading measures of accuracy, speed and comprehension were entered as dependent variables (separate regression analyses for each measure were run). Sex and age were entered into each regression first. These were followed by the phonological related measures of non-word reading (speed and accuracy), fluency (semantic, alliteration and rhyme), spoonerisms (combined accuracy and speed scores for parts 1 and 2) and rapid naming time (digits and objects). After the control variables of age and sex, the remaining predictor variables were entered using stepwise procedures in order to investigate the best predictors of variability in the reading measures.

6.3.2.1 Predictors of Greek reading ability for G1L

For *reading accuracy* none of the phonological measures predicted a significant amount of variability of Greek reading ability in the G1L group (see table 6.4 for analysis passages 1 and 2 combined). The two passages were further analysed separately. When the easy passage was considered alone, reading accuracy was predicted to some extent by rapid naming of digits accounting for 20% of the variance (R^2 change=0.23, $F=3.21$, $p=0.05$ for the model). Reading accuracy of hard text, however, was not predicted by any of the Greek phonological measures. Similarly, *reading speed* was only predicted by on-word reading speed. Reading speed of easy text, however, was best predicted by rapid naming of digits (R^2 change=0.25, $F=3.34$, $p=0.05$ for the model), whereas reading speed of hard text was best predicted by non-word reading speed (R^2 change=0.35; $F=5.68$, $p=0.01$ for the model). Finally, *reading*

comprehension was predicted by three variables, semantic fluency, spoonerisms and rapid naming of digits that predicted considerable amount of variability when entered in the regression model (see regression table 6.4. below). For the easy text, the only predictor to emerge was spoonerisms time (R^2 change=0.28; $F=2.18$, $p=0.14$ for the model), but this was non-significant. For the hard text, measures of rapid naming of digits (R^2 change=0.29; $F=1.85$, $p=0.19$ for the model), non-word reading accuracy (R^2 change=0.31; $F=4.70$, $p=0.016$ for the model) and semantic fluency (R^2 change=0.16; $F=7.43$, $p=0.00$ for the model) emerged as predictors.

Table 6.4 Regression analyses for predictors of reading amongst G1L students

Variable entered	Predictor	R^2	Adj. R^2	R^2 Change	F	p
Analysis 1 – reading accuracy (P1&2)						
Block 1. Age and sex – enter		.31	.21		3.13	.075
Block 2. phonological measures – stepwise	none					
Analysis 2 – reading speed (P1&2)						
Block 1. Age and sex – enter		.23	.12		2.05	.165
Block 2. phonological measures – stepwise	Non-word reading speed	.56	.45	.33	5.44	<.05
Analysis 3 – reading comprehension (P1&2)						
Block 1. Age and sex – enter		.05	0		0.38	.692
Block 2. phonological measures – stepwise	Semantic fluency	.41	.27	.36	3.01	.069
	Spoonerisms	.72	.62	.31	7.56	<.05
	Rapid naming digits	.88	.82	.16	15.56	<.001

Note: p values in bold indicate significant at **<.05**

6.3.3.2 Predictors of English reading ability in G-ESL

Neither reading accuracy nor reading comprehension could be predicted with any degree of reliability in this group. However, as for the G1L group, reading speed was somewhat related to non-word reading, although this only approached significance in the G-ESL group and it was accuracy rather than speed that seemed to be a more important predictor of English literacy (see regression table 6.5. below). Reading

accuracy of easy and hard text was equally non-predictable by the phonological measures used in this study. Reading speed of easy text could also not be predicted by any measures of phonology, although reading speed of hard text was predicted by non-word reading accuracy (R^2 change=.59; $F=4.80$, $p=.025$ for the model). Interestingly, a number of predictors emerged for reading comprehension. Although no significant predictors emerged when both passages were combined for the regression analysis, text complexity did seem to be influenced by different variables. Reading comprehension of easy text was predicted by Spoonerisms accuracy (R^2 change=.26; $F=3.05$, $p=.079$ for the model), Spoonerisms time (R^2 change= .56; $F=6.3$, $p=.010$ for the model), non-word reading accuracy (R^2 change= .74; $F=11.68$, $p=.002$ for the model), non-word reading speed (R^2 change= .82; $F= 17.39$, $p= .001$ for the model), alliteration fluency (R^2 change=.91; $F=61.13$, $p= .000$ for the model) and rhyme fluency (R^2 change=.93 ; $F=115.85$, $p=.000$ for the model). For reading comprehension of hard text, it was rhyme fluency (R^2 change=.20; $F=2.69$, $p=.103$ for the model), semantic fluency (R^2 change= .58; $F= 7.36$ $p=.006$ for the model), non-word reading speed (R^2 change= 74; $F=12.4$, $p=.001$ for the model) and rapid naming of digits (R^2 change=.86; $F=31.54$, $p=.000$ for the model) that came out as predictors of the regression model.

Table 6.5 Regression analyses for predictors of reading amongst G-ESL students

Variable entered	Predictor	R^2	Adj. R^2	R^2 Change	F	p
<i>Analysis 1 – reading accuracy (P1&2)</i>						
Block 1 Age and sex – enter		.23	.09		1.68	.231
Block 2 phon.measures - stepwise	none					
<i>Analysis 2 – reading speed (P1&2)</i>						
Block 1. Age and sex – enter		.01	0		0.06	.944
Block 2. phonological measures – stepwise	non-word reading accuracy	.48	.33	.47	3.09	.077
<i>Analysis 3 – reading comprehension (P1&2)</i>						
Block 1. Age and sex – enter		.16	.01		1.07	.375
Block 2. phonological measures – stepwise	none					

6.4 Discussion

Overall, comparisons of the two language groups revealed relatively small differences in reading performance of easy text but better scores produced by the G1L group in harder text. The G-ESL group presented evidence of poor performance in non-word reading speed. Rhyme fluency was found to be poor in both groups. In the Spoonerisms task the G1L performed slightly better than the G-ESL group, whereas in the rapid naming tasks the two groups were almost similar in terms of object naming, with the G1L being slightly better than the G-ESL group in digit naming. Correlation analyses provided further contrasts of the two groups' abilities. For the G-ESL found only weak relationships between the phonological and literacy measures were found compared to evidence indicating strong relationships between those measures for the G1L group.

Results obtained from regression analyses indicated that after controlling for age and sex, reading accuracy was not reliably predicted by the phonological measures in either group, although there was some evidence for non-word reading to be related to text reading speed in both groups. Reading comprehension could be reliably predicted by a combination of phonological measures like semantic fluency, Spoonerisms scores and digit naming times for the G1L group but could not be predicted by any of the same measures for the G-ESL group. However, these measures did predict variability in comprehension for G-ESL students when easy and hard texts were considered separately. Given the small amount of variability in scores produced by ceiling effects in the above tasks, there was little hope for obtaining 'strong' results in the regression analyses performed.

It could be argued there was no commonality in predictors of Greek and English reading ability in the two language groups. This would suggest that measures of phonological processing could not equally predict variability in English and Greek literacy ability in the two languages under study. There was, however, some evidence to indicate variability in non-word reading ability, which was found to be a common predictor of text reading speed for both groups. In the case of Greek monolinguals (G1L), it is non-word reading speed that most influences reading speed performance, whereas in the case of Greek-English bilinguals (G-ESL) it was non-word reading

accuracy that played an important role in reading ability. This finding might be indicative of the level of performance in non-word reading accuracy shown by both groups, with the G-ESL group showing slightly more potential for variability in accuracy than the G1L group (see table 6.1).

The performance of the G-ESL group was inconsistent across the different areas that were assessed. Variations in their performance are likely to be indicative of different levels of L2 proficiency across areas of oracy, literacy and phonological awareness. This would suggest that some language skills appear to be better developed amongst the G-ESL group than others. Verbal fluency, for example, was found to be an area where the G-ESL group had no difficulty in their L2. The oral and fluency skills of the G-ESL group were as well developed in their L2 as they were for the G1L group. Yet, as expected, their L2 reading and reading comprehension skills were less developed. Consistent with our predictions and with findings from Ulijn (1978), the fact that the two languages compared in this study are structurally dissimilar may have posed a problem for L2 learners in terms of their reading comprehension and their reading speed performance. Differences that emerged in text reading of L1 and L2 could be attributed to insufficient grammatical or conceptual knowledge, subject knowledge, or finally problems with specific word meanings.

Another key difference that emerged in the predictors of L1 and L2 literacy was that relating to **reading comprehension**. Consistent with our predictions, L2 reading comprehension of easy and hard texts amongst the ESL group was found to differ in L1 and L2. There was no evidence for a developmental progression of L2 reading comprehension from easy to hard text for the ESL group. The results indicated that reading comprehension could be predicted by certain phonological components such as phoneme manipulation, semantic knowledge and rapid accessing of verbal labels in Greek (L1) but not in English (L2). When easy and hard texts were considered separately, non-word reading also played an important part in predicting variability in reading comprehension ability.

In terms of the predictors of L2 reading comprehension, variation in predictors seemed to indicate a *text complexity effect*. More specifically, phonological measures could predict variability in the comprehension of easy text, but phonological (i.e.

fluency and non-word reading) and lexical representation access/storage (i.e. semantics and rapid naming) measures are needed to predict variability in harder text. However, such complexity effects do not seem to help explain variability in L1 reading comprehension, which may again be evidence for language or orthography-related differences or may be attributed to language competence and experience factors. For comprehending easier text in one's L2 language, L2 language experience is not so important. For understanding conceptually harder texts, however, the level of L2 experience does seem to play a more significant role and is mediated by a number of phonological components.

Certainly more research into whether certain components of L1 and L2 literacy can be related to and can be predicted by different aspects of phonology is needed to unravel the links between literacy skills and phonological skills and where differences in prediction lie.

Consistent with findings obtained in study 3, the area of **fluency** that both the G1L and the G-ESL group struggled with was rhyme fluency. The present study presented further evidence that both groups have a specific difficulty in their ability to produce words that rhyme with a given word both in their L1 and L2. It appears that lack of familiarity of the rhyme task is the main factor that could have accounted for their low performance in this particular area of verbal fluency, which is also clearly evident in the data obtained from study 4. Greek children only receive minimal exposure to rhyme tasks/games during their early school years compared to English-speaking children who are more experienced in that account.

Performance on the **rapid naming** task revealed that rapid naming of digits appeared to be a simple automatised process for the G1L group. This finding also replicates the findings obtained in previous studies (1 and 2). The degree of daily exposure and familiarity with digits may have influenced their higher performance in this particular task. However, it should be noted that an obvious limitation with the use of the rapid naming task in different languages is, as Miles and Miles (1999) have argued, that the length of the words represented by each digit is different in different languages may put a strain on the working memory process, what they have referred to as the '*word-*

length effect'. As they explain: "any word which takes longer to pronounce reduces the number of words that can be held within the span of working memory. This is also true of Greek digits . . . (p.49). Therefore, whereas in English only number seven is a two syllable word, six, which is a single syllable word, may actually take longer to pronounce. This can influence both reading times and recall of digits (in digit span tasks for example).

Similarly, in rapid naming of pictures, it is likely that the names of the pictures included in the cards were polysyllable words (three out of four words included in the task contained three or more syllables, e. g. κα-ρέ-κλα, τρα-πέ-ζι, κα-πέ-λο), which could in fact have slowed down Greek participants' reading time scores. On the contrary, most of the equivalent English words contained in the picture-naming task were either monosyllabic or disyllabic, which in turn may have accounted for better reading times produced by the ESL group.

Performance across measures of rapid naming and semantic fluency was, however, inconsistent within the L2 group. Although evidence obtained from study 3 seems to suggest that these two areas are related in ESL individuals, findings from the present study seem to suggest that they may be related to a different degree in L1 and L2 accordingly. The G-ESL group was found to be relatively good at verbal fluency, but relatively poor at digit naming. This finding would suggest that verbal production tasks are therefore easier than naming tasks in one's L2. The first involve oral skills and productive use of language, whereas the second one requires the development of word decoding and automaticity skills to be able to retrieve L2 information from LTM.

Non-word reading speed was significantly slower in the L2 than it was in L1. G-ESL may need considerably more time to process unfamiliar words in the L2 than L1 readers do to be able to recognise and decode non-sense words in their L1. Could it be argued then that L2 non-word reading speed deficit presented by the ESL group is indicative of or attributed to their overall poor performance in L2 speed reading? The above result could be interpreted as an artefact of orthographic dissimilarity. It could

be argued that applying grapheme-phoneme correspondence rules that are different in L2 may have accounted for the poor performance amongst the ESL on the specific task. Similar findings were obtained from Nikolopoulos' (2001) work with Greek children in which it was found that although the underlying phonological deficit (non-word deficit) is essentially the same amongst Greek and English readers and spellers, the degree of severity and the manifestation of the deficit in different orthographies, namely in Greek and English, differ. As a result, any reading deficits amongst Greek individuals manifest themselves in their ability for speed reading, whereas any reading deficits amongst English dyslexics are more evident in their ability to read accurately.

Scores obtained from the **Spoonerisms** task indicated that the ability to manipulate sounds within words is a difficult task in the L2. It requires higher-order phonological processing for which ESL students needed considerably longer time than their monolingual controls. Differences in variability in the spoonerisms task are most likely due to the level of language competence amongst the ESL group and how this can often support the way they are dealing with complex phonological forms at the phoneme level in their L2. Their poor performance in this language-based verbal production task might also have to do with their difficulty to process non-words (as indicated by and possibly related to their poor performance on the non-word reading task too) in L2. Differences in the ability to process non-words may further relate to the orthographic dissimilarity of the two languages. This finding is consistent with the viewpoint that reading and writing difficulties in Greek may result from difficulties in phoneme segmentation, in converting symbols to phonological codes and in decoding (Porpodas, 1999).

There are, arguably, a number of methodological confounds in this study that ought to make us treat such findings with caution. Direct comparisons between the G-ESL and G1L are difficult, if not possible, to make given the varying ability of the two groups under study. More sound conclusions would have been possible if individuals from the same group were tested on both the Greek and English versions of the tests used to be able to assess performance in both languages. A major confound in the present study was therefore the fact that the G-ESL group was not tested in their L1 to

examine their level of reading ability in their L1 and therefore investigate the extent to which they were able to transfer these skills onto their L2. The following study will try to overcome this methodological concern by testing and comparing the same group of individuals in both their L1 and L2 language skills.

What is more, the low variability in reading accuracy and reading comprehension scores may have had an impact on the results obtained in the correlation and regression analyses performed. Therefore, the value of the correlations and regression analyses needs to be treated with caution due to the problem of ceiling effects in the reading accuracy and comprehension measures

It has to be argued that the Greek and English measures used in this study might have been helpful as assessment tools in identifying areas of relative strengths and weaknesses in literacy and phonological skills in the L1 and L2 groups. They are not, however, equally effective in identifying potential causes of underlying deficits as they are measures derived from the monolingual literature that may arguably not be appropriate for use with bilingual populations. One could also argue against the relative equivalence of the tests (i.e. non-word reading, spoonerisms, rapid naming). Tests that are translated from one language to another are not necessarily equivalent (see relevant section in the introduction of the thesis) and comparable. However, given the lack of equivalent standardised Greek versions of the tests within the Greek literature, the existing tests can be considered the best possible screening tools available for use for the purposes of this investigation.

This study identified differences in the level of prediction of literacy provided by measures of phonological ability amongst Greek monolingual and bilingual students. Study 6 extended beyond reading and the predictors of L1 and L2 reading ability to suggest that both E1L dyslexics and Greek/English bilinguals show lower levels of performance on measures of literacy and literacy-related skills but also that these groups differ on general English verbal skills with the lower performance of bilinguals being better predicted by these general language skills.

CHAPTER 7

Spelling

7.1. Introduction

Spelling ability comprises an essential component of literacy acquisition and language learning in both adults and children (Brown and Ellis, 1996a). Yet, it is an area of research that has not been given much attention in comparison to the bulk of studies that have been conducted on reading. It has only received increasing focus during the last two or three decades.

Like reading, spelling is also a literacy skill that heavily relies upon knowledge of the rules that govern the phonology and orthography of a given language. According to recent definitions, spelling is “a complex cognitive process that depends on phonological processing and coding skills and involves the use of higher-level syntactic, semantic, phonemic and graphemic information in addition to visual memory and phonological processes” (Siegel, 1996, p.227). Barry (1996) refers to it as the “ability to retrieve or to assemble an orthographic representation, that is, a coded sequence of letters” (p. 36). According to Seymour and Porpodas (1980) “spelling depends on *permanent storage* of information about letter identity and sequence” (p. 471). Writing, in turn, refers to the means through which this orthographic code is being translated, that is the means through which semantic information is converted to an orthographic output (Link and Caramazza, 1994). As Burt and Butterworth (1996) note, spelling is not a simple “visual learning task” (p.4); among other things it involves the ability to make sound-to-spelling mappings (between orthography and phonology) and to understand and use structural regularities of words at different levels. Written units are represented in different modalities or types of linguistic representation, such as in the form of phonemes, graphemes, onsets, rimes and words. Spelling reflects the ability for correct mapping and processing of these different form levels.

7.1.1 Links between reading and spelling

A number of studies have indicated that reading ability predicts spelling ability. For example, Burt and Fury (2000) found that reading experience (as measured by an adaptation of the Author Recognition Test) and reading accuracy (as measured by the ability to distinguish a previously read word from a similar distractor word) made independent contributions to the prediction of spelling proficiency amongst university students when reading comprehension, reading rate, and vocabulary knowledge were controlled.

More recently, Zabell (2003) found that reading was the single best predictor of spelling ability in both dyslexic and non-dyslexic adults. Spelling ability was positively correlated with vocabulary, Spoonerisms, and digit span amongst other measures, with Spoonerisms accounting for most of the variance of spelling ability (31%) and arithmetic accounting for most of the variance in reading ability (34%) in adult dyslexic males. For females, it was found that the strongest predictor of both reading and spelling ability was information accounting for 39% of the variance. Consistent with this line of evidence, Beech (2002) argues that individuals with good decoding skills will also be good at lexical processing. He explains that reading improves phonological skills, which in turn assist the development of a sight vocabulary. What is more, those that are more familiar with the orthography of a specific language have more exposure to print and therefore become better spellers. The fact that good readers are found to be good spellers and that poor readers are poor spellers is consistent with views presented in the reading literature for “Matthew effects”, i.e. poor reading ability will impact on related areas of skill acquisition, such as spelling (Stanovich, 1986).

Although much evidence suggests that those who are good readers are good spellers, a number of studies have demonstrated that impaired phonetic spelling (e.g. lexical dysgraphia) and normal reading can sometimes co-occur (Frith, 1980). Indeed, some good readers can be poor spellers and vice versa and yet others can be both poor readers and poor spellers the same time. Frith (1980) gives the example of good readers who are nevertheless poor spellers suggesting that they may read ‘by eye’ but spell ‘by ear’. This means that although those individuals have mastered the orthographic strategy in reading, they have failed to transfer it to spelling, thus having

ease with regular and difficulty with irregular word spellings. This would suggest that orthographic processing may not necessarily develop independently from logographic and alphabetic processing and that distinct resources (namely logographic and alphabetic) contribute to reading and spelling differently.

Given the great individual variations in reading and spelling ability, the exact connections between the two still remain unclear. Compared to good readers, poor readers have been found to rely more on phonological strategies in their spelling choices, thus producing more phonologically accurate errors in irregular than in regular words. Good readers, on the contrary, rely both on phonological and visual-orthographic strategies, “since the irregular words appear to require a visual orthographic entry in the lexicon in order to be pronounced” (Barron et al 1980, p. 210). In a comparative study of children’s developing reading and spelling ability, Bryant and Bradley (1980) found that children were able to spell regular words that they were unable to read in the first place, suggesting that the same children were not necessarily better at reading than they were at spelling. The same was not true, however, for non-words, where children’s spelling and reading performance was found to be more consistent (words that were not phonetically spelled were not phonetically read either). Bryant and Bradley (1980) therefore concluded that “children often try to read and to spell the same words in different ways that they often depend on visual chunks when they read and phonological segments when they spell” (p.368).

In trying to establish the link between reading and spelling, it has further been suggested that individuals often tend to monitor one skill by means of using the other. As Barron et al (1980) explain, “when we spell, we frequently read what we have spelled to make sure it is correct”. We might also check possible readings of a word by using our knowledge of spelling” (p. 166). There is, therefore, the possibility of transfer of reading skills to spelling skills.

Seymour and Evans (1996) have concluded that the reading and spelling systems may be linked in the following ways:

1. A phonological source is a common basis for alphabetic reading and spelling which assists the formation of phonologically structured orthographic frameworks in both domains,

2. The logographic process in reading is the source of the lexical/semantic constraints in spelling and, hence, of the ‘morphemic pattern’ of dyslexia (or dysgraphia), and
3. Emerging awareness of the special feature of words might accompany development of the lexical source, and that a ‘syntactic awareness’ of morphological structure may be needed for the spelling for complex forms (p.144).

Indeed, most current theoretical models of literacy acquisition tend to encompass the reading and spelling systems as being closely interrelated, suggesting that in essence, “reading and writing mutually influence and grow from each other” (Ellis, 1996, p.155). According to Frith (1985) “spelling and reading interact to advance the learner towards increased proficiency in each ability” (p.158). The same developmental stages that are involved in spelling, (from a logographic to an alphabetic and finally to orthographic) are evident in reading too. More specifically, during the logographic stage whole word vocabulary knowledge in reading assists the learning of spelling. Entering into the alphabetic stage, practising spelling and gaining familiarity with the alphabetic code aids the development of alphabetic reading, and finally at the last stage, the orthographic stage, where orthographic representations acquired through reading are being transferred to spelling. At this last stage it is therefore practice with reading that “encourages sufficient analysis of letter sequences in words to allow the reader to develop internal representations that are well specified in terms of letter-by-letter detail” (Ellis, 1996, p.160). Spelling strategies therefore assist reading development while the acquisition of orthographic knowledge through reading facilitates the development of orthographic spelling in later stages.

7.1.2 The role of orthographic and phonological processing skills in spelling

It has been long established that orthographic processing skills, the successful use of orthographic information (i.e. knowledge of the written form of words) when processing written code, as well as phonological processing skills, the ability or knowledge of correct letter-to-sound correspondence rules and word decoding skills influence both reading and writing performance. Yet, do phonological and

orthographic processing skills make independent contributions to skilled spelling or is there an overlap between the two component skills?

According to Cataldo and Ellis (1988) “research that examines the relationship of phonological awareness to the emergence of literacy has often neglected spelling as a bona fide agent that independently influences and is influenced by phonological awareness and reading” (p. 88). There are, however, few correlational studies that have managed to establish a clear link between reading, spelling, phonological and orthographic processing skills in normal and poor adult spellers and/or readers despite the bulk of evidence (e.g. Juel, Griffith and Gough, 1986; Ellis and Large, 1987) suggesting a strong relationship between early reading and spelling as well as between phoneme awareness and spelling ability (Cataldo and Ellis, 1988) and that which suggests that spelling best predicts phonological awareness skills and that phonological awareness is a strong contributor to the development of spelling ability at later stages of literacy.

Allyn and Burt (1998) have also argued that there is a strong positive relationship between phonological processing skills and adult spelling ability and that this relationship was mediated by phonological coding (spelling-sound knowledge). That is, those with higher levels of spelling proficiency presented evidence of superior phonological processing skills compared to those scoring lower in a number of phonological awareness (e.g. Spoonerisms, phoneme deletion) and phonological coding (e.g. non-word pronunciation and abstract spelling patterns) tasks.

However, the exact link between phonological processing skills, orthographic knowledge and spelling ability in adults has not been clearly established yet. Some studies (e.g. Stanovich and West, 1989) have found orthographic knowledge to significantly predict adult spelling ability and to distinguish between adult poor and good spellers, whereas other studies report phonological skills as making more important contributions to spelling competency (e.g. Bruck and Treiman, 1990). It is likely that orthographic and phonological skills are interrelated, with some evidence indicating that the development of orthographic knowledge is dependent on phonological abilities.

Orthographic processing skills defined as the successful “use of orthographic information when processing written code” (Nassaji, 2003, p.265) have been typically measured through the use of real word tasks, orthographic and homophone choice tasks (e.g. Barker, Torgesen, Wagner, 1992; Wagner and Barker, 1994) as well through the use of pseudo-word tasks containing letter strings of words that do not exist in the English vocabulary, i.e. non-words (e.g. Siegel, Share and Geva, 1995). Nassaji (2003) argues that when it comes to assessing the orthographic processing skills of ESL readers or spellers, tasks involving real words may be deemed as inappropriate. This is because “in performing real word tasks, people might rely on word-specific (lexical) information rather than on general orthographic information, confounding word-specific knowledge with general orthographic knowledge” (p.265-6).

Good spellers have been found to integrate visual memory skills and phonological information effectively compared to those with poor spelling ability. That is, they employ both visual cues and phonologically based rules almost to the same extent when asked to spell difficult words. Poor spellers, on the other hand, rely more on visual memory strategies and orthographic conventions when asked to spell difficult words. However, in order to have a clear picture of the relative contribution of both variables in spelling performance, future research in the area will need to delineate the two measures of phonological processing abilities and orthographic knowledge. Measures designed for assessing adults’ spelling skills should therefore aim at directly assessing each component skill separately. This is not an easy task particularly considering that any difficulties in breaking down the different components associated with spelling ability may actually reflect the inherent interrelatedness of the two skills.

7.1.3 Spelling and adult dyslexia

It has long established that a defining characteristic of dyslexia is poor spelling ability. Although many adult dyslexics may obtain high scores on measures of single word reading, they still show evidence of persisting problems in their spelling (Miles, 1993). Dyslexics make one spelling error in five, whereas the ratio for normal readers is one in thirty five. They are not only more prone to more spelling errors, their spellings are qualitatively different from those of normal learners (Moats, 1994;1996) and are much slower when retrieving familiar word spellings. Dyslexics are also

found to be slower when presented with unfamiliar information such as non-word spellings. Such non-word processing deficits are most likely due to poor orthography-to-phonology conversion processes. They further present evidence of difficulties with orthographic processes, such as weaknesses in processing homophones. More specifically, dyslexics have difficulties in the ability to segment and translate graphemes to phonemes and vice versa and because of their inability to make the above conversion they cannot progress to the alphabetic stage. Spelling problems in dyslexics originate from the *acquisition* of spelling knowledge by the semantic memory system (Nicolson and Fawcett, 1995).

7.1.4 Reading and spelling in different orthographies: the role of phonological awareness and orthographic representations

In more transparent orthographies, like Greek for example, one would expect to find readers who develop orthographic representations on the basis of grapheme-phoneme correspondences. One would therefore expect nonsense words like *daik* to be decoded as quickly and as easily as nonsense words like *dake*. One would also expect nonsense words with both orthographically and phonologically unfamiliar rimes to be easily decoded. Goswami (1999) presents a test of this hypothesis in a cross-linguistic study of English and Greek readers aged 7-9. Participants were presented with familiar rimes (e.g. *bomic*) and unfamiliar rhymes (e.g. *bommick*). She found that compared to English readers who found nonsense words like *bomic* much easier to read and to decode, Greek readers showed the same reading accuracy and speed in decoding both words. This finding provided evidence for the hypothesis that for Greek readers who learn to read in a more transparent orthography the grapheme-phoneme correspondences are more important units in the orthographic representations (Goswami, 1999).

7.1.5 Spelling difficulties in adult L2 learners

Cross-language comparisons: English VS Greek spelling

Orthographic transparency is a determiner of the degree to which L2 learners use phonology during word recognition. L2 readers therefore become less dependent on phonological mediation with experience and this reduction is more rapid for readers of opaque orthographies.

Do readers/spellers of orthographies in which there is a simple relation between spelling and sound (transparent orthographies) depend more on decoding for word recognition than do readers of opaque orthographies? To what extent do readers depend on decoding (assembled phonology) to recognize and spell a target word?

A transparent orthography (Greek), in which each letter has only one pronunciation, was compared to a more opaque one (English).

This study addresses the question of whether there are processing differences among readers of different alphabetic writing systems in recognizing and spelling of isolated printed words, non-words or words within text. The role of processing differences between two alphabetic writing systems (orthographies) that differ in the way the spoken word is represented by print is under investigation in this study. In one, Greek, the alphabetic principle (i.e., the letter-to phoneme correspondence) is perfectly consistent; in the other, English, it is not. The Greek orthography is said to be fairly transparent, whereas English is said to be opaque.

7.1.6 Spelling ability in L2 learning

Recent research has indicated that L2 skilled readers and spellers rely less on phonological than on orthographic codes, which in turn may be indicative of the fact that the relative contribution of phonological and orthographic knowledge might differ in different stages of language proficiency (Nassaji, 2003). Spelling difficulties amongst ESL individuals have also been related to their inefficient use of their mental dictionaries or mental lexicons in real word and non-word processing. There are currently three models in the bilingual literature that describe how bilinguals' lexical knowledge is accessed and organised in their L1 and L2. According to the *independence hypothesis* (concept mediation) there are distinct word memories for each language so that information processing in one language does not directly affect processing in the other. Proponents of this view argue that "lexical information is represented in functionally separate language-specific lexicons" (Gerard and Scarborough, 1989, p.135). They therefore claim that there is a neutral store leading to two lexicons and that bilinguals group words from two languages into categories in two separate mental dictionaries in each language. On the other hand, proponents of the *language interdependence hypothesis*, (e.g. Lopez and Young, 1975) argue that lexical representation in bilinguals is language specific and that L1 and L2 mental

lexicons function independently during reading and spelling. According to the interdependence hypothesis there is no single integrated word memory system that is in use for processing information in both languages (McCormack, 1977). Finally, according to a third model, the *language selective access hypothesis model*, there is a language switch mechanism involved in bilinguals that controls which lexicon (L1 or L2) is activated in different situations (Van Wijnendaele and Brysbaert, 2002).

Evidence to support the first two theories has been obtained over the years through the use of different measures in bilinguals' L1 and L2 languages like the Stroop effect (Chen and Ho, 1986), free-recall, word categorisation, sentence memory, word association, word recognition and lexical decision tasks. As Gerard and Scarborough (1989) note, however, "it seems that neither a complete independence nor a completely integrated model adequately describes bilingual linguistic memory" (p. 306). They explain that contrasting findings from experiments that have used the above measures "may arise because the various experimental tasks emphasize different processes. For example, bilinguals may have an integrated semantic memory, but there may be language-specific processes involved in encoding and retrieval of a word in the bilinguals' lexicon(s)" (Gerard and Scarborough, p.306). Therefore, "different tasks may differentially emphasize encoding and semantic processing so that bilinguals may show evidence for language independence in some circumstances, language integration in others, or a mixture of effects" (p.306). The independence-interdependence debate needs more clarification and as Gerard and Scarborough (1989) point out "finer analysis of task demands and processes" (p.306).

In view of such methodological and conceptual concerns research needs to address the question of whether lexical information is represented in separate language-specific lexicons or in a single integrated mental lexicon in the case of Greek-English speaking individuals. Given that English and Greek are notably orthographically dissimilar languages-- and in fact completely different scripts-- there are unique spelling patterns and letter strings for any given word found in each language. Therefore, it is expected that different language-specific processing is taking place in Greek-English speaking individuals separately and that the independence hypothesis would be confirmed.

7.1.7 The role of vocabulary knowledge in L1 and L2

Vocabulary knowledge is viewed as an important cornerstone of literacy for L1 and L2 learners alike. In recent years, linguistic research has placed a great focus on the role of vocabulary knowledge in certain aspects of L2 acquisition like reading ability, comprehension ability and spelling ability. Studies into L2 vocabulary have provided evidence that there is in fact a reciprocal relationship between these skills:

development of adequate vocabulary influences reading and spelling performance and vice versa. Attainment of vocabulary knowledge is, in other words, considered to be both a cause and a consequence of reading and spelling skills development.

According to Stoller and Grabe (1993), “vocabulary learning involves the acquisition of a range of skills. More specifically, students must be able to recall meaning, infer meaning, comprehend a text, communicate orally, spell correctly etc” (p.30).

7.1.8 Measuring vocabulary knowledge

It is now well established that beginning L2 learners heavily rely on context for word recognition as well as for inferring the meaning of unfamiliar words whereas more advanced L2 learners do not. It has in fact been argued that use of contextual definitions to a great extent facilitate vocabulary acquisition and learning skills.

According to Clarke and Silberstein (1977) “contextual definition is the most crucial of vocabulary skills” (Stein, 1993, p. 203). Yet, sometimes contextual definitions are not enough for adequate L2 comprehension as they do not always provide sufficient clues for inferring word meaning unless the unknown word has been previously recognised or adequately understood. Nation (1993) further argues that vocabulary is an indicator of good world knowledge and claims that “this world knowledge enables reading comprehension because the reader must bring as much information to the text as the reader expects to get from it” (p. 116).

7.1.9 Semantic reasoning and spelling

Current research has frequently implemented the use of semantic reasoning tasks as a measure of assessing spelling performance and as an index of general language ability. To be able to spell one should know the meaning of a given word, that is, the semantics of the word. The ability of being able to link the spelling to meaning has been tested through the use of semantic tests in which participants are asked to judge whether pairs of words, for example, *reign/king* and *barren/aristocrat* are related in

meaning (the first pair is but the second is not). Such a task essentially assesses participants' ability to "link the spelling of homophones with their meaning indicated only by their spelling" (Beech, 2002, p.126). Semantic reasoning tasks, unlike orthographic choice tasks, are useful in providing information about whether participants actually know the different meanings of the words presented and is therefore also considered to be a measure of vocabulary knowledge. Furthermore, they incorporate an element of problem solving. Beech (2002) reports that ability for semantic reasoning, homophony, and spelling, are all correlated with each other. It was found that those who are good at recognising homophonic words are least susceptible to word regularity perform better at meaning judgement tasks and are, subsequently, better spellers.

In the present research a semantic reasoning task was used as an index of general world knowledge and reasoning ability. It was expected that the three groups would not differ in their performance on this task. Of particular interest was to test whether performance in semantic reasoning would predict performance in measures related to language experience and thus investigate whether low or high language experience would be a factor that could lead to bad or good overall performance on the literacy and spelling measures used in this study.

Samarzi (1999) studied the spelling, short term memory, and reasoning ability of 12 and 13-year-old Greek children, half of whom were dyslexic and half were non-dyslexic. Measures included a spelling task, a sequence and reasoning task and a short-term memory task. For the spelling task, participants had to spell nine irregular words with vowels, diphthongs and different combination of consonants. They were tested on letter omission, letter reversal, word endings, letter substitution, and errors in the use of different vowels. In the sequencing task, children were presented with seven different pictures of a man and had to mark next to each picture the right number (ranging from 1 to 7) in order of complexity. The memory task required participants to recall visually presented familiar pictures from class textbooks and to identify a number of objects presented in sequence at the beginning of the experiment. Participants were then asked to write down the corresponding word of the stimulus pictures and objects presented to them. It was found that in the spelling task, both dyslexics and non-dyslexics had difficulty with vowels and diphthongs that

correspond to specific Greek phonemes “o” and “i”. However, dyslexics were significantly poorer than non-dyslexics in spelling correctly all the vowels and diphthongs in the spelling task. Significant differences between the two groups were found in letter omission, letter reversals, word endings and letter substitutions. Yet, in the sequencing and reasoning task both groups performed at an almost equivalent level (82% success rate for non-dyslexics and 80% success rate from dyslexics). In the memory task, overall non-dyslexics outperformed the dyslexics.

It appears then, that at least at the phoneme level, even non-dyslexics exhibit some difficulties, which according to Samarzi (1999), may be attributed to the different variations that certain Greek phonemes such as “o” and “i” have and that present a source of confusion in their spelling. Such spelling difficulties in selecting the appropriate grapheme suggest that dyslexic children may still be in the alphabetic stage of the spelling development which does not allow them to apply orthographic rules such as grapheme-phoneme correspondences (Kasviki, 1992). Such findings are also consistent with the viewpoint that reading and writing difficulties in Greek may result from difficulties in phoneme segmentation, in converting symbols to phonological codes and in decoding (Porpodas, 1989; 1990).

7.1.10 Cross-language comparisons: English VS Greek spelling

Orthographic transparency is a determiner of the degree to which L2 learners use phonology during word recognition. L2 readers therefore become less dependent on phonological mediation with experience and this reduction is more rapid for readers of shallow orthographies (Goswami, 1999).

Nikolopoulos (2001) argues that orthographic transparency plays a major role in explaining manifestations of dyslexia in Greece. He compared grade 2 and grade 4 dyslexic and non-dyslexic children on measures of word and non-word reading, spelling, phonological awareness, phonological processing and syntactic awareness. Findings demonstrated that young Greek dyslexic readers were highly accurate, but very slow when reading words and non-words and when responding to questions about the phonological structure of words in the different phonological awareness tasks. Yet, despite their reading accuracy, dyslexics made significantly more errors than non-dyslexics on both reading measures, and significantly more errors on non-

word reading. Differences were also evident in the spelling ability of the two groups. Nikolopoulos (2001) argued that written language deficits amongst Greek poor spellers are possibly linked to phonological deficits as poor scores on phonological awareness and rapid naming scores indicated. He concluded that although the underlying phonological deficit (non-word deficit) is essentially the same amongst Greek and English spellers, the degree of severity and the manifestation of the deficit in different orthographies, namely in Greek and English, differ.

When learning any new spelling, learners of different scripts rely on morphology or phonology to a different degree depending on how orthographically shallow or deep the language is. Users of orthographically deep languages are more likely to have more problems with the phonological route in their L2 than users of more orthographically shallow languages who would be expected to have more problems with accessing the visual route (Cook, 1997).

Research on Greek spelling ability has mainly focused on children rather than adults. To date, there is very little research on adults' spelling ability particularly amongst adult dyslexic and ESL groups. There is also little cross-linguistic research contrasting the performance of Greek and English spellers across the two orthographic systems. The current work will attempt a cross-linguistic comparison of the two spelling systems and will investigate the areas of difficulties encountered by English and Greek readers and spellers.

Study 6

Beyond reading: assessing phonology, orthography and vocabulary in English and Greek spelling

7.2 Aims and research questions

The present research employed adult student populations to compare their spelling performance in both their first and second languages. In addition to such comparisons, the study investigated the relationship between levels of spelling proficiency, vocabulary knowledge and phonological processing skills across two different scripts (English versus Greek) that have different orthographic conventions. This study addresses the question of whether there are processing differences among users of different alphabetic writing systems in recognizing and spelling isolated printed words, non-words or words within text.

The aim of the present study was therefore to assess the language ability of Greek-as-a-first-language adult students with English-as-a-Second-Language (G-ESL) and compare their performance to that of E1L dyslexics and E1L non-dyslexics on certain literacy skills at the word, sentence and text level.

Having established from previous studies that phonological processing deficits impact on literacy skills in both dyslexics and ESL individuals, this study was undertaken in order to investigate whether phonological deficits influence the development of L1 and L2 orthographic processing skills as assessed in terms of L1 and L2 spelling ability and vocabulary knowledge or whether these skills develop independently from phonology.

The present study will therefore attempt to clarify the relationship between and the relative contribution of phonological awareness and orthographic knowledge in adult L1 and L2 spelling. In particular, it is hypothesised that individuals with high levels of *spelling proficiency* and *vocabulary knowledge* will also show superior performance in phonological and orthographic processing skills and individuals with poor spelling skills and vocabulary knowledge will present evidence of poorer phonological and orthographic processing skills. The above skills will be assessed in two different language groups exposed to different types of orthographies, one which is

orthographically transparent and in which there is a close grapheme-phoneme correspondence (Greek) and a more opaque one where there are more grapheme-phoneme inconsistencies (English).

Additionally, knowledge of orthographic conventions of the two language systems would be expected to be related to spelling ability in the two language groups differently. Any language deficits common between the dyslexic and ESL groups will be specific to the ESL' L2 related deficits. It is also expected that deficits evident in English will not be found in the Greek language and that English students will be likely to make more spelling errors in quantity as opposed to Greek students as a result of English being less orthographically transparent language.

The spelling tests included in this study will aim to assess the orthographic processing skills of ESL and E1L dyslexic students and establish whether spelling develops independently from other phonological aspects of language. In particular, they intend to test participants' ability to recognise or produce correctly spelled words and identify spelling errors on the basis of word order and meaning (context) provided.

The work is specifically designed to investigate the relationship between spelling proficiency and vocabulary knowledge and examine the relative contribution of phonological and orthographic processing skills in predicting individuals' performance in these two areas.

The findings of this study will be valuable in allowing us to assess different theoretical causes of literacy problems in ESL and dyslexic individuals, devise appropriate assessment procedures and produce the right tools to support poor spelling performance in these two groups of individuals.

The specific research questions formulated for this study were therefore the following: Are there any differences in the spelling ability of dyslexics and ESL and do these differences suggest general language difficulties or specific difficulties relating only to L2 spelling amongst the ESL? A second question that was set forward was whether native learners of transparent orthographies (Greek) depend more on phonology (decoding) or on orthographic cues (orthography) for word recognition and spelling

compared to learners of more opaque orthographies (English). Additionally, are there any language processing differences among readers of the two different alphabetic writing systems in recognizing the right spelling and misspelling of isolated printed words and non-words within a sentence or text context? Finally, is there an interdependence between phonological processing and orthographic processing skills during spelling and if so, then do phonological and orthographic processing skills make independent contributions to spelling performance or is there an overlap between the two?

7.3. Method

7.3.1 Participants

A total of 55 participants took part in this study. All were adult college-level students with an age range of 18-51 years old (mean age =26.9, sd=6.1) who were recruited from two UK Universities in the South East.

E1L (English-as-a-first language) group

This was an opportunity sample of 20 postgraduate University students. Fifteen of them were female and five were male, with a mean age of 29.3 (sd=5.65). All were native English speakers who were undertaking a number of different postgraduate courses. Prior to completing the tests, participants signed a consent form agreeing to take part in the study and were asked to fill in a short questionnaire which included background questions about their studies, educational background and whether they had or were currently experiencing literacy difficulties (difficulties in reading and spelling English). None reported any history of literacy problems and all indicated that English was their first language.

Greek ESL (English-as-a-second language) group

This was an opportunity sample consisting of 20 Greek postgraduate University students. Fourteen of them were female and six were male, with a mean age of 25.9 (sd= 2.75). Although they all had learnt English as a second language, they were considered proficient English language speakers given that they all reported having more than 10 years of formal English language education and exposure. None

reported having any history of literacy problems based on the same self-report questionnaire used for the EL1 group. ESL participants were first administered the English version of the orthographic choice, pseudohomophone and spelling tests, followed by the same tasks translated into Greek.

E1L dyslexic group

This was an opportunity sample of 15 native English students diagnosed with specific literacy difficulties (i.e. difficulties in reading, spelling and with their academic writing) who were recruited from the University's additional learning support unit. Seven were male and eight were female, with a mean age of 25.3, (sd= 8.85). All reported a history of some form of literacy difficulty and all were experiencing literacy difficulties at the time of testing on the basis a self-report questionnaire that they filled in before completion of the spelling tests. The majority reported experiencing problems with poor spelling and poor reading ability (slow reading and comprehension problems) and were receiving additional learning support for their written academic work (essay writing, exams etc.).

Before administering the tests the procedure was explained to the participants who were asked not to spend much time on any items in any of the tests and were told that they could withdraw from the experiment at any time and for any reason. After the end of the experiment, participants were debriefed about the nature and purpose of the research. A practice item was provided at the beginning of each task to ensure that participants understood the instructions of each test clearly.

7.4. Measures

7.4.1. Tests of English spelling ability

Orthographic/pseudohomophone choice task

This is a test used to assess participants' orthographic and phonological processing skills at the word level. It has two parts:

Part A: Orthographic choice task (OCT)

This task was adapted from the Olson et al. (1985). Participants were presented with pairs of letter strings, one of which was a real word and the other a non-word and

were asked to identify (circle) the real word with the correct spelling (e.g. ‘*monk-munk*’--The correct answer is ‘*monk*’).

The orthographic choice task was used to specifically assess participants’ ability to visually access a word entry from the mental verbal lexicon that cannot be successfully retrieved via grapheme-phoneme translation processes. Only knowledge of the orthographic codes could be used to select the correct answer; use of phonological processes alone would not lead to correct answers as the word pairs in the task were designed to produce the same pronunciation when sounded out (e.g. *goat-gote*). It is therefore a task that requires knowledge of orthographic codes to be able to distinguish between the pseudo-homophones and the correctly spelled words presented. Performance on this task was measured in terms of accuracy.

Part B: Pseudo-homophone choice task (PSH)

This second part of the test is similar to the one previously used by Siegel, Share and Geva (1995) and Nassaji (2003). It was used to assess participants’ ability to identify and process pseudohomophones. It is argued that the task can be considered a phonological choice task “given that the stimulus pairs are both nonwords and the only way to respond correctly is to recode the stimuli phonologically” (Stanovich and West, 1989 p.414). As such, the task provides an index of phonological recoding skills.

The task comprises two non-words, only one of which sounds like a real word. Participants were asked to identify (circle) the pseudo-homophone, that is, the word that sounded like a real one (e.g. *dore-warg*—the correct answer is ‘*dore*’ because it sounds like the word *door*). The items used were monosyllabic (e.g. *gruss*, *sed*) and polysyllabic (*rynosserus*, *ensiklopedya*) letter strings that contained sequences of letters (bigrams and trigrams) that either conformed or did not conform to English spelling rules in terms of consonant-vowel positions (the sequence *orl* in non-word *orlthoe*, for instance, is never found in initial positions within English words, whereas the sequence *ins* in the pseudohomophone *insashabul* does). They were chosen to be visually and phonologically dissimilar, non-rhyming pairs presented in order of increasing difficulty. Performance on this task was measured in terms of accuracy.

2. Cloze spelling task

This task was used to test participants' vocabulary knowledge, orthographic processing and decoding skills at the sentence level. It is a task that requires both productive use of vocabulary knowledge and use of general background word knowledge.

In this task participants were asked to complete the missing word from a set of 20 short sentences judging by the sentence context. The number of dashes that followed the first letter of the primed word indicated the number of letters of that word (e.g. 'the y- - - - is a type of boat with sails'- the answer is 'yacht'). The primed words were controlled for frequency and regularity, most of them being low-frequency, irregular words and were contextually inflexible to eliminate the possibility of more than one acceptable answers (fillers). The meaning of the target word could be inferred by either the syntactical or the grammatical content of each sentence (item). Almost half of the sentences provided a general definition/description of the target word. However, all the items in the test were designed to provide narrow context clues and high textual support, including semantic clues (e.g. *S_ _ _ _ _ _ _ _ _ _ bacteria are usually found in eggs*, the semantic clue here being the word *eggs*) and structural clues (e.g. *She h_ _ _ _ him whisper the secret message*, in which the target word was the main verb of the sentence and needed to agree with the subject/noun). The number of words correctly spelt was used as the measure in this task.

3. Proof-reading (spelling errors identification) task

This test was used to assess the participants' orthographic processing skills at the text level. In particular, it was used to assess the participants' ability to identify spelling errors within unfamiliar text and to produce correct word spellings by incorporating syntactical, grammatical and vocabulary knowledge.

Participants were asked to read 3 fictional passages of increasing difficulty in terms of meaning, content and vocabulary, each of which contained 12 errors (grammatical, spelling or content) that they have to identify and correct (e.g. 'a yatch is a type of boat with sails'- correct the word 'yatch' because it is spelled incorrectly). The number of errors corrected was used as the measure for the test; however, participants

1. Orthographic choice and pseudohomophone choice tasks

Given the lack of a Greek standardized adult spelling test, the words used for the Greek versions of the two tasks in this study were adopted from Kasviki (1992). The test consists of 37 words, 3 sentences taken from Greek primary language books (OEBP 1987) appropriate for a vocabulary covering 6 grades and 5 non-words. Out of the 37 words, 30 are irregular words based on inconsistencies of pronunciation of both vowels and consonants- e.g. words containing diphthongs, three-consonant clusters or 3 vowel clusters and 7 are regular (C-V-C) words containing vowels in their simplest phonetic form- e.g. σῶζω (s/o/z/o), φόβος (f/o/v/o/s).

The words chosen from the above test were words that Kasviki's (1992) experimental group most frequently misspelled; i.e. the most easily confusable words out of the 37 contained in the test. The words chosen for the test were controlled for orthographic regularity, frequency, length and complexity (in terms of spelling-sound inconsistencies) to avoid any ceiling effects and were presented in order of increasing difficulty. The kind of words that were therefore included were the following:

- 7 low-frequency C-V-C words, e.g. β-ή-χ-α-ς (cough), β-υ-θ-ό-ς (bottom of the sea) which are commonly confused by Greek spellers in terms of the correct vowel spelling sequence due their high degree of inconsistency.
- 2 irregular words containing diphthongs, e.g. ευ, αυ, which can either be pronounced as /ef/ or /ev/ and as /af/ or /av/ respectively depending on the letter that follows (e.g. ευαίσθητος, ναυαγωσώστης).
- 3 irregular words containing a consonant cluster which is pronounced differently from the way it is spelled, e.g. σβ in the word σβήνω is spelled 'sv' but pronounced as /zv/, γχ in the word συγχαρητήρια (congratulations) is also pronounced differently as /nx/ and σμ in the word ψιθύρισμα is pronounced as /zm/.
- 3 irregular words containing double consonants, which are pronounced as single letters, e.g. ρρ (/rr/) in the word παλίρροια (tide), σσ in the word ταξιδιώτισσα (feminine for traveller) and μμ in the word κομμάτι (piece).
- 2 irregular words containing three-consonant clusters, e.g. στρ (/str/) in the word στρείδι or σπν (/spn/) in the word δύσπνοια.

- 2 irregular words containing a double consonant blend which is pronounced as a single sound, e.g. γκ (/g/) in the word αγκαλιά (hug) and γγ (/g/) in the word συγγενής (relative- noun form).
- 1 irregular word containing three-vowel clusters which are pronounced as two sounds, e.g. ιει (/ii/) in the word υγιεινός (healthy).

Out of the twenty words used in this task 11 were nouns, 2 were verbs, 5 were adjectives and 2 were adverbs. Four words were 2-syllable, 5 were 3-syllable, 6 were 4-syllable and 5 were 5-syllable words.

Five of the non-words used in the pseudohomophone task were also adopted from Kasviki's Greek Spelling Test (1992). The rest were devised by the experimenter by changing consonants either at the beginning or at the middle of each word. As in the orthographic choice task, choice of Greek pseudo-homophones (misspelled words sounding like real ones) was based on regularity, frequency, word length and complexity in terms of sound-spelling inconsistencies. In terms of grammatical class 9 of the words were nouns, 4 were verbs, 5 were adjectives and 2 were adverbs. In terms of word length, 3 of the words were 2-syllable, 7 were 3-syllable, 8 were 4-syllable and 2 were 5-syllable.

2. Greek spelling errors identification (proof-reading) task

A Greek translation of passage 1 used in the proof-reading task (read by English participants) was also included to assess bilinguals' proof-reading skills in their first language. Consistency of spelling, grammatical and meaning errors within the passage could not be achieved through direct translation from one language to another so errors were modified to ensure that equivalent types of errors occurred in the English and Greek versions of the tests. Like in the English version of the texts, there were a total of 12 or errors in the text (4 grammatical, 4 syntactical and 4 spelling) that participants had to identify and correct. They were instructed not to correct more than 12 errors as this would result in deduction of marks.

All the component measures in the study that were not standardised were piloted with native English speakers prior to being used in the study (Please refer to appendix X for full version of the bespoke tests).

7.5. Results

7.5.1 Preliminary analysis

Means and standard deviations of each group of participants for each of the measures in the study are presented in table 7.1. The data were initially analysed to investigate differences between the three groups' performance. Preliminary analyses were performed to examine whether participants' scores differed across the English orthographic, phonological and spelling tasks. One-way analyses of variance (ANOVA) revealed significant differences between the three groups for all the tasks in this study. Post-hoc pairwise comparisons indicated that both E1L dyslexics and ESL students performed significantly worse than E1L non-dyslexics in all of the tasks except in the semantic reasoning task, where the E1L dyslexics were not significantly different from the E1L non-dyslexics.

ESL individuals scored significantly worse than the dyslexics in the orthographic choice task ($p < .05$), but not in the pseudo-homophone choice and proof-reading tasks. These two tasks could not, therefore, reliably distinguish between dyslexics and ESL performance. However, the cloze spelling and the semantic reasoning tasks were able to differentiate between the two groups with the dyslexics significantly outperforming the ESL (see tables 7.1. and 7.2.).

Table 7.1. Mean number of correct responses (and standard deviations in parentheses) of the 3 groups on phonological, orthographic, spelling and vocabulary tasks with results of analysis of variance indicating differences in their performance.

Tasks	E1L non-dyslexics (N=20)	ESL (N=20)	E1L dyslexics (N=15)	F value df=2,54	p value
Orthographic choice(OCT)/20	19.9 (.22)	18.6 (.98)	18.5 (1.50)	11.83	<.001
Pseudo-homophone choice (PSH)/20	19.2 (.94)	14.6 (3.6)	15.6 (3.06)	13.66	<.001
Cloze spelling/20	15.3 (2.4)	8.8 (2.1)	11.0 (2.9)	35.05	<.001
Proof-reading p2&3	9.6 (1.2)	6.1 (2.3)	6.3 (2.5)	13.57	<.001
Semantic reasoning/20	17.1 (1.4)	14.5 (1.7)	16.0 (1.9)	11.61	<.001

Table 7.2 Post-hoc pairwise comparisons between the three groups

Tasks	E1L dyslexics vs E1L non-dyslexics	E1L dyslexics vs ESL	ESL vs E1L non-dyslexics
Orthographic choice (OCT)/20	<.001	NS	<.001
Pseudo-homophone choice (PSH)/20	<.05	NS	<.001
Cloze spelling /20	<.001	<.05	<.001
Proof-reading p2 & 3	<.001	NS	<.001
Semantic reasoning/20	NS	<.05	<.001

7.5.2 Correlations

Correlation analyses revealed that for the ESL group L2 orthography and phonology seem to be interrelated, which was not true for the other two groups for which L1 orthographic and phonological processing skills were unrelated. When ESL performance on the OCT and PSH tasks was contrasted to this of the dyslexics and non-dyslexics, no significant effects emerged, which can be partly attributed to the fact that performance of the two latter groups hit ceiling in both tasks. Phonological and orthographic processing skills also seem to significantly impact on the ESL group's ability to identify and correct spelling errors in their L2 as evident by their performance on the proof-reading task. However, none of these three tasks was significantly related to the cloze spelling task or to the semantic reasoning task, despite the fact that there was some evidence for a marginal, although non-significant relationship between the latter two and the proof-reading measures. Performance in the semantic reasoning task was, finally, significantly related to the cloze spelling ability (table 7.3).

Table 7.3 Correlations between English measures for the ESL group

Tasks	Pseudo-homophone choice	Proof-reading (p2 and 3)	Cloze spelling	Semantic reasoning
Orthographic choice	r=.518, p<.05	r=.498, p<.05	r=.340, p=.142	r=.301 p=.197
Pseudohomophone choice		r=.470, p<.05	r=.072, p=.763	r=.141 p=.552
Proof-reading (p2 and 3)			r=.333, p=.176	r=.449 p=.062
Cloze spelling				r=.547, p<.05

For dyslexics, on the other hand, it seems that only cloze spelling and proof-reading abilities were significantly related (see table 7.4.). The more word spellings they were able to generate, the more errors they were able to identify. This can be contrasted with the ESL students who showed evidence for only a small relationship between these literacy related tasks. The groups can be compared in terms of the relationships between the orthographic choice and pseudo-homophone choice tasks, with the dyslexics showing virtually no relationship between these two tasks in contrast to the ESL students. Similarly, both these tasks seem to show little relationship with the proof-reading and cloze spelling tasks, in contrast to the ESL students. Similarities were more evident between the groups in the semantic reasoning task. For both groups, verbal skills are marginally related to the orthographic choice and the spelling related tasks; however, they are not related to the sound-based pseudohomophone choice task (see table 7.4).

Table 7.4 Correlations between English measures for the E1L dyslexics

Tasks	Pseudo-homophone choice	Proof-reading (p2 and 3)	Cloze spelling	Semantic reasoning
Orthographic choice	r=-.005, NS	r=.151, NS	r=.268, NS	r=.410, NS
Pseudohomophone choice		r=.375, NS	r=.075, NS	r=-.020, NS
Proof-reading (p2 and 3)			r=.646, p<.05	r=.418, NS
Cloze spelling				r=.475, NS

Table 7.5 Correlations between English measures for the E1L non-dyslexics

Tasks	Pseudo-homophone choice	Proof-reading (p1, 2 and 3)	Cloze spelling	Semantic reasoning
Orthographic choice	r=-.206 NS	r=.087 NS	r=-.063 NS	r=-.137 NS
Pseudo-homophone choice		r=.216 NS	r=.303 NS	r=-.037 NS
Proof-reading (p1, 2 and 3)			r=.201 NS	r=.564 p<.05
Cloze spelling				r=.355 NS

7.5.3 L1 and L2 differences

Additional analyses were also performed to look for differences in L1 and L2 ability within the ESL group specifically based on their performance in the English and Greek versions of the orthographic, pseudohomophone and proof-reading tasks (English passages 2 and 3 and Greek passage1) and investigate whether their performance on a measure of general ability such as the semantic reasoning task would be predictive of the group's overall literacy and spelling ability in the above tasks (table 7.5).

Table 7.6 Mean scores produced by Greek-English bilinguals (with standard deviations in parentheses) on Greek and English versions of the orthographic choice, pseudo-homophone and proof-reading tasks

Spelling tasks	English version	Greek version
Orthographic choice task (correct out of 20)	18.65 (.98)	19.2 (.91)
Pseudo-homophone choice task (correct out of 20)	14.6 (3.61)	19.3 (1.17)
Proof-reading task - p2 (number of spell. errors identified out of 12)	6.15 (2.38)	10.31 (1.70)
English proof-reading task -p3 (number of spelling errors identified out of 12)	6.47 (3.22)	10.10 (1.85)

Table 7.7 Correlations between Greek and English versions of OCT, PSH, cloze spelling and proof-reading tasks for the ESL group.

Tasks	Greek orthographic choice	Greek pseudo-homophone choice	Greek proof-reading
English orthographic choice	r=-.541, p<.05	r=.186, NS	r=.471, p<.05
English pseudo-homophone choice	r=-.351, NS	r=.587, p<.05	r=-.063, NS
English cloze spelling	r=-.192, NS	r=-.207, NS	r=.657, p<.05
English proof-reading	r=.526, p<.05	r=.268, NS	r=.348, NS

Bivariate correlations between the English and Greek versions of the tasks were therefore carried out to examine whether performance in orthographic and phonological skills would be interrelated in the two languages. Although the performance of the ESL group was not related in the English and Greek versions of the pseudo-homophone choice task their performance was comparable across the English and Greek orthographic choice tasks. There was also a significant cross-task comparison revealed between the English proof-reading task (passages 2 and 3) and the Greek orthographic choice task although the Greek and English versions of the proof-reading tasks did not come out as significantly interrelated. As expected, the ESL students were significantly better in identifying spelling errors within L1 text than L2 text ($p=.000$ for passages 2 and 3). A significant negative correlation was finally revealed between the English and Greek orthographic choice task ($r=-.541$, $p=.014$) and a positive one between the English and Greek pseudo-homophone choice tasks ($r=.587$, $p=.006$), which would suggest that L1 orthographic knowledge might facilitate L2 orthographic knowledge as suggested by the threshold hypothesis.

7.6 Discussion

The results obtained in this study indicated that in the orthographic choice task the ESL and E1L dyslexic students scored at an equivalent level and that both were significantly worse than E1L non-dyslexics. Comparisons of the three groups on the orthographic and pseudohomophone choice tasks confirmed that, consistent with our predictions, both dyslexics and ESL students present evidence of poor orthographic and phonological processing skills compared to E1L non-dyslexics. Overall, the orthographic choice task was found to be the task that both dyslexics and ESL individuals produced ceiling effects compared to scores in the other tasks. In the pseudo-homophone choice task the ESL performed slightly worse than the dyslexics and significantly worse than E1L non-dyslexics. Dyslexics were also significantly worse than E1L non-dyslexics.

Dyslexics' poor performance on the pseudohomophone task may provide support for the non-word processing deficit hypothesis suggesting that dyslexics have a particular difficulty in orthography-to-phonology conversion processes, poor knowledge of spelling-sound correspondences, poor phonological awareness skills, over-reliance on

or inadequate use of spelling-sound information and limited use of visual-orthographic cues for the recognition of familiar and unfamiliar words (Bruck, 1993; Everatt, 1997). The specific difficulties that dyslexics have with orthographic processing such as weaknesses in processing homophones may also suggest problems with the orthographic lexicon.

It is not only the orthographic representation of a word, but also its phonology that determines the ability to recognise homophonic words in the L2. The only way for participants to respond correctly in the pseudohomophone choice task is to have recoded the target word phonologically (i.e. via the phonological route). The fact that both word choices in this part of the task were non-words may also have impacted on participants' ability to distinguish whether a word sounded like a real one or not. For example, failing to recognise the phonological code of the word '*misselani*' may have also been attributed to their lack of knowledge of the 'sound-alike' word *miscellaneous*, or it might have been an issue of lack of vocabulary knowledge. ESL individuals, on the other hand, heavily rely on context for word recognition and for inferring meaning of previously unfamiliar words. Lack of contextual cues and/or definitions for word recognition of the unfamiliar words provided in these two tasks may have been a factor accounting for their poor performance in the orthographic and pseudohomophone choice tasks.

The findings provide evidence that the ability for distinguishing between correct and incorrect word spellings at the word level, as opposed to the non-word level, seems to be a less difficult area for both ESL and dyslexics. Compared to the pseudohomophone choice, the orthographic choice task is a visual task that does not involve complex phonological processing and decoding skills. Perhaps because of the visual-based strategies that many adult dyslexics have adopted they are able to make correct orthographic choices between word spellings on the basis of the visual route. The findings therefore present evidence for a pseudohomophone effect, which suggests that misspelled words which sound like a real word are generally harder to recognise than misspellings which both sound as a non-word as well as being orthographically incorrect (Cohen, 1980). Such homophone effects were more evident in English at least for the ESL individuals, a finding which lends further support to the hypothesis

that homophonic effects can be more prominent in some languages than in others depending on how transparent or opaque the orthography is (Jorg, Meyer and Levelot, 2003).

Our findings raise questions about the relationship between orthographic and phonological processing skills in ESL and dyslexic individuals. The two skills were found to be more related amongst the ESL group than amongst the dyslexics. Gerard and Scarborough (1989) argue that in the case of ESL individuals there is a language-specific lexical access of homophones. According to the shared representations model (SRM), homophones share a common lexical-phonological representation, but different semantic and lexical –grammatical representations (Jeschniak, Meyer and Levelt, 2003). Yet, according to the independent representations hypothesis, homophones are represented independently and do not share a common word form representation (Caramazza et al., 2002). The scores produced by the ESL students would favour the interference hypothesis.

It was also found that within the ESL sample L1 language ability predicted L2 ability. The significant negative relationship revealed between the Greek and English versions of the orthographic and pseudohomophone choice tasks may be indicative of a language effect, and not of an experience effect as the amount of language experience (as indicated by the number of years of speaking ESL) was not found to be positively correlated to performance in these two tasks.

Further comparisons of ESL L1 and L2 orthographic and phonological processing skills at the word level indicated that they only scored significantly worse in the English pseudohomophone choice task than they did on the Greek version of the task. No significant difference was revealed between their performance on the English and Greek OCT tasks. This finding suggests that the ability to identify and potentially process homophones in the L2 is a phonologically mediated skill that depends on accurate decoding and knowledge of certain phonological-based rules that ESL students (although highly experienced) do not seem to have mastered yet as well as they have in their L1. The findings may also be indicative of the relatively small size of vocabulary store in L2 as well as the fact that the ESL could have relied on contextual text information for spelling identification.

Comparisons of the three groups' spelling performance at the sentence level revealed that in the **cloze spelling** task again the ESL group scored significantly lower than E1L dyslexics and significantly lower than E1L non-dyslexics. Overall, this was the task that the ESL group most struggled with. Their low performance on this task may be interpreted as an effect of general language problems, such as a lack of vocabulary knowledge, whereas for dyslexics to misspelling and inability to access/retrieve the correct word spelling from verbal lexicon, may suggest underlying phonological deficits, for example in word decoding.

Conducting a more in-depth spelling errors analysis to look into the kind of errors ESL and dyslexics made might have shed more light into the kind of problems that both groups present in this area (for example, were differences in the two groups' performance due to not knowing the missing word in the first place or because of being unable to infer meaning from context?). It would also have allowed an examination of the type of spelling errors, namely grammatical, syntactic or meaning that our groups found it more difficult to identify and correct.

Contrasts between the three groups' performance on the **proof-reading task** yielded interesting findings. In the first passage of the spelling proof-reading task, it was found that E1L dyslexics performed significantly worse than E1L non-dyslexics. In passages 2 and 3 of the same task E1L dyslexics and ESL performed at an equivalent level and both were significantly worse than E1L controls. The performance of both groups was slightly better in passage 2 than in passage 3. Overall, both E1L dyslexics and non-dyslexics performed significantly better in passage 1 than they did in passages 2 and 3. What these findings suggest is that the level of passage difficulty and text complexity (as defined by content and type of spelling errors included in this study) did significantly impact on the ability of both groups to identify and correct the errors presented in this task. ESL individuals had more difficulty identifying and correcting spelling errors within hard text in their L2 than they did in their L1 (half of the errors they were able to identify and correct within Greek passage), a finding which may be related to text reading comprehension problems or problems with actual word spellings that may reflect inadequate L2 vocabulary knowledge.

Comprehension problems related with reading of hard text may also have affected the performance of the dyslexic group, given the existing evidence obtained from study 3 that dyslexics have a particular difficulty in comprehending information within hard text.

Another important factor worth considering here is the effect of reading ability on ESL and E1L dyslexics' spelling performance given the relationship between the two variables. E1L dyslexics' poor reading ability (the majority of individuals in this study reported problems with reading than with any other area) may have impacted on their ability to recognise and identify errors, so reading is a variable that we need to account for in explaining the performance of our dyslexic students in this particular task.

Consistent with findings from previous research (Seymour and Porpodas, 1980; Barry, 1996; Siegel, 1996) spelling, like reading, was found to be complex process that depends on a number of phonological processing and coding skills.

In line with the phonological processing theory, spelling among other things, involves the ability to make correct spelling-to-sound mappings (between orthography and phonology), to understand the structural regularities and irregularities of words at different levels, the modalities or types of linguistic representation, such as phonemes, graphemes, onsets, rimes and words. The results of study 6 provide evidence for the above theory; they demonstrate that spelling reflects the ability to make correct mapping and processing of phonological forms at different levels as Burt and Butterworth (1996) have purported. They therefore provide support for the evidence that much of the spelling errors reflect problems with grapheme-phoneme correspondences. Such evidence is furthermore in the line with the dual route model of spelling acquisition suggesting that written letters are related to spoken sounds through a set of rules, i.e. letter-sound correspondences (Snowling, 1996).

Another theoretical question that emerges from the findings of this study is do L2 learners tend to use only the route they are familiar with in their L1 or do they use a different route when asked to spell in an orthographically and phonologically different writing system? Using a homophone choice task enabled us to test whether spelling

errors are sound-linked and whether these are attributed to incorrect use of sound-letter correspondences. The present study examined the relative contribution of phonology and orthography in L1 and L2 as well as how these two might possibly interact or work separately to assist the development of spelling ability of L1 and L2 individuals. Our findings are comparable in terms of cross-language interrelationships. Interestingly, however, they show evidence for cross-language and cross-task interrelationships at the same time. Where evidence for both was found it means that the same underlying processes are taking place in the two language groups no matter the language background (i.e. Greek or English). Where no evidence was found for either of the two, it means that the two groups might be using phonology to a different degree during their reading or spelling and that the two tasks, namely the orthographic and pseudohomophone choice tasks, may be used to distinguish between the different ways the two groups might be reading and spelling using different processes. Readers/spellers of regular orthographies rely mainly on phonology, whereas in more irregular orthographies individuals tend to rely on both phonology and orthography.

Porpodas (1989) has suggested that Greek-English speakers, in contrast to native English speakers, may depend much more on phonological cues rather than on orthographic cues for spelling; they depend on spelling-sound information, not just on visual information. Greek readers and spellers therefore use both phonological and visual-based information for recognizing correct spellings. Yet, they are able to accurately translate phonemes to graphemes only when the orthographic form of the words presented can be derived through the use of sound-spelling correspondence rules and/or knowledge. Based on contrasts between Greek and English phonological and orthographic processing skills the results of the present study appear to lend support to the above argument.

Pavlidis (2004) recently compared a group of Greek dyslexic and English dyslexic young students on the quantity (i.e. number) and quality (i.e. type) of spelling errors investigating the effects of language transparency in the spelling performance of the two language groups. He found that Greek dyslexic students produced significantly more spelling errors than English dyslexics and that their errors were primarily visual, then grammatical and very few phonological. English dyslexics on the other hand,

produced significantly more phonological type errors than visual or grammatical ones. The above findings seem to refute the phonological processing theory which would predict that because Greek is orthographically more transparent we would expect less phonological type spelling errors by English dyslexics and more by Greek dyslexics. This finding has further important implications both in terms of the diagnosis and treatment of the two language groups. Pavlidis' (2004) findings would suggest that: a) different diagnostic criteria should be used for English dyslexic and Greek dyslexic individuals and that b) different spelling intervention approaches should be used in the two language groups. It should be noted, however, that in Pavlidis' (2004) research the above theory was tested in poor readers, whereas in the present study compared dyslexic and non-dyslexic groups from different language backgrounds.

The present study also investigated the extent to which ESL individuals and EIL individuals with and without literacy difficulties depend on decoding (assembled phonology) in recognising and spelling a target word within a sentence, a text context or independently of context. In cases of English homophones, although the two words are phonologically identical, different spelling rules need to be applied for producing correctly spellings. According to the rule theory (Kreiner and Gough, 1990) arguing that unfamiliar words can be spelled through accessing lexical entries analogous to the phonemic form of the word to be spelled, ESL students may have recognised the pseudohomophone by using *analogy* rules. It is unlikely that they could have simply relied on visual memory alone to produce correct spellings of irregular words as well as unfamiliar words or non-words that the two tasks required. The findings obtained from the spelling tasks most likely suggest that it is phonological rather than visual skills that play a key role before the ESL are able to reach a certain level of spelling proficiency as Goswami (1992) has proposed. Yet, such a finding needs to be interpreted with caution. Data obtained from average scores on the OCT and PSH tasks suggest that ESL students may rely more on phonological than on orthographic codes; this, however, may be indicative of the fact that the relative contribution of phonological and orthographic knowledge might differ in different stages of language proficiency.

Previous research (e.g. Stanovich and West, 1989) suggests that orthographic knowledge significantly predicts adult spelling ability and that it can distinguish between adult poor and good spellers. Other work argues that phonological skills make important contributions to spelling competency (Bruck and Treiman, 1990). The present data provide some evidence for an inter-relationship between orthographic and phonological skills (see also Allyn and Burt, 1998). It still remains unclear, however, whether it is the development of orthographic knowledge that depends on phonological ability or vice versa. More research is needed in this area to establish a clear link between the two and the interrelationships between orthographic and phonological skills.

Finally, as expected, in the **semantic reasoning task**, E1L dyslexics and non-dyslexics did not differ significantly. ESL individuals, however, scored significantly lower than the two groups in this area. Their specific difficulty in this task might again be indicative of general language problems such as limited L2 vocabulary knowledge. Significant relationships emerged between the semantic reasoning and the cloze-spelling and proof-reading tasks, and between semantic reasoning and phonological and orthographic processing skills. Inconsistent with previous research (e.g. Beech, 2002) direct links between semantic reasoning, homophone recognition and spelling ability were not established in this study. There was no evidence that those who were good at recognising homophonic words were less good at making judgement tasks or less good spellers either. Overall, the three groups' performance in the semantic reasoning task was not related to their ability to recognise homophones or with their ability to make judgements about semantic relations between words.

An obvious limitation concerning the use of the orthographic choice task (OCT) in the current study is that it is originally designed for assessing the orthographic skills of children rather than adults. This could help explain the massive ceiling effects obtained in L1 tasks used in this study, especially evident in the performance of the ESL group in the orthographic and pseudohomophone tasks ($r = -.32$, $r = .169$). Such findings indicate that there is a clear need for developing tasks suitable for assessing adults' orthographic processing skills. Adult-appropriate tasks could be designed that could include a more difficult choice of target words (low-frequency words, harder in

terms of spelling and meaning) or having to choose between three or more alternatives instead of two.

This was a quantitative approach that attempted to compare dyslexics and ESL spellers focusing mainly on the number of spelling errors. Perhaps a more rigorous qualitative approach such as a spelling errors analysis would have provided a closer look into the different types of spelling errors produced, for example, grammatical, syntactical, phonological or visual, and could have possibly allowed for firmer conclusions as to whether it is phonological processing or other language-related or non-verbal processing mechanisms (e.g. visual) that impact on the spelling ability of the two groups.

CHAPTER 8

General discussion

The aim of this thesis was to compare dyslexics and ESL individuals across different areas of literacy and phonological processing. The four main topics that constituted the core of the assessment studies presented were reading, spelling, phonological and verbal skills. This closing section will try to bring together the main conclusions obtained from the work presented. It will summarise the main findings from each of the studies, discuss the main conclusions derived from each of them, the usefulness of the results and the theoretical implications for further research, and in particular, the implications for future literacy and language assessment practices in the areas of dyslexia and L2 learning.

8.1 Assessment profiles: the reading, spelling, phonological and language abilities and disabilities of adult dyslexics and ESL revisited: same or different?

Areas of strengths and weaknesses were identified amongst the dyslexics and ESL groups and assessment profiles were obtained. Weaknesses compared to control group performance emerged in the scores produced on measures of reading, spelling, and phonological processing skills but less so in terms of general language and verbal skills. Each area was assessed separately through a number of different measures designed to tap into each individual skill. As such, reading ability was assessed in terms of accuracy, speed and comprehension, as well as through single-word reading and text reading tasks. Similarly, spelling was assessed at the word, sentence and text level using spelling production, cloze spelling and proof-reading tasks. Underlying phonological processing skills were assessed using non-word reading, rapid naming, and phoneme manipulation tasks, whereas orthographic processing and other literacy-related skills were assessed through orthographic and pseudohomophone choice tasks. Finally, general language skills were assessed in terms of verbal fluency (such as the ability to generate words from letter sounds), verbal reasoning and vocabulary knowledge.

Studies 1 and 2 showed that, overall, across measures of phonological ability (with the exception of rapid naming) ESL individuals outperformed the dyslexics. It seems, therefore, that amongst the ESL individuals L2 phonological processing skills were

better developed than dyslexics' L1 phonological processing skills. Poor performance amongst the dyslexic groups in areas of phonological processing were consistent with previous research and support the view of a phonological processing deficit being the underlying reason behind literacy difficulties in adult dyslexics (Bryant and Bradley, 1980; Bruck, 1993; Snowling, 1995; Hanley, 1997). However, the two groups appeared to be overall the same in terms of their literacy skills (reading and spelling), although this seemed to change when the level of language proficiency of the ESL individuals was accounted for; dyslexics and ESL individuals could be distinguished on literacy measures when language experience had reached an appropriate level (i.e. 7+years) for the latter group. Highly experienced ESL individuals (with 7 years or more of L2 language experience) were better able to perform certain literacy tasks in their L2 than dyslexics were in their L1. It would appear from these results that the level of language experience does not impact on phonological processing skills as much as it does on the reading ability of ESL individuals.

A major finding obtained from these initial assessment studies was that phonological processing skills can better distinguish between the two groups than reading and spelling ability does. The two groups differed more in terms of their underlying phonological processing skills rather than in terms of their reading and spelling skills. Compared to ESL students, dyslexics were found to struggle with non-word decoding and verbal short-term memory tasks. The ESL students, on the other hand, presented a time delay in the rapid accessing of English names from LTM, which could suggest that even relatively experienced individuals (with more than seven years of experience) may not have acquired sufficient English language experience required for the automatic access of words from their L2 verbal lexicon, contrary to suggestions proposed by existing theories such as the threshold hypothesis supported by Cummins (1979; 1991).

It is important to note, however, that although the length of L2 language experience was controlled for in study 2 by contrasting high and low ESL individuals, it is by no means implied that the <7 years ESL group level of experience is the same as the one defined in Cummins populations. The results obtained cannot be comparable because the samples were obtained using different criteria; Cummins findings were obtained from ESL school children attending English-language schools for a period of <7

years. In our studies our individuals who had this amount of experience may not have necessarily had 7 continuous years of formal English education in an English language school or higher education institution. They may have learned English at a later stage of their life (i.e. during adulthood) or they may not have even been taught English or attended English classes.

To establish why rapid naming was a specific area of deficit amongst the ESL students and why accessing names in a L2 may be a relative slow process even for those having relatively good levels of L2 experience further research will be necessary. It is interesting to note, however, that such rapid naming deficits can be found in individuals with good levels of phonological processing ability in terms of grapheme-phoneme translation and short-term memory, and near “normal” levels of literacy ability in most areas of reading and single-word spelling. These specific areas of deficits contrast with those presented by the dyslexic students, suggesting that the same deficits in rapid naming may be due to different factors and that there may be a dissociation between rapid naming and literacy levels: i.e. it is not necessarily the case that poor literacy due to phonological-related deficits will be identified by poor scores on measures of rapid naming as previously suggested (Wolf, 1991; Wolf and Bowers, 2000). Therefore, it could be argued that the same reasons that help explain poor rapid naming performance amongst the ESL may not explain poor performance in the same area presented by the dyslexics, who are more likely to be influenced by phonological processing and decoding deficits at a basic word level (i.e. problems with translating phonemes to graphemes and with single-word reading) (Snowling, 1997). Similar types of deficits were not, however, evident in the profile of the ESL who have normally already acquired the necessary phonological skills during their L1 acquisition and have possibly been able to transfer such skills to their L2 as a number of transfer theories (e.g. Anderson, 1991) would argue.

Study 3 found that verbal and rapid naming skills appeared to be interrelated, which could suggest a possible link between general language and phonological processing skills. For dyslexics there may be the same underlying processing mechanisms involved in the process of retrieving different kinds of lexical information, namely digits, objects and specific words from the verbal lexicon. For ESL individuals, however, performance across the two areas may rely on different processes as no

significant relationship between fluency and rapid naming ability was revealed for this group. This finding may suggest that there is a different mechanism underlying the process of retrieving lexical information in the L2 and may therefore provide support for the *independence hypothesis* suggesting that there is possibly a separate memory store for digits and objects and separate one for word meanings for the two languages in bilingual individuals.

Overall, reading fluency (as assessed by reading accuracy, speed and comprehension scores) was not found to be related to verbal fluency, which would suggest that there is no clear link between these specific general language skills and reading skills. Reading skills were unrelated to verbal skills for both dyslexics and ESL individuals. Although measures of verbal fluency were able to distinguish between English dyslexics and ESL individuals in study 3, they were less able to show differences between Greek first language and G-ESL groups in study 5. The areas that did effectively distinguish between Greek L1 and English L2 performance within these two groups were non-word reading speed and ability to perform complex phonological tasks (Spoonerisms).

The study further found evidence for a *time retrieval deficit* evident amongst dyslexics who require more time to read text and to name visually presented objects and digits. These findings lend support to the '*double deficit hypothesis*' (Bowers and Wolf, 1993; Wolf, 1998) suggesting that individuals with reading difficulties may have both a poor understanding of the phonological segments of the language as well as problems in speed of access of lexical information. Compared to age matched controls, dyslexic individuals were found to present poor performance in both domains.

Consistent with findings from study 1, study 4 provided further evidence for a *non-word reading speed deficit*, not only amongst the dyslexics but also amongst the ESL as well who required more time to recognise and decode non-words in their L2 possibly because they require more time to conceptually mediate information in the L2 (i.e. have less automatic access to L2 lexicon because they take more time to

integrate meanings across languages) as suggested by the L2 *concept mediation hypothesis* (Kroll, 1993).

However, analyses of the two groups' performance across different components of reading indicated significant differences in single-word reading, speed and accuracy of text comprehension (with the exception of reading accuracy of hard text where the dyslexics produced more reading errors than the ESL). Yet, the two groups did not differ in terms of their reading comprehension ability, despite the fact that the dyslexics were more confounded by text complexity and by making inferences from hard texts while the ESL by recall of text information (factual, non-word).

Reading skills would therefore seem to develop in ESL individuals as L2 experience increases and after which they should be expected to reach a level equivalent to that of E1L individuals. Another major finding related to the reading performance of the two groups was that speed of reading appears to be a significant indicator of reading problems amongst adults with reading difficulties for both dyslexics and ESL students. Dyslexics make use of different compensatory strategies during reading that ESL students may not employ. For example, they may use contextual clues to comprehend text more effectively, but this can occur to the detriment of their reading speed. They often sacrifice reading speed to maintain reading accuracy and/or comprehension. Dyslexics may be able to produce good reading accuracy scores, performing slightly above average in comprehension, but are significantly lower than average when it comes to reading speed. They may lose time in their effort to decode words correctly and to still try to maintain a good level of accuracy. Their low reading rate scores may further be a result of deficits in short term memory and speed in which they are processing text information. Although they are found to be more accurate on easier passages, their reading performance seemed to deteriorate with text complexity, a finding previously supported by other researchers claiming that when a reading component is weak another reading component may compensate for it (Stanovich, 1980). ESL individuals, on the other hand, are able to transfer their L1 reading ability to aid their L2 reading comprehension depending on the level of their L2 experience as suggested by previous research (Yamashita, 2002).

Study 5 further supported the idea that compared to G1L, the ESL are slower in non-word reading in their L2. They need considerably more time to process unfamiliar words in the L2 than G1L users do to recognise and decode non-sense words in their L1. The ability to manipulate sounds within words is also a difficult task for L2 learners as it requires higher-order phonological processing for which ESL individuals need considerably longer time than L1 users.

Verbal fluency further distinguished between G1L and G-ESL performance in study 5. Differences in performance in this study were more likely to be indicative of variations in levels of L2 proficiency across areas of oracy, literacy and phonological awareness, which could suggest that some language skills appear to be more developed amongst G-ESL than amongst G1L readers. Verbal fluency was an area where the G-ESL had no difficulty in their L2. The G-ESL group's oral and fluency skills were as well developed in their L2 as they were for the native language group (G1L), although their L2 reading and reading comprehension skills were less developed. L2 grammatical, syntactic and vocabulary knowledge or text content, may have impacted on their L2 reading and reading comprehension performance. The structural dissimilarity of the two languages, English and Greek also seemed to pose a problem for L2 learners in terms of their reading comprehension and their reading speed.

Linking these results to those obtained in study 4, ESL students were found to be significantly different compared to students using their first language across the two measures of text reading, which could be attributed to insufficient grammatical or conceptual knowledge. Text complexity seemed to significantly affect ESL individuals' reading accuracy in both studies 4 and 5. Additionally, text complexity further influenced ESL students' reading comprehension ability as suggested by difficulties in recall of factual information from hard text and in making inferences from hard text in their L2 (study 4). For comprehending easier text in their L2 language, L2 language experience was not so important. For understanding conceptually harder texts, however, L2 experience did seem to play a more significant role.

Performance across measures of rapid naming and semantic fluency was inconsistent within the L2 groups. Although evidence from study 4 suggests that these two areas are related in ESL individuals, findings from study 5 suggest that they may be related to a different degree in monolingual (L1) and bilingual (L2) individuals. The ESL groups were found to be relatively good at verbal fluency, but relatively poor at digit naming. Verbal production tasks are therefore easier than naming tasks in the L2. The first involve oral skills and productive use of language, whereas the second require processes of automatic retrieval of L2 information from LTM, which might be a less developed skill for the ESL.

Further cross-language comparisons in more complex phonological tasks such as the Spoonerisms indicated differences between G1L and G-ESL performance. The ability to manipulate sounds within words was found to be a difficult task in the L2. It requires higher-order phonological processing for which bilinguals needed considerably longer time than monolinguals. Poor performance in this task may have also been the result of orthographic dissimilarity between L1 and L2 or it might have been also related to specific difficulties in processing non-words in the L2 as indicated by the poor non-word reading scores. Such a finding is consistent with the viewpoint that reading and writing difficulties in Greek may result from difficulties in phoneme segmentation, in converting symbols to phonological codes and in decoding (Porpodas, 1993).

Overall, study 5 found no commonality in predictors of Greek and English reading ability amongst the two language groups. Reading accuracy could not be predicted by the phonological measures, although there was some evidence for non-word reading to be related to text reading speed in both groups. Reading comprehension could be reliably predicted by a combination of phonological measures like semantic fluency, Spoonerisms scores and digit naming times for the G1L group but could not be predicted by any of the same measures for the G-ESL group. There was some evidence to suggest that non-word reading deficits might be common to both groups. In both groups, speed of reading was found to be best predicted by non-word decoding. For Greek monolinguals (G1L), it was non-word reading speed that most

influenced reading speed performance, whereas for Greek-English bilinguals (G-ESL) it was non-word reading accuracy that played an important role in reading ability.

Study 6 indicated that both dyslexics and ESL individuals presented some evidence of poor orthographic and phonological processing skills. The areas of phonological processing that ESL individuals were found to struggle with were rapid naming of objects (although not in rapid naming of digits), rhyme production, identification and processing of homophonic words. Phonological and orthographic processing skills were found to be significantly related for the ESL but not for dyslexic individuals. For the ESL it was phonological rather than visual cues that played the greatest role in being able to reach a certain level of spelling competence. Yet, such a finding needs to be interpreted with caution. Data presented by Goswami (1992) suggest that L2 skilled readers and spellers rely less on phonological than on orthographic codes; this, however, may be indicative of the fact that the relative contribution of phonological and orthographic knowledge might differ in different stages of language proficiency.

The area of spelling that ESL individuals most struggled with, compared to dyslexics, was in generating correct word spellings from sentence cues (cloze-spelling task). Low performance on this task is most probably attributed to general language problems such as inadequate vocabulary knowledge. For dyslexics, misspellings and inability to access and/or retrieve correct word spellings from their verbal lexicon may indicate underlying phonological deficits (i.e. in word decoding). The ESL presented fewer problems in identifying and correcting spelling errors within hard text in their L2 than they did in their L1 (proof-reading task). In this task the level of passage difficulty and text complexity appeared to significantly impact on the ability of the two groups to identify and correct spelling errors. ESL individuals had a particular difficulty identifying and correcting spelling errors within hard text in their L2 than they did in their L1, which may be related to text reading comprehension problems.

8.2 Usefulness and contributions of the research

The findings obtained from the present research are valuable in informing procedures to: (i) assess different possible causes of dyslexia, (ii) devise appropriate assessment procedures, and (iii) produce the right educational tools to support the learning of

people with (and without) dyslexia. Future research in one or more of these areas could further inform researchers, dyslexia theorists and practitioners, as well as second language educators.

The implications of the research reported in this thesis focus on the importance and the usefulness of assessment procedures for providing appropriate support to dyslexic and ESL individuals. The findings of this work firstly indicate the importance of identifying the potential *causes* underlying reading and writing difficulties presented by the two groups of individuals. They are further useful in recognising the *efficacy* of using certain educational tools that are designed to assess literacy and that are geared towards the specific deficits presented by the two groups of individuals. Although causal explanations for the performance of the two groups are hard to make, the findings suggest that current causal definitions and theoretical models of dyslexia that explain who is 'dyslexic' and who is not could be potentially *revised* to consider other factors such as the language and educational background of L2 individuals.

Identification of the relative differences between areas of strength and weakness may be important for providing individuals with the similar kind of support strategies irrespective of language background. Such a possibility could be investigated by future research assessing the level of improvement found after providing support for reading and writing.

Using the right identification tools for the assessment of spelling or reading skills may be important for remediation of deficits evident in dyslexia and L2 learning.

Identifying, for example, strengths in visual areas may mean that the individual will learn best under learning regimes and techniques that emphasise visual processing. Identifying strengths in phonological areas may mean, on the other hand, that the individual is more likely to learn best or improve their learning when the support method focuses on sounds within words (Brooks, 1995; Weeks, Brooks and Everatt, 2002).

This thesis has approached the two concepts of dyslexia and bilingualism and has tried to find the possible links and factors that distinguish a dyslexic from an individual with ESL. Individual needs, especially those related to language-specific

and cultural factors, should be accounted for in any assessment of these two groups. Any generalisations about the deficits identified are bound to be not only language, but also culture-related in the case of ESL individuals. Similarly, the degree of severity of reading and writing difficulties amongst dyslexics is another factor that does not allow for definite conclusions to be drawn. Yet, evidence obtained of relative areas of strengths and weaknesses can be potentially a very useful first step towards identifying the potential reasons for literacy difficulties amongst both groups. The two main reasons that were found to account for literacy deficits were language (in the case of the ESL) and phonology (in the case of dyslexics).

Two very important issues in the development of any assessment tool are the appropriateness of measures for the population under study and the need for appropriate translations across languages and cultures. Appropriate translations and pilot work were essential procedures within such an assessment context particularly if contrasts between different language groups are to be performed. However, direct comparisons between the G-ESL and E1L groups were difficult, if not impossible to make given the varying ability of the two groups under study. Firmer conclusions about the relative abilities and disabilities of the two groups across different areas could have been possible only if individuals from the same group were tested on both the Greek and English versions of the tests used to be able to assess performance in both languages and compare the same group of individuals in both their L1 and L2 language skills.

Secondly, it has to be argued that the Greek and English measures used in this study might have been helpful as assessment tools in identifying areas of relative strengths and weaknesses in literacy and phonological skills in the L1 and L2 groups. They are not, however, equally effective in identifying potential causes of underlying deficits as they are measures derived from the monolingual literature that may arguably not be appropriate for use with bilingual populations. One could also argue against the relative equivalence of the tests (i.e. non-word reading, spoonerisms, rapid naming). Tests that are translated from one language to another are not necessarily equivalent (see relevant section in the introduction of the thesis) and comparable. However, given the lack of equivalent standardised Greek versions of the tests within the Greek

literature, the existing tests can be viewed as possible screening tools for the purposes of this investigation.

This research highlights the need to consider the appropriateness of test measures and materials across a range of language contexts and to redress the lack of, as well as the need for, the development of suitable procedures for use within multilingual contexts. Research into difficulties with phonological processing and literacy skills has predominantly focused on children rather than in adults. Assessing adults' (dyslexics and non-dyslexics alike) reading and writing ability is essential not only for educational, but for employment and career purposes. This research was designed in such a way as to enable examination of adult dyslexics' performance across different levels of literacy ability. Most of the individuals in these groups were found to perform at levels expected of much younger and therefore less experienced learners even in cases where the tests administered were originally designed for use with children. It was surprising to find that these students were attending undergraduate and postgraduate degree courses and were able to successfully perform and cope within an academically stringent environment and yet still struggle with spelling, reading speed and reading comprehension. Reading and writing difficulties may hinder many aspects of adults' social life, and although many have managed to overcome or compensate for these difficulties, they may still pose a threat to academic and work achievement.

What is more, despite the vast amount of research suggesting that phonological deficits constitute the core causal factor in literacy problems faced by both dyslexic children and adults, this cause has not been confirmed across different languages. The present cross-linguistic research has contributed towards this direction by investigating literacy and phonological deficits in two different languages with different orthographies, namely English and Greek.

A major limitation of the present research is related to the appropriateness of the use of different literacy and phonological assessment tools used for identifying the relative areas of weaknesses and strengths and the underlying reasons for literacy deficits amongst dyslexic and ESL individuals. A related issue is also the effectiveness of certain measures derived from the *monolingual* literature which look

for potential causes of underlying deficits in monolingual populations. Yet, based on the arguments of Cummins (1979) and more recently those by Guron and Lundberg (2003), given sufficient exposure to L2 (i.e. more than seven years), it is possible to assess a range of phonological skills among L1 non-English speakers using the same battery of tasks as those administered to English native speakers (E1L). However, the findings obtained from this research seem to only partly support such theoretical claims. Although the findings from studies 1, 2 and 3 suggest that literacy skills develop in ESL individuals and that their L2 skills could potentially reach up to monolingual levels, evidence obtained from the latter studies suggest that there are certain phonological areas where they do not. Therefore, the Cummins (1979) argument that 7 years of second language exposure are enough before L2 learners achieve a level comparable to L1 monolinguals does not hold for some phonological skills. It may take even individuals who are highly experienced in their L2 longer than 7 years before they are able to perform at a level consistent with monolingual controls in areas such as semantic or rhyme fluency. This finding may suggest that there is a need to wait more than 7 years (or possibly longer) before testing and being able to identify any literacy and/or phonological deficits amongst ESL students. Yet, at the opposite end it could be argued that this time period may be too long for assessment to wait and also that the threshold of L2 language proficiency may be different for each individual.

8.3 Theoretical implications

Evidence for poor performance amongst the dyslexic groups in areas of phonological processing was found across studies 1, 2 and 6. Such evidence is consistent with previous research and provides further support for the *phonological processing deficit hypothesis* suggesting that phonology problems constitute the underlying reason behind literacy difficulties amongst adult dyslexics (Bryant and Bradley, 1980; Bruck, 1993; Snowling, 1995; Hanley, 1997). However, the findings indicate that dyslexics and ESL individuals may not be distinguished in terms of their literacy ability. This finding raises important questions about the current definitions of dyslexia (e.g. see BPS working definition of dyslexia in the general introduction) that view dyslexia primarily as a literacy problem without making any causal reference as to why literacy deficit might occur in dyslexic individuals. Although our data by no means provide

causal explanations for literacy and phonological deficits amongst dyslexics and bilingual individuals, they nevertheless challenge such non-causal views of dyslexia. They indicate that it would perhaps be necessary to revise current definitions of dyslexia to include theoretical explanations and causal statements about the reason/s why different literacy and phonological deficits are evident amongst different populations, including L2 learners. Identifying that literacy or phonological deficits are present amongst a given population is one important step in recognising the kind of difficulties and in assessing individuals, yet being able to explain why such deficits occur is even more important.

Study 2 provided evidence for continued reading deficits amongst adult dyslexics at the basic word level. Such findings seem at odds with views proposing that dyslexics' deficits in single-word reading are likely to reduce or disappear in adulthood (see Everatt, 1997; Miles, 1993). A possible explanation that may account for the contrasting evidence may be that the different strategies that may be employed by the two groups during reading at the text and even at the word level can affect the individual performance profile. Results from study 2, for example, have shown that dyslexics employ different reading strategies from bilinguals: they may slow their rate of reading to aid their comprehension whereas the same was not found to be true for the bilingual groups who did not reduce their speed of reading to the detriment of text comprehension. Similarly, although speed of reading was found to be a specific area of difficulty for both groups across the different studies, it may have been affected by individual differences in reading strategy use. Consistent with previous work by Stanovich (1980; 1988) was the finding that specific working memory or automaticity deficits may have accounted for the fact that inference type questions had a different effect than factual questions in terms of text comprehension of the two groups. The present work draws on the potential for individual variations and differences both within and between the dyslexic and ESL groups, given that the process of literacy development is unique to each individual and even more so between individuals coming from different language backgrounds.

Another major issue that the results of this research raise is this of what is *phonology*. The notion of phonology has been viewed in different ways. Given the lack of relationships between certain measures such as semantic fluency and rapid naming in

study 4, both of which assess phonological skills at different levels, the findings seem to suggest that the two processes maybe independent of each other, and may not therefore be actually measuring the same underlying skills. It is hard to establish why some phonological measures such as rhyme were more able to distinguish between the two groups than others. One possible explanation is the individuals' previous familiarity with the tasks themselves. Future work might be necessary to investigate the relationships between the phonological measures used within the monolingual literature before we see if we are able to reliably apply them to bilingual or multilingual contexts. In future research we need to revise exactly what we mean by the terms 'phonology' and 'phonological processing' before we are to actually measure these processes. The findings may also suggest that there are different processing mechanisms for dyslexics and bilinguals taking place when performing different phonological tasks, which has further importance for including the right tasks in assessments.

Yet, it was not only in phonology but also in literacy that inconsistencies were found. Evidence from studies 1 and 4 seem to suggest that there are different decoding mechanisms and literacy skills involved in terms of non-word reading in the two groups. Such differences in non-word deficits identified amongst dyslexics and ESL individuals in these two studies demonstrate the need to be careful about making generalizations across language groups. Although the two groups were the same in their non-word reading skills in study 1, a significant difference was found in study 4. These differences may be due to the different language backgrounds of the ESL samples used in the two studies. Non-word (decoding) differences that emerged between the two language groups in study 5 may have been further influenced by the more transparent nature of the Greek script and may have therefore been an artifact of the orthography of the two languages, a finding which would seem to be also supported by the non-word deficit hypothesis. Reading non-words in an irregular orthography may be a more complex process than in a regular orthography, where most words are read on the basis of grapheme-phoneme correspondence rules. This suggests the need to be cautious about generalizing this and other findings to different language groups and about including the right measures of language experience, meaning measures that incorporate the role of cultural and educational background (study 6).

Similarly, inconsistencies between the findings from studies obtained in studies 1 and 2 and those of study 4 were revealed in relation to effects of answering inference comprehension questions. The results again highlight the need for not generalising across languages or language groups as well as for varying the level and type of comprehension questions included in tests of reading comprehension.

Evidence obtained from Study 6 suggesting problems with phonological and orthographic processing particularly amongst the dyslexic group seemed to support the *doual-route model of spelling* (Snowling, 1996). The data suggest that for dyslexics and bilinguals both phonological and orthographic processing skills were found to be important not only in identifying and recognising correct and incorrect spelling errors but also in producing new word spellings. Both of these areas may, therefore, be important for assessment purposes when trying to compare the spelling performance of the two groups.

8.4 Implications for practice and future research

8.4.1 Implications for assessment practices

In terms of assessment procedures the findings exemplify the difficulty of establishing the most appropriate assessment of literacy or language ability. However, the data seem to suggest that one appropriate approach when trying to distinguish dyslexics from non-dyslexics with ESL is to combine measures of literacy ability with measures of underlying phonological skills.

One important theoretical question that was addressed in this research was whether any literacy deficits amongst the ESL are language-related or reading-related. Most of the evidence obtained seems to provide support for the first hypothesis, namely that they are language-related and that the degree of language experience is very likely to impact on the ESL phonological and literacy abilities. These findings, however, raise questions about language assessment practices when it comes to assessing an individual with literacy problems: should we use the same or different assessment procedures and if yes how should these vary? Similarly, our findings are of particular importance in the assessment of dyslexia amongst bilinguals or more commonly

amongst foreign students who enter University having ESL. Going back to the issue already addressed in the general introduction of this thesis, should we perform L1 assessments in ESL if not already assessed in their country of origin so that the Greek dyslexic student, for instance, is assessed in the very same way as the English dyslexic student? The data presented from studies 5 and 6 seem to provide a possible answer to the above questions. An English monolingual dyslexic is someone who most likely experiences a number of literacy difficulties in their L1. A Greek-English dyslexic student, on the other hand, is someone who is either dyslexic in his L1 or someone who simply experiences problems in the process of learning English-as-a-foreign-language and should therefore be treated differently. The assessment, however, becomes an even more complicated matter in the case of students who might be both dyslexic and bilingual. Although this group of individuals has not been considered in this research, it would be a challenge for future research to investigate the assessment procedures specific and appropriate to this group of individuals.

Assessments focusing on one language only can lead to disadvantages. Learning to read and spell in one language is not necessarily the same in the L2 (see discussions in: Aaron and Joshi, 1989; Goswami, 2000; Katz and Frost, 1992; Leong and Joshi, 1997; Smythe, Everatt and Salter, 2004). This would mean that the underlying factors that need to be assessed may vary across different languages. Similarly, there is no reason to believe that the predictors of literacy will be the same across all languages or scripts. Assessments can further often fail to predict variations in literacy skills and distinguish the good reader from the poor reader.

Unfortunately for practitioners there is no international assessment of dyslexia that would enable them to assess individuals from any language background. A possible solution to this problem would be to devise a computerised assessment package that could potentially, if proven to be a procedure as valid and reliable as a human test-taker, provide the very same assessments in most languages (Smythe, personal communication). If such a test were to be developed and successfully implemented in the future, it could be an extremely valuable tool in our hands.

As a final note, it would be wrong to view bilingualism as a disadvantage to literacy learning. The experiences that bilingual individuals attain as a result of exposure to

two or more languages might actually improve literacy learning, and in some cases, reduce the incidence of phonological-related learning difficulties.

8.4.2 Implications for further research

The results of this research are firstly valuable to special needs and second language educators not only for assessment but also for intervention purposes. Literacy is not only a developmental but also a major educational issue that affects the society as a whole. In a highly literate world, poor reading and spelling pose a threat to academic achievement, leading to poor employment prospects and job dissatisfaction. Related to literacy problems are also a number of social and emotional difficulties that we cannot dismiss. Yet, poor reading and spelling problems amongst adult dyslexic and ESL students can be remediated if provided with the right kind of support. Although most of the research on dyslexia leads to the conclusion that generally early identification leads to more effective outcomes in terms of remediation, our findings support the idea that it is still important to try to remediate literacy problems, and particularly persisting phonological deficits even at a later stage in life. Drawing on from the findings obtained, if this research was to be extended it would follow on from assessments to designing a framework of appropriate interventions for groups of adult dyslexics and bilinguals. The research work could further be extended to compare individuals from languages using different alphabetic versus non-alphabetic scripts, for example, contrasting English or Greek students with individuals from Chinese or Arabic language backgrounds, and investigate the role of culture and education in the development of literacy or phonological deficits in relation to these different orthographies.

Furthermore, the research could be extended to investigating the nature of reading-related deficits and how these could be effectively remediated in adult dyslexics and bilingual individuals. Speed of reading, which was found to be an area of difficulty amongst the two groups in this research, could be the focus of future work in terms of how it can affect reading comprehension processes. If, for instance, students were required to read within a specific time limit, would their reading comprehension suffer? If different types of comprehension questions were to be incorporated to vary between inference and general knowledge-type questions, would we still find an inference effect amongst dyslexic individuals, and would bilinguals still under-

perform because of unknown cultural schemata? Similarly, further work might be necessary to establish why non-word reading is an area of poor performance amongst some ESL students and why accessing names in a L2 maybe a relative slow process even for those with relatively good levels of L2 experience given the evidence that such deficits persist even in some ESL individuals with more than 10 years of English language experience and exposure.

For research to inform assessment procedures, it would be useful if the focus of research on literacy were drawn away from studying only monolingual populations and emphasised more on bilingual populations, their development of literacy and phonological skills, and their particular educational needs. In a world of biliteracy and cultural exchange where there is frequent contact with different populations from different linguistic and cultural backgrounds, it is essential to accommodate educationally the needs of bilingual, namely the 'biliterate' (those who acquire literacy skills in two languages) and 'biscriptal' individuals (those who apply two different orthographic systems of rules that associate written symbols to different language sounds) in every society at all stages of academic life. This means that for ESL individuals we need to develop appropriate assessment tools so that the assessment of L2 learners is no longer complicated by bilingual-related language problems. Many bilingual students are still tragically being incorrectly identified as requiring special education needs when in fact there are not any present. On the other hand, ESL individuals who present evidence of literacy difficulties can often be overlooked in the referral process because it is believed that their problems will improve with further exposure to English, therefore depriving them of specialist help and support (Everatt et al, 2000). Appropriate assessment is further necessary for educators to be able to identify whether such problems stem from reading and writing difficulties evident in their L1 as well or from specific difficulties in the process of L2 learning.

References

- Aaron, P.G. and Joshi, R.M. (1989). *Reading and writing disorders in different orthographic systems*. Holland: Kluwer Academic Press.
- Aaron, P. and Guillemardo, J.C. (1993). Artistic as dyslexics. In D. Willows, R. Kruck and E. Corcos (Eds). *Visual processes in reading and reading disabilities*. Hillsdale, N. J: Lawrence Erlbaum Associates.
- Adams, M. J. and Collins, A. (1985). A schema-theoretic view of reading. In H. Singer and R.B. Ruddell (Eds), *Theoretical models and processes of reading*. Newark, DE: International Reading Association.
- Adams, M.J. (1990). *Beginning to Read: Thinking and learning about print*. London: MIT press.
- Adiv, E. (1984). Language learning strategies: The relationship between L1 operating principles and language transfer in L2 development. In R. Andersen (Ed.), *Second Languages: A cross-linguistic perspective*. Rowley, MA: Newbury House.
- Alderson, J. C., Bastien, S. S. and Madrazo, A. M. (1977). *A comparison of reading comprehension in English and Spanish*. Research and Development Unit Report No. 9, mimeo, Mexico City: UNAM.
- Alderson, J.C. (1998). Reading in a foreign language: a reading problem or a language problem? In J. C. Alderson and A. H. Urquhart (Eds), *Reading in a foreign language*. New York: Longman.
- Alderson, J. C. and Urquhart, A. H. (1998). *Reading in a foreign language*. New York: Longman.
- Allyn, F. and Burt, J. (1998). Pinch my wig or winch my pig: Spelling, spoonerisms and other language skills. *Reading and Writing: An Interdisciplinary Journal*, 10, 51-74.

- Amos, P. (1997). Bottom-up and top-down processing. *English Teaching Professional*, 3, 11-17.
- Anderson, N. J. (1991). Individual differences in strategy use in second language reading and testing. *The Modern Language Journal*, 75, 460-472.
- Appel, R. (1996). The lexicon in second language acquisition. In P. Jordens and J. Lalleman (Eds), *Investigating second language acquisition*. Berlin: Mouton de Gruyter.
- Ambak, E. and Elbro, C. (2000). The effects of morphological awareness training on the reading and spelling skills of young dyslexics. *Scandinavian Journal of Educational Research*, 44, 229-251.
- Baker, C. (1993). *Foundations of bilingual education and bilingualism*. Clevedon: Multilingual Matters.
- Barker, T. A., Torgesen, J. K. and Wagner, R. K. (1992). The role of orthographic processing skills on five different reading tasks. *Reading Research Quarterly*, 27, 335-345.
- Barron, R (1980). Visual and phonological strategies in reading and spelling. In U. Frith (Ed.), *Cognitive Processes in Spelling*. London: Academic Press.
- Barry, C. (1996). Spelling routes (or roots or rutes). In G. Brown and N. Ellis (Eds), *Handbook of Spelling: theory, process and intervention*. Chichester: Wiley and Sons.
- Beaton, A., McDougall, S. and Singleton, G. H. (1997), *Dyslexia in literate adults*. Special issue of the Journal of Research in Reading, 20, (1).
- Beech, J. (2002). Individual differences in mature readers in reading, spelling, and grapheme-phoneme conversion. *Current Psychology*, 21, 121-132.

- Bell, S. M., Mc Callum, R. S. and Cox, E. A. (2003). Toward a research-based assessment of dyslexia: Using cognitive measures to identify reading disabilities. *Journal of Learning Disabilities*, **36**, 505-516.
- Berninger, V.W., Abbott, R.D., Billingsley, F. and Nagy, W (2001). Processes underlying timing and fluency of reading: efficiency, automaticity, co-ordination, and morphological awareness. In M. Wolf (Ed.), *Time, Fluency, and Dyslexia*. New York: York Press.
- Bloom, B. (1985). *Developing talent in young people*. New York. Ballantine.
- Bourassa, D. and Treiman, R. (2001). Spelling development and disability: the importance of linguistic factors. *Language, Speech, and Hearing Services in Schools*, **32**, 172-181.
- Bowers, P.G., Sunseth, K. and Golden, J. (1999). The route between rapid naming and reading progress. *Scientific Studies of Reading*, **3**, 31-53.
- Bowers, P.G. and Wolf, M. (1993). Theoretical links among naming speed, precise naming mechanisms and orthographic skill in dyslexia. *Reading and Writing*, **5**, 60-85.
- Brackett, J. and McPherson, A. (1996). Learning disabilities diagnosis in postsecondary students: A comparison of discrepancy-based diagnostic models. In N. Gregg, C. Hoy, and A. F. Gay (Eds), *Adults with learning disabilities: theoretical and practical perspectives*. New York: Guilford Press.
- Brisbois, J. I. (1995). Connections between first-and second-language reading. *Journal of Reading Behavior*, **27**, 565-584.
- British Dyslexia Association (1999). Statistics on Dyslexia. October 1995. <http://www.bda-dyslexia.org.uk>. Accessed June 2001.

- British Psychological Society (1999). *Dyslexia: literacy and psychological assessment*. Report of a working party of the Division of Educational and Child Psychology. Leicester: Author.
- Brooks, L. (1994). Dyslexia: A 100 years on brain research and understanding. *Dyslexia Review*, **6**, 9-15. Staines: The Dyslexia Institute.
- Brooks, P. I. (1995). A comparison of the effectiveness of different teaching strategies in teaching spelling to a student with severe learning difficulties/dyslexia. *Educational and Child Psychology*, **12**, 80-88.
- Brooks, G., Pugh, A.K. and Schagen, I. (1996). *Reading performance at nine*. Slough: NFER.
- Brooks, P.L. and McLean, B.E. (1998). Helen Arkell Spelling Test, Part 1. Frensham: Helen Arkell Dyslexia Centre.
- Brooks, P. and Everatt, J. (submitted). Phonology, discrepancy, instruction and dyslexia: Adversaries or allies? *Educational Psychology in Practice*.
- Brooks, P., Everatt, J., and Fidler, R. (2004). The Adult Reading Test. London: Roehampton University of Surrey.
- Brown, H. D. (1970). Categories of spelling difficulty in speakers of English as a first and second language. *Journal of Verbal Learning and Verbal Behaviour*, **9**, 232-236.
- Brown S. A. (1990). A review of recent research on spelling. *Educational Psychology Review*, **2**, 365-397.
- Brown, C. (1993). Factors affecting the acquisition of vocabulary: frequency and saliency of words. In T. Huckin, M. Haynes and J. Coady (Eds), *Second language reading and vocabulary learning*. Norwood, NJ: Ablex Publishing.

Brown, G. and Ellis, N. (1996a). *Handbook of Spelling: Theory, process and intervention*. Chichester: Wiley and Sons.

Brown, G. and Ellis, N. (1996b). Issues in Spelling Research: An overview. In G. Brown and N. Ellis (Eds), *Handbook of Spelling: theory, process and intervention*. Chichester: Wiley and Sons.

Brown, G. and Loosemore, R. (1996). Computational Approaches to normal and impaired spelling. In G. Brown and N. Ellis (Eds), *Handbook of Spelling: theory, process and intervention*. Chichester: Wiley and Sons.

Bruck, M. and Treiman, R. (1990). Phonological awareness and spelling in normal children and dyslexics: The case of initial consonant clusters. *Journal of Experimental Child Psychology*, **50**, 156-178.

Bruck, M. (1993). Word Recognition and component phonological processing skills of adults with childhood diagnosis of dyslexia. *Developmental Review*, **13**, 258-268.

Bryant, P. and Bradley, L. (1980). Why children sometimes write words which they do not read. In U. Frith (Ed.), *Cognitive Processes in Spelling*. Chichester: Wiley and Sons.

Bryant, P., Nunes, T. and Bindman, M. (1997a). Backward readers' awareness of language: Strengths and weaknesses. *European Journal of Psychology of Education*, **12**, 357-372.

Bryant, P. Nunes, T. and Bindman, M. (1997b). Children's understanding of the connection between grammar and spelling. In B. Blachman (Ed.), *Foundations of reading acquisition and dyslexia*. New Jersey: Lawrence Erlbaum Associates.

Bryant, P., Nunes, T. and Aidinis, A. (1999). Different morphemes, same spelling problems: cross-linguistic developmental studies. In M. Harris and G. Hatano (Eds), *Learning to Read and Write: A Cross-linguistic Perspective*. Cambridge: Cambridge University Press.

Burt, J. and Butterworth, P. (1996). Spelling in adults: orthographic transparency, learning new letter strings and reading accuracy. *European Journal of Cognitive Psychology*, **8** (1), 3-43.

Burt, J. S. and Fury, M. B. (2000). Spelling in adults: The role of reading skills and experience. *Reading and Writing: An Interdisciplinary Journal*, **13**, 1-30.

Caramazza, A., Costa, A., Miozzo, M., and Bi, Y. (2001). The specific-word frequency effect: implications for the representation of homophones in speech production. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, **27**, 1430-1450.

Carney, E. (1997). *English Spelling*. London: Routledge.

Carrell, P. L. (1989). Metacognitive awareness and second language reading. *Modern Language Journal*, **73**, 121-134.

Carrell, P.L. (1991). Second language reading: Reading ability or language proficiency? *Applied Linguistics*, **12**, 159-179.

Carson, J., Carrell, P., Silberstein, S., and Kuehn, P. (1990). Reading-writing relationships in first and second language. *TESOL Quarterly*, **24**, 245-266.

Cataldo, S. and Ellis, N. (1988). Interactions in the development of spelling, reading and phonological skills. *Journal of Research in Reading*, **11**, 86-109.

Catts, H. (1989). Phonological processing deficits and reading disabilities. In A. G. Kamhi and H. W. Catts (Eds.), *Reading disabilities: A developmental language perspective*. Boston: Allyn and Bacon.

Catts, H. (1996). Defining dyslexia as a developmental language disorder: An expanded view. *Topics in Language Disorders*, **16**, 14-29.

Chall, J. S. (1996). *Stages of reading development* (2nd ed.). Fort Worth: Harcourt Brace College Publishers.

Chen, H. and Ho, C. (1986). Developmental study of the reversed Stroop effect in Chinese-English bilinguals. *Journal of General Psychology*, **113**, 121-125.

Chen, R. S. and Vellutino, F. R. (1997). Prediction of reading ability: A cross-validation study of the simple view of reading. *Journal of Literacy Research*, **29**, 1-24.

Clarke, M. (1979). Reading in Spanish and English: evidence from adult ESL students. *Language Learning*, **29**, 121-150.

Cline, T. and Reason, R. (1993). Specific reading difficulties (dyslexia): equal opportunities issues. *British Journal of Special Education*, **20**, 30-34.

Cline, T. and Frederickson, N. (1999). Identification and Assessment of Dyslexia in bi/multilingual children. *International Journal of Bilingual Education and Bilingualism* **2**, 81-93.

Cline T. and Shamsi T. (2000). Language needs or special needs? The assessment of learning difficulties in literacy among children learning English as an additional language: A literature review. London: DfEE.

Cline, T. (2000). Multilingualism and dyslexia: challenges for research and practice. *Dyslexia: An International Journal of Research and Practice*, **6**, 1-12.

Coady, J. (1997). L2 vocabulary acquisition through extensive reading. In J. Coady and T. Huckin (Eds), *Second language vocabulary acquisition*. Cambridge: Cambridge University Press.

Code of Practice on the Identification and Assessment of Pupils with Special Educational Needs (2000). DfEE: London.

Cohen, G. (1980) Reading and searching for spelling errors. In U. Frith (Ed.), *Cognitive Processes in Spelling*. London: Academic Press.

Cohen, A. D. (1987). Recent uses for mentalistic data in reading strategy research. *Documentos de Estudos em Lingística Teórica e Aplicada*, (DELTA) 3, 57-84.

Coltheart, M. and Coltheart, V. (1997). Reading comprehension is not exclusively reliant upon phonological representation. *Cognitive Neuropsychology*, 14, 167-175.

Cook, L. (1980). Misspelling analysis in dyslexia: observation of developmental strategy shifts. *Bulletin of the Orton Society*, 13, 123-134.

Cook, V. J. (1997). L2 users and English spelling. *Journal of Multilingual and Multicultural Development*, 18, 474-488.

Cossu, G., Shankweiler, D., Liberman, I., Katz, L. and Tola, G. (1988). Awareness of phonological segments and reading ability in Italian children. *Applied Psycholinguistics*, 9, 1-16.

Cowan, J. R. (1976). Reading, perceptual strategies and contrastive analysis. *Language Learning*, 26, 95-109.

Cowan, J. R. and Sarmad, Z. (1976). Reading performance of bilingual children according to type of school and home language. *Language Learning*, 26, 353-376.

Cronin, V. and Carver, P. (1998). Phonological sensitivity, rapid naming and beginning reading. *Applied Psycholinguistics*, 19, 447-461.

Cummins, J. (1976). The influence of bilingualism on cognitive growth: a synthesis of research findings and explanatory hypotheses. *Working Papers on Bilingualism*, 19, 2-43.

Cummins, J. (1979). Cognitive/academic language proficiency, linguistic interdependence, the optimum age question and some other matters. *Working Papers on Bilingualism*, **19**, 197-205.

Cummins, J. (1984). *Bilingualism and special education: Issues in assessment and pedagogy*. Avon: Multilingual Matters.

Cummins, J. (1991). Interdependence of first-and second language proficiency in bilingual children. In E. Bialystok (Ed.), *Language processing in bilingual children*. Cambridge, MA: Cambridge University Press.

Cziko, G. A. (1978). Differences in first and second language reading: the use of syntactic, semantic and discourse constraints. *Canadian Modern Language Review*, **34**, 473-489.

Dalby, M. A., Elbro, C. and Stodkilde-Jorgensen, H. (1998). Temporal lobe asymmetry and dyslexia: an in vivo study using MRI. *Brain Language*, **62**, 51-69.

Daneman, M. and Carpenter, P. A. (1980). Individual differences in working memory and reading. *Journal of Verbal Learning and Verbal Behavior*, **19**, 450-466.

Darden, C. and Morgan, A. W. (1996). Cognitive functioning profiles of the adult population with learning disabilities. In N. Gregg, C. Hoy, and A. F. Gay (Eds), *Adults with learning disabilities: theoretical and practical perspectives*. New York: Guilford Press.

Denckla, M. B. and Rudel, R. G. (1976). Rapid 'automatised' naming (R. A. N.): Dyslexia differentiated from other learning disabilities. *Neuropsychologia*, **14**, 471-479.

Department for Education and Employment (1994). *Code of practice on the identification and assessment of special educational needs*. London: HMSO.

Department for Education and Employment (2000). *Draft SEN Code of practice on the identification and assessment of pupils with special educational needs*. London: Author.

Deponio, P, Landon, J, Mullin, K. and Reid, G. (2000). An audit of the processes involved in identifying and assessing bilingual learners suspected of being dyslexic: A Scottish study. *Dyslexia*, 6, 29-41.

Deponio, P. (2004). The co-occurrence of specific learning difficulties: implications for identification and assessment. In G. Reid and A. Fawcett (Eds), *Dyslexia in context: Research, policy and practice*. London: Whurr.

Dulay, H., Burt, M. and Krashen, S. (1982). *Language two*. New York: Oxford Universal Press.

Eden, G., VanMeter, J., Rumsey, J., Maisog, J., Woods, R., and Zeffiro, T. (1996). Abnormal processing of visual motion in dyslexia revealed by functional brain imaging. *Nature*, 382, 66-69.

Elliott, C.D., Murray, T. S. and Pearson, R. (1978). *British Abilities Scales*. Windsor: NFER-Nelson.

Elliot, C.D., Smith, P. and McCulloch, K. (1996). *British Abilities Scales II*. Windsor: NFER-Nelson.

Ellis N. and Large, B. (1987). The development of reading: as you seek so shall you find. *British Journal of Psychology*, 78, 1-28.

Ellis, N. C. (1996). Longitudinal studies of spelling development. In D. A. Brown and N. C. Ellis (Eds), *Handbook of Spelling: theory, process and intervention*. Chichester: Wiley and Sons.

Everatt, J. (1997). The abilities and disabilities associated with adult developmental dyslexia. *Journal of Research in Reading*, **20**, 13-21.

Everatt, J., Smythe, I., Adams, E. and Ocampo, D. (2000). Dyslexia screening measures and bilingualism. *Dyslexia*, **6**, 42-56.

Everatt, J., Smythe, I., Ocampo, D. and Veii, K. (2002). Dyslexia assessment of the bi-scriptal reader. *Topics in Language Disorders*, **22**, 32-45.

Fawcett, A. and Nicolson, R. (2001). Dyslexia: the role of the cerebellum. In A. Fawcett (Ed), *Dyslexia: theory and good practice*. London: Whurr.

Felton, R. H., Wood, F. B. Brow, I. S. and Campbell, S. K. (1987). Separate verbal memory and naming deficits in attention deficit disorder and reading disability. *Brain and Language*, **31**, 171-184.

Felton, R. H., Naylor, C. E. and Wood, F. B. (1990). Neuropsychological profile of adult dyslexics. *Brain and Language*, **39**, 485-497.

Fidler, R. Brooks, P. and Everatt, J. (March, 2004). *Evaluation of adult literacy skills as part of an FE/HE dyslexia assessment process*. Paper presented to the BDA Annual Conference, University of Warwick: Warwick.

Fisher, S. E.; Marlow, A. J.; Lamb, J.; Maestrini, E.; Williams, D. F.; Richardson, A. J.; Weeks, D. E.; Stein, J. F. and Monaco, A. P. (1999). A quantitative-trait locus on chromosome 6p influences different aspects of developmental dyslexia. *American Journal of Human Genetics*, **64**, 146-156.

Frederickson, N., Frith, U. and Reason, R. (1996). Phonological Assessment Battery (PhAB). Manual and Test materials. NFER: Nelson.

Frederickson, N. and Frith, U. (1998). Identifying dyslexia in bilingual children: A phonological approach with inner London Sylheti speakers. *Dyslexia*, 4, 119-131.

Frith, U. (1980). *Cognitive Processes in Spelling*. London: Academic Press.

Frith, U. (1985). Beneath the surface of developmental dyslexia. In K. E. Patterson, J.C. Marshall and M. Coltheart (Eds), *Surface dyslexia: cognitive and neuropsychological studies of phonological reading*. London: Routledge and Kegan Paul.

Frith, U., Landerl, K. and Frith, C. (1995). Dyslexia and verbal fluency: more evidence for a phonological deficit. *Dyslexia*, 1, 2-22.

Frost, R. (1994). Prelexical and postlexical strategies in reading: Evidence from a deep and a shallow orthography. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 20, 116-129.

Gathercole, S. E. and Baddeley, A. D. (1993). *Working memory and language*. Hove, Sussex: Erlbaum.

Gerard, L. and Scarborough, D. (1989). Language-specific lexical access of homographs by bilinguals. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 15, 305-315.

Gersten, R. and Woodward, J. (1994). The language minority student and special education: issues, trends and paradoxes. *Exceptional Children*, 60, 310-322.

Geschwind, N. and Galaburda, A. (1987). *Cerebral lateralization*. Cambridge, M. A.: MIT Press.

Geva, E. and Siegel, L. (2000). Orthographic factors in the concurrent development of basic reading skills in two languages. *Reading and Writing: An Interdisciplinary Journal*, 12, 1-30.

Gilger, J.W., Pennington, B.F. and DeFries, J.C. (1991). Risk for reading disability as a function of parental history in three family studies. *Reading and Writing*, **3**, 205-217.

Glover, P. and Brown, G. (1996). Measuring Spelling Production Times: methodology and tests of a model. In G. Brown and N. Ellis (Eds), *Handbook of Spelling: theory, process and intervention*. Chichester: Wiley and Sons.

Goodman, K. S. (1973). Reading: A Psycholinguistic Guessing Game. *Journal of the Reading Specialist*, **4**, 126-135.

Goodman, K.S. (1973). Psycholinguistic universals of the reading process. In F. Smith (Ed.), *Psycholinguistics and Reading*, pp. 21-29. New York: Holt, Rinehart and Winston.

Goover, W. A. and Gough, P. B. (1990). The simple view of reading. *Reading and Writing*, **2**, 127-160.

Goswami, U. and Bryant, P. (1990). *Phonological skills and learning to read*. Hillsdale, NJ: Erlbaum.

Goswami, U. (1992). Annotation: Phonological factors in spelling development. *Journal of Child Psychology and Psychiatry*, **33**, 967-975.

Goswami, U. (1999). The relationship between phonological awareness and orthographic representation in different orthographies. In M. Harris and G. Hatano (Eds), *Learning to read and write: A cross-linguistic perspective*. Cambridge: Cambridge University Press.

Goswami, U. (2000). Phonological representations, reading development and dyslexia: Towards a cross-linguistic theoretical framework. *Dyslexia*, **6**, 133-151.

Gottardo, A. Siegel, L. S. and Stanovich, K. E. (1997). The assessment of adults with reading disabilities: What can we learn from experimental tasks? *Journal of Research in Reading*, **2**, 42-54.

Gough, P.B. and Tunmer, W. (1986). Decoding, reading, and reading disability. *Remedial and Special Education*, **7**, 6-10.

Gough, P. Ehri, L. and Treiman, R. (1992). *Reading acquisition*. New Jersey: Erlbaum.

Gough, P., Hoover, W. and Peterson, C. (1996). Some observations on a simple view of reading. In C. Cornoldi and J. Oakhill (Eds), *Reading comprehension difficulties: processes and intervention*. New Jersey: Lawrence Erlbaum.

Graesser, A. C. and Bertus, E. L. (1998). The construction of causal inferences while reading expository texts on science and technology. *Scientific studies of reading* **2**, 247-269.

Grosjean, F. (1998). Studying bilinguals: methodological and conceptual issues. *Bilingualism: Language and Cognition*, **1**, 131-149.

Guron, L. M. and Lundberg, I. (2003). Identifying dyslexia in multilingual students: Can phonological awareness be assessed in the majority language? *Journal of Research in Reading*, **26**, 69-82.

Hanley, J.R (1997). Reading and spelling impairments in undergraduate students with developmental dyslexia. *Journal of Research in Reading*, **20**, 22-30.

Harris, M. and Giannouli, V. (1999). Learning to read and spell in Greek: the importance of letter knowledge and morphological awareness. In M. Harris and G. Hatano (Eds), *Learning to Read and Write: A Cross-linguistic perspective*. Cambridge: Cambridge University Press.

- Harris M. and Hatano, G. (1999). *Learning to Read and write: A cross-linguistic perspective*. Cambridge: Cambridge University Press.
- Hatcher, J., Snowling, M. and Griffiths, Y. (2002). Cognitive assessment of dyslexic students in higher education. *British Journal of Educational Psychology*, **72**, 119-133.
- Hawks, R. (1996). Assessing adults with learning disabilities. In N. Gregg, C. Hoy, and A. F. Gay (Eds), *Adults with learning disabilities: theoretical and practical perspectives*. New York: Guilford Press.
- Heinman, T., and Precel, K. (2003). Students with learning disabilities in higher education: academic strategies profile. *Journal of Learning Disabilities*, **36**, 248-258.
- Herskovits, M. and Gyarmathy, E. (1995). Types of high ability: Highly able children with an unbalanced intelligence structure. *European Journal for High Ability*, **6**, 38-48.
- Ho, C. S. H. and Bryant, P. (1997). Phonological skills are important in learning to read Chinese. *Developmental Psychology*, **33**, 946-951.
- Ho, C. S. H. and Lai, D. (1999). Naming-speed deficits and phonological memory deficits in Chinese developmental dyslexia. *Learning and Individual Differences*, **11**, 173-186.
- Hoover, W. A. and Gough, P. B. (1990). The simple view of reading. *Reading and Writing: An Interdisciplinary Journal*, **2**, 127-160.
- Huckin, T., Haynes, M. and Coady, J. (1993). *Second language reading and vocabulary learning*. New Jersey: Ablex Publishing Corporation.
- Jakobson, R. (1953). Results of the conference of anthropologists and linguists. *IJAL Supplement*, Memoir 8, 19-22.

Jamieson, C. (2001). Manifestations of dyslexia in university students: implications for assessment and diagnosis. Paper presented at the Multilingual Symposium to the 5th BDA International Conference. University of York: York.

Jastak, S., Wilkinson, G. and Jastak, J. (1987). The Wide Range Achievement Test-Revised (WRAT-R). Jastak Associates, Inc.

Jescheniak J. D., Meyer, A. S. and Levelt, W. (2003). Specific-word frequency is not all that counts in speech production: Comments of Caramazza, Costa et al (2001) and new experimental data. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, **29**, 432-438.

Jolly, D. (October 1978). *The establishment of a self-access scheme for intensive reading*. Paper presented to the Goethe Institute, British Council Colloquium on Reading, Paris.

Juel, C., Griffith, P. L. and Gough, P. B. (1986). The acquisition of literacy: A longitudinal study of children in first and second grade. *Journal of Educational Psychology*, **78**, 243-255.

Kasviki, A. (1992). *The diagnosis of developmental dyslexia in Greece*. Doctoral thesis. University of North Wales: Bangor.

Katz, L. and Frost, R. (1992). The reading process is different for different orthographies: The orthographic depth hypothesis. In R. Frost and L. Katz (Eds), *Orthography, phonology, morphology and meaning*. Amsterdam: North-Holland.

Kellerman E. and Sharwood Smith, M. (1986). *Crosslinguistic influence in second language acquisition*. New York: Pergamon.

Kitz, W. R. and Nash, R. T. (1992). Testing the effectiveness of the Project success summer program for adult dyslexics. *Annals of Dyslexia*, **42**, 3-24.

- Krashen, S. D. (1982). *Principles and Practice in Second language acquisition*. Oxford: Pergamon.
- Kreiner, D, and Gough, P. (1990). Two ideas about spelling: rules and word-specific memory. *Journal of memory and language*, **29**, 103-118.
- Kroll, J. (1993). Assessing conceptual representations for words in a second language. In R. Schreuder and B. Weltens (Eds), *The bilingual lexicon*. Amsterdam: Benjamins Publishing Company.
- Kroll, J. F, Michael, E., Tokowicz, N. and Dufour, R. (2002). The development of lexical fluency in a second language. *Second Language Research*, **18**, 137-171.
- LaBerge, D. and Samuels, S. J. (1974). Toward a theory of automatic information processing in reading. *Cognitive Psychology*, **6**, 293-323.
- Lalleman, J. (1996). The state of the art in second language acquisition research. In P. Jordens and J. Lalleman (Eds), *Investigating second language acquisition*. Berlin: Mouton de Gruyter.
- Landerl, K., Wimmer, H. and Frith, U. (1997). The impact of orthographic consistency on dyslexia: A German-English comparison. *Cognition*, **63**, 315-334.
- Lapkin, S. and Swain, M. (1977). The use of English and French cloze tests in a bilingual education program evaluation: Validity and error analysis. *Language Learning*, **27**, 279-313.
- Lee, J. and Schallert, D. L. (1997). The relative contribution of L2 language proficiency and L1 reading ability to L2 reading performance: a test of the threshold hypothesis in an EFL content. *TESOL Quarterly*, **31**, 713-739.

Lennox, C. and Siegel, L. (1996). The role of phonological and orthographic processes in learning to spell. In G. Brown and N. Ellis (Eds), *Handbook of Spelling: theory, process and intervention*. Chichester: Wiley and Sons.

Leong, C.K. and Joshi, R.M. (1997). *Cross-language studies of learning to read and spell: Phonologic and orthographic processing*. Dordrecht: Kluwer Academic Press.

Li, P. and Yip, M. (1998). Context effects and the processing of spoken homophones. *Reading and Writing: An Interdisciplinary Journal*, **10**, 223-243.

Lieberman, A. M. (1997). How theories of speech affect research in reading. In B. A. Blachman (Ed.), *Foundations of Reading Acquisition and Dyslexia*. New Jersey: Lawrence Erlbaum Associates.

Link, K. and Caramazza, A. (1996). Orthographic structure and the spelling process: a comparison of different codes. In G. Brown and N. Elliot (Eds), *Handbook of Spelling: theory, process and intervention*. Chichester: Wiley and Sons.

Livingstone, M., Rosen, G., Drislane, F., and Galaburda, A. (1991). Physiological and Anatomical evidence for a magnocellular defect in developmental dyslexia. *Proceedings of the National Academy of Science*, **88**, 7943-7947.

Long, D.L, Oppy, B.J and Seely, M.R. (1997). Individual differences in readers' sentence and text level representations. *Journal of Memory and Language*, **36**, 129-145.

Mahony, D., Singson, M. and Mann, V. (2000). Reading ability and sensitivity to morphological relations. *Reading and Writing*, **12**, 191-218.

Marsh, G. et al. (1980). The development of strategies in spelling. In U. Frith (Ed.), *Cognitive processes in spelling*. London: Academic Press.

Mavrommati, D. (1995). *Η κατάρτηση ενός προγράμματος αντιμετώπισης της δυσλεξίας*. Athens: Mavrommati. (In Greek).

Mazi, M., Nenopoulou, S. and Everatt, J. (2003). Dyslexia in Greece. In I. Smythe, J. Everatt and R. Salter (Eds). *The International Book of Dyslexia* (2nd ed). Chichester: Wiley.

McLaughlin, B. (1992). Working memory capacity as a constraint on L2 development. In R. Harris (Ed.), *Cognitive processing in bilinguals*. Amsterdam: North Holland.

Meyer, M. S. and Felton, R. H. (1999). Evolution of fluency training: old approaches and new directions. *Annals of Dyslexia*, **49**, 283-306.

Miles, T. (1993). *Dyslexia: the pattern of difficulties*, 2nd Ed. London: Whurr.

Miles, T. R. and Miles, E. (1999). *Dyslexia: A hundred years on* (2nd Ed). Buckingham: Open University Press.

Miles, E. (2000). Dyslexia may show a different face in different languages. *Dyslexia*, **6**, 193-201.

Ministry of Education and Religious Affairs (1994). *Information Manual of Special Education*. Athens: Department of Special Education Training (In Greek).

Moats, L. C. (1994). Assessment of spelling in learning disabilities research. In G. R. Lyon (Ed.). *Frames for reference for the assessment of learning disabilities: New views on measurement issues*. Baltimore: Paul H. Brookes Publishing Company.

Moats, L. C. (1996). Phonological spelling errors in the writing of dyslexic adolescents. *Reading and Writing: An Interdisciplinary Journal*, **8**, 105-119.

Morais, J., Cary, L., Alegria, J. and Bertelson, P. (1979). Does awareness of speech as a sequence of phonemes arise spontaneously? *Cognition*, **7**, 323-331.

Morton (1980). The Logogen model and orthographic structure. In U. Frith (Ed.), *Cognitive Processes in Spelling*. London: Academic Press.

Mueller, K. and Brady, S. (2001). Correlates of early reading performance in a transparent orthography. *Reading and Writing*, **14**, 757-799.

Murray, T. S., Kirsch, I. S. and Jenkins, L. B. (1998). *Adult literacy in OECD countries: Technical report on the First International Adult Literacy Survey*. Washington DC: National Center for Educational Statistics, (ED), U.S. Government Printing Office.

Nassaji (2003). Higher-level and lower-level text processing skills in advanced ESL reading comprehension. *The Modern Language Journal*, **87**, 261-276.

Nation, P. (1993). Vocabulary size, growth and use. In R. Schreuder and B. Weltens (Eds), *The bilingual lexicon*. Amsterdam: John Benjamins Publishing Company.

Nation, K. and Snowling, M. J. (1998). Individual differences in contextual facilitation: Evidence from dyslexia and poor reading comprehension. *Child Development*, **69**, 996-1011.

Department for Education and Employment (1998). *The National Literacy Strategy - framework for teaching*. London: DfEE. Accessed from the Internet, June 2004, www.dfes.gov.uk. Accessed November 2002.

Nelson, H. (1980). Analysis of spelling errors in normal and dyslexic children. In U. Frith (Ed.), *Cognitive Processes in Spelling*. London: Academic Press.

Nelson, H.E. and Willison, J.R. (1991). *The National Adult Reading Test manual* 2nd ed. NFER-Nelson: Windsor.

Nicolson, R. I. and Fawcett, A. J. (1995). Dyslexia is more than a phonological disability. *Dyslexia*, **1**, 19-36.

Nikolopoulos, D. (April 2001). Differing patterns of developmental dyslexia in Greek. Paper presented at the Multilingual Symposium to the 5th BDA International Conference of Dyslexia. University of York: York.

Nunes, T., Bryant, P., and Bindman, M. (1997a). Learning to spell regular and irregular verbs. *Reading and Writing*, **9**, 427-449.

Nunes, T., Bryant, P., and Bindman, M. (1997b). Morphological spelling strategies: Developmental stages and processes. *Developmental Psychology*, **33**, 637-649.

Oakhill, J. and Cain, K. (1997). Assessment of comprehension in reading. In J. Beech and C. Singleton (Eds), *The Psychological Assessment of Reading*. London: Routledge.

Ocampo, D. (2002). *Effects of bilingualism on literacy development*. Doctoral thesis. Submitted at University of Surrey: Surrey.

Olson, R. K., Forsberg, H. and Wise, B. W. (1994a). The varieties of orthographic knowledge I: Theoretical and developmental issues. In V. W. Berninger and B. W. Wise (Eds), *Neuropsychology and cognition*. Dordrecht: Kluwer.

Olson, R. K., Forsberg, H. and Wise, B. W. (1994b). Genes, environment and the development of orthographic skills. The varieties of orthographic knowledge I: Theoretical and Developmental issues. In V. W. Berninger (Ed.), *The Varieties of Orthographic Knowledge*. Dordrecht: Kluwer.

Oney B. and Durgunoglu, A. Y. (1997). Beginning to read in Turkish: A phonologically transparent orthography. *Applied Psycholinguistics*, **18**, 1-15.

Oney, B., Peter, M., and Katz, L. (1997). Phonological processing in printed word recognition: effects of age and writing system. *Scientific Studies of Reading*, **1**, 65-83.

Ormrod, J. E. (1985). Visual memory in a spelling matching task: Comparison of good and poor spellers. *Perceptual and Motor Skills*, **61**, 183-188.

Ott, P. (1997). *How to detect and manage dyslexia: A reference and resource manual*. Oxford: Heinemann.

Oxford, R. and Crookall, D. (1989). Research on language learning strategies: methods, findings and instructional issues. *Modern Language Journal*, **73**, 404-419.

Patterson, K. E. (1986). Lexical but nonsemantic spelling? *Cognitive Neuropsychology*, **3**, 341-367.

Patterson, K. E., Seidenberg, M. S. and McClelland, J. L. (1990). Connections and disconnections: Acquired dyslexia in a computational model of reading processes. In R. G. M. Morris (Ed.), *Parallel Distributed Processing: Implications for Psychology and Neuroscience*. London: Oxford University Press.

Patton, J. R. and Polloway, E. A. (1996). Adults with learning disabilities: An emerging area of professional interest and public attention. In J. Patton and E. Polloway (Eds.), *Learning disabilities: The challenges of adulthood*. Austin, TX: PRO-ED.

Paulesu, E. and Frith, U. (1996). Developmental dyslexia: a disconnection syndrome? Evidence from PET scanning. *Brain*, **119**, 143-157.

Pavlidis, G. Th. (1981). *Dyslexia research and its applications to education*.

In G. Th. Pavlidis and T.R Miles (Eds.). Chichester: Wiley and Sons.

Pavlidis, G. Th. (1985). Eye movements in Dyslexia: Their diagnostic significance.

Journal of Learning Disability, **18**, 42-49.

Pavlidis, G. Th. (1991). Diagnostic significance and relationship between dyslexia and erratic eye movements. In J. F. Stein (Ed.) *Vision and Visual Dysfunction Vol 13: Vision and Visual Dyslexia*. Basingstoke: Macmillan Press.

Pavlidis, G. Th. (March 2004). *Why spelling errors accurately differentiate Greek from English speaking dyslexics: Implications for the causes and treatment of dyslexia*. Paper presented at the 6th BDA International Conference of Dyslexia. University of Warwick, Coventry.

Peer, L. (1999). Dyslexia/SpLD: A reappraisal as we move into the next century. *The Dyslexia Handbook*. Reading: British Dyslexia Association.

Peer, L. and Reid, G. (2000). *Multilingualism, literacy and dyslexia*. London: David Fulton Publishers.

Pennington, B.F., Bender, B., Puck, M., Salbenblatt, J., and Robinson, A. (1982). Learning disabilities in children with sex chromosome anomalies. *Child Development*, **53**, 1182-1192.

Pennington, B. F. (1990). The genetics of dyslexia. *Journal of Child Psychology and Psychiatry*, **31**, 193-201.

Pennington, B. F., Vvan Orden, G. C., Smith, S. D., Green, P. A. and Haith, M. M. (1990). Phonological processing skills and deficits in adult dyslexics. *Child development*, **61**, 1753-1778.

- Pennington, B.F., Gilger, J.W, Pauls D., Smith S. A, Smith S. D, and De Fries J.C (1991). Evidence for major gene transmission of developmental dyslexia. *Journal of the American Medical Association*, **266**, 1527-1534.
- Perfetti, C. A. (1985). *Reading Ability*. Oxford: Oxford University Press.
- Perin, D. (1983). Phonemic segmentation and spelling. *British Journal of Psychology*, **74**, 129-144.
- Perkins, K., Brutton, S. R. and Pohlmann, J. T. (1989). First and second language reading comprehension, *RELC Journal*, **20**, 1-9.
- Perry, C., Ziegel, J.C.and Coltheart, M. (2002). How predictable is spelling? Developing and testing metrics of phoneme-grapheme contingency. *The Quarterly Journal of Experimental Psychology*, **55A** , 897-915.
- Porpodas, C. D. (1981). *Dyslexia*. Athens: Gutenberg.
- Porpodas, C. D. (1989). The phonological factor in reading and spelling of Greek. In P. G. Aaron and R. M. Joshi (Eds), *Reading and Writing Disorders in different orthographic systems. NATO ASI Series D: Behavioural and Social Sciences*, 52. London: Kluwer.
- Porpodas, C. D. (1990). Processes used in children's reading and spelling of Greek words. In G. Th. Pavlidis (Ed.), *Perspectives on Dyslexia. Vol. 2. Cognition, Language and Treatment*. Chichester: Wiley and Sons.
- Porpodas, C.D. (1999). Patterns of phonological and memory processing in beginning readers and spellers of Greek. *Journal of Learning Disabilities*, **32**, 406-416.
- Rack, J. P., Snowling, M. J. and Olson, R. K. (1992). The non-word reading deficit in developmental dyslexia: A review. *Reading Research Quarterly*, **27**, 29-53.

Ram, A. and Moorman, K. (1999). *Understanding Language Understanding: Computational Models of Reading*, Cambridge, M. A: MIT Press.

Ravid, D. (2001). Learning to spell in Hebrew: Phonological and morphological factors. *Reading and Writing*, **14**, 459-485.

Rayner, K. and Pollatsek, A. (1989). *The Psychology of Reading*. Englewood Cliffs, N. J.: Prentice Hall.

Read, C. (1986). *Children's creative spelling*. London: Routledge and Kegan Paul.

The Reading Excellence Act (REA) definition of reading Section 2252 (4),
U.S. Department of Education, Office of Special Education Programs
(www.ed.gov/offices/OESE/REA/reading_act.pdf, 2003).

Reason, R., Frederickson, N., Martin, C., and Woods, K. (1999). *Dyslexia, literacy and psychological assessment*. Report by a Working Party of the Division of Educational and Child Psychology of the British Psychological Society.

Reason, R. (2001). Educational practice and dyslexia. *The Psychologist*, **14**, 298-301.

Reid, G. and Kirk, J. (2001). *Dyslexia in Adults: Education and Employment*. Chichester: Willey.

Ringbom, H. (1986). Crosslinguistic influence and the foreign language learning process. In E. Kellerman and M. Sharwood Smith (Eds), *Crosslinguistic influence in second language acquisition*. New York: Pergamon.

Robichon, F., Levrier, O., Farnarier, P. and Habib, M. (2000). Developmental dyslexia: atypical cortical asymmetries and functional significance. *European Neurology*, **71**, 35-46.

Rosen, S. (1999). Language disorders: a problem with auditory processing? *Current Biology*, 9, R698-R700.

Samarzi, S. (1999). Μελέτη ορισμένων πλευρών της δυσλεξίας. *Σύγχρονη Εκπαίδευση*, 109, 35-42 (In Greek).

Scarborough, H. S. (1990). Very early language deficits in dyslexic children. *Child Development*, 61, 1728-1734.

Schneider, E., Elke, J. and Ganschow, N. (2000). Dynamic Assessment and instructional strategies for learners who struggle to learn a foreign language. *Dyslexia*, 6, 72-82.

Scholfield, P. (1996). Writing and Spelling: The View from Linguistics. In G. Brown and N. Ellis (Eds), *Handbook of Spelling: Theory, process and intervention*. Chichester: Wiley and Sons.

Schreuder, R. and Weltens, B. (1993). *The bilingual lexicon*. Amsterdam: John Benjamins Publishing Company.

Senechal, M. (2000). Morphological effects in children's spelling of French words. *Canadian Journal of Experimental Psychology*, 54, 76-86.

Seymour, P. H. and Porpodas, C. D. (1980). Lexical and non-lexical processing of spelling in dyslexia. In U. Frith (Ed.), *Cognitive processes in spelling*. London: Academic Press.

Seymour, P. and Evans, H. (1996). Sources of constraint and individual variations in normal and impaired spelling. In G. Brown and N. Ellis (Eds), *Handbook of Spelling: theory, process and intervention*. Chichester: Wiley and Sons.

Seymour, P., Mikko, A. and Erskine, J. (2003). Foundation literacy acquisition in European Orthographies. *British Journal of Psychology*, 94, 143-174.

Shallice, T. (1988). *From neuropsychology to mental structure*. Cambridge: Cambridge University Press.

Shaywitz S.E., Shaywitz B.A., Fletcher J.M, and Escobar M.D. (1990). Prevalence of reading disability in boys and girls: Results of the Connecticut Longitudinal Study. *Journal of the American Medical Association*, **264**, 998-1002.

Shaywitz, B., Shaywitz, S., and Pugh, K. (1995). Sex differences in the functional organisation of the brain for language. *Nature*, **373**, 607-609.

Shaywitz , S. (1996). Dyslexia. *Scientific American*, **275**, 98-104.

Siegel, L., Share, D. and Geva, E. (1995). Evidence for superior orthographic skills in dyslexics. *Psychological Science*, **6**, 250-254.

Siegel (1996). The modularity of reading and spelling: Evidence from hyperlexia. In G. D. A. Brown and N. C. Ellis (Eds), *Handbook of Spelling: Theory, process and intervention*. Bangor: Wiley and Sons.

Siegel, L.S. (1999). Issues in the definition and diagnosis of learning disabilities: A Perspective on Guckenberger v. Boston University. *Journal of Learning Disabilities*, **32**, 304-319.

Simmons, F. and Singleton, C. (2001). The reading comprehension abilities of dyslexic students in higher education. *Dyslexia: An International Journal of Research and Practice*, **6**, 178-192.

Simpson, J. T. (2004). Phonological skills and rapid naming as predictors of literacy achievement. Unpublished doctoral thesis. University of Surrey.

Singer, H. and Ruddell, R. B. (1985). *Theoretical models and processes of reading*. Newark, DE: International Reading Association.

Singleton, C. H. (1999). *Dyslexia in Higher Education: Policy, Provision and Practice*. The Report of the National Working Party on Dyslexia in Higher Education. Hull: University of Hull.

Sloboda, J. (1980). Visual Imagery and individual differences in spelling. In U. Frith (Ed.), *Cognitive Processes in Spelling*. Chichester: Wiley and Sons.

Smith, S.D., Pennington, B.F., Kimberling, W.J., and Ing, P.S. (1990). Familial dyslexia: Use of genetic linkage data to define subtypes. *Journal of the American Academy of Child and Adolescent Psychiatry*, **29**, 204-213.

Smith, S.D., Kimberling, W.J., and Pennington, B.F. (1991). Screening for multiple genes influencing dyslexia. *Reading and Writing*, **3**, 285-298.

Smith, M. C. and Magee, L. E. (1980). Tracing the time course of picture-word processing. *Journal of Experimental psychology: General*, **109**, 373-392.

Smythe, I. and Everatt, J. (2000). Dyslexia diagnosis in different languages. In L. Peer and G. Reid (Eds), *Multilingualism, literacy and dyslexia: A Challenge for Educators*. David Fulton Publishers: BDA.

Smythe, I. (2002). The International Cognitive Profiling Test (ICPT). Diagnosing specific learning difficulties in multilingual children. In M. Johnson and L. Peer (Eds), *The Dyslexia Handbook*. Reading: BDA.

Smythe, I. (2002). Cognitive factors underlying reading and spelling difficulties: a cross-linguistic study. Unpublished doctoral thesis. University of Surrey.

Smythe, I. and Everatt, J. (2002). Dyslexia and the multilingual child. *Topics in Language Disorders*, **22**, 71-80.

Smythe, I., Everatt, J. and Salter, R. (2004). *The International Book of Dyslexia* (2nd ed). Chichester: Wiley.

Snodgrass, J. (1993). Translating versus picture naming: similarities and differences. In R. Schreuder and B. Weltens (Eds), *The bilingual lexicon*. Amsterdam: John Benjamins Publishing Company.

Snowling, M. (1995). Phonological processing and developmental dyslexia. *Journal of Research in Reading*, **18**, 132-138.

Snowling, M. (1996). Towards a model of spelling acquisition: the development of some component skills. In G. Brown and N. Elliot (Eds), *Handbook of Spelling: theory, process and intervention*. Chichester: Wiley and Sons.

Snowling, M. Nation, K., Moxham, P., Gallagher, A. and Frith, U. (1997). Phonological processing deficits in dyslexic students: A preliminary account. *Journal of Research in Reading*, **20**, 31-41.

Snowling, M. J. (2000). *Dyslexia* (second edition). Oxford: Blackwell Publishers.

Stampoltzis, A., Polychronopoulou, S and Papadopoulos, A. (2004). Dyslexia in Higher Education in Greece: A study of incidence, provision and practice. Retrieved from the Internet, June 2004.

(<http://www.ispaweb.org/eu/colloquim/nyborg/Nyborg%20Presentations/Stampotzis.htm>)

Stanovich, K. E. (1980). Toward an interactive compensatory model of individual differences in the development of reading fluency. *Reading Research Quarterly*, **16**, 32-71.

Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly*, **21**, 360-407.

Stanovich, K.E. (1988). Explaining the differences between the dyslexic and the garden variety poor reader: The phonological-core variable difference model. *Journal of Learning Disabilities*, **21**, 590-604.

Stanovich, K. E. and West, R. F. (1989). Exposure to print and orthographic processing. *Reading Research Quarterly*, **4**, 402-433.

Stanovich, K. E. and Siegel, L.S. (1994). Phenotypic performance profile of children with reading disabilities: A regression-based test of the phonological-core variable-difference model. *Journal of Educational Psychology*, **86**, 24-53.

Stanovich, West, Cunningham Levin, Korat and Amsterdamer (1996). The role of inadequate print exposure as a determinant of reading comprehension problems. In C. Cornoldi and J. Oakhill (Eds), *Reading comprehension difficulties: Processes and intervention*. New Jersey: LEA.

Stanovich, K. E. (1998). Refining the phonological core deficit model. *Child Psychology and Psychiatry Review*, **3**, 17-21

Stein, J. F. (1991). *Vision and Visual Dysfunction Vol 13: Vision and Visual Dyslexia*. Basingstoke: Macmillan Press.

Stein, M. (1993). The healthy inadequacy of contextual definition. In T. Huckin, M. Haynes and J. Coady (Eds), *Second language reading and vocabulary learning*. New Jersey: Ablex Publishing Corporation.

Stein, J., and Walsh, V. (1997). To see but not to read; the magnocellular theory of dyslexia, *Trends in Neuroscience*, **2**, 147-152.

Stoller, F. and Grabe, W. (1993). Implications for L2 vocabulary acquisition and instruction from L1 vocabulary research. In T. Huckin, M. Haynes and J. Coady (Eds), *Second language reading and vocabulary learning*. New Jersey: Ablex Publishing Corporation.

Studdert-Kennedy, M. and Mody, M. (1995). Auditory temporal perception deficits in the reading impaired: a critical review of the evidence. *Psychonomic Bulletin and Review*, **2**, 508-514.

Swanson, H.L. and Alexander, J.E (1997). Cognitive processes as predictors of word recognition and reading comprehension in learning-disabled and skilled readers: Revisiting the specificity hypothesis. *Journal of Educational Psychology*, **89**, 128-158.

Taillefer, G. E. (1996). L2 reading ability: further insight into the short-circuit hypothesis. *Modern Language Journal*, **80**, 461-477.

Tallal, P. (1980). Auditory temporal perception phonics and reading disabilities in children. *Brain and Language*, **9**, 182-198.

Torgensen, J., Rashote, C. and Alexander, A. (2001). The prevention and remediation of reading fluency problems. In M. Wolf (Ed.), *Time, Fluency, and Dyslexia*. New York: York Press.

Treiman, R. (1996). Sources of information used by beginning spellers. In G. Brown and N. Ellis (Eds), *Handbook of Spelling: theory, process and intervention*. Chichester: Wiley and Sons.

Tureba, H, Guthrie, G and Au, K (Eds), (1981). Culture and the bilingual classroom: Studies in classroom ethnography. Rowley, MA: Newbury House.

Ulijn, J. M. (August 1978). *Conceptualisation in Second Language Reading*. Paper presented at the 5th International Congress of Applied Linguistics, Montreal.
UNESCO ALSSED-LSP NEWSLETTER - ISSN 0106-0341, Online Articles and reports published in the Unesco Alsed-LSP Newsletter from 1977 to 2000.

Van Winjnendaele I. and Brysbaert, M. (2002). Visual word recognition in bilinguals: phonological priming from the second to the first language. *Journal of Experimental Psychology: Human Perception and Performance*, **28**, 616-627.

Wagner, R. K. and Torgesen, J. K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin*, **101**, 192-212.

Wagner, R. K., Torgesen, J. K. and Rashotte, C. A. (1994). Development of reading-related phonological processing abilities: New evidence of bidirectional causality from a latent variable longitudinal study. *Developmental Psychology*, **1**, 73-87.

Wagner, R. K. and Barker, T. A. (1994). The development of orthographic processing ability. In V. W. Berninger (Ed.), *The varieties of orthographic knowledge I: Theoretical and developmental issues*. Dordrecht, the Netherlands: Kluwer.

Walczyk, J. J. and Taylor, R. W. (1996). How do the efficiencies of reading subcomponents relate to looking back in text? *Journal of Educational Psychology*, **88**, 537-545.

Weeks, S., Brooks, P. and Everatt, J. (2002). Individual Differences in Learning to Spell. *Educational and Child Psychology*, **19**, 47-62.

Wimmer, H. (1993). Characteristics of developmental dyslexia in a regular writing system. *Applied Psycholinguistics*, **14**, 1-33.

Wimmer, H. and Goswami, U. (1994). The influence of orthographic consistency of reading development: word recognition in English and German children. *Cognition*, **51**, 91-103.

Wimmer, H., Karolyi, C.V. and Malinsky, D. (2000). Dyslexia and visual-spatial talents: No clear link. *Perspectives*, 26-30.

Wimmer, H., Landerl, K. and Schneider, W. (1994). The role of rhyme awareness in learning to read a regular orthography. *British Journal of Developmental Psychology*, **12**, 469-484.

Wode, H. (1981). *Learning a Second Language*. Tübingen: Narr.

Wolf, M. (1991). Naming speed and reading: The contribution of the cognitive neurosciences. *Reading research quarterly*, **26**, 123-141.

Wolf, M. and Obregon, M. (1992). Early naming deficit, developmental dyslexia and a specific deficit hypothesis. *Brain and Language*, **42**, 219-247.

Wolf, M. and O'Brien, B. (April 2001). *On issues of time, fluency, and intervention*. Paper presented at the 5th BDA International Conference, University of York: York.

Wolf, M. and Katzir-Cohen, T. (2001). Reading fluency and its intervention. *Scientific Studies of Reading*. (Special issue on fluency), **5**, 211-238.

Wolf, M. and Bowers, P. G. (1999). The double-deficit hypothesis for the developmental dyslexias. *Journal of Educational Psychology*, **91**, 415-438.

Wolf, M. and Bowers, P. G. (2000). Naming speed processes and developmental reading disabilities: An introduction to the special issue on the double-deficits hypothesis. *Journal of Learning Disabilities*, **33**, 322-329.

Yamashita, J. (2002). Mutual Compensation between L1 reading ability and L2 language proficiency in L2 reading comprehension. *Journal of Research in Reading*, **25**, 81-95.

Yorio, C. A. (1971). Some sources of reading problems for foreign language learners. *Language Learning*, **21**, 107-115.

Zabell, C (2003). Individual differences in dyslexia. Unpublished doctoral thesis, University of Surrey.

Appendix 1

Bespoke measures used in Study 1

Text cut off in original

SPELLING

This is a spelling task. I will read out a word for you to spell, followed by a sentence context and the word again. All you have to do is write down the word as you think it is spelt.

For example, if you are to write down the word 'blue', I will say:

'blue' 'The sky is blue' 'blue'

Is this clear?

Test items:

- | | |
|--|--------------|
| 1. A hand has four fingers and a thumb | four |
| 2. The musicians played at the Hollywood Bowl | Bowl |
| 3. He turned on the light because it was dark | light |
| 4. We didn't know who he was | who |
| 5. The lawn was wet with the dew | dew |
| 6. Bad weather stopped play | play |
| 7. The car is worth a thousand pounds | worth |
| 8. She threaded the cotton through the needle | through |
| 9. In an emergency dial 999 | dial |
| 10. She heard him whisper the secret message | heard |
| 11. The ship crossed the Atlantic ocean | ocean |
| 12. He wrote out a bank cheque for fifty pounds | cheque |
| 13. The boat was moored by the quay | quay |
| 14. The lounge suite comprised a sofa and two chairs | suite |
| 15. The composer was pleased with the rhythm of the music | rhythm |
| 16. Fudge is a confectionery | fudge |
| 17. A saucer is a type of crockery | saucer |
| 18. The doctor will inoculate with a sterile syringe | inoculate |
| 19. Analogue watches have a dial, hands and numbers | analogue |
| 20. The cells developing from an egg are called an embryo | embryo |
| 21. Surgery on the eye is performed by an ophthalmic surgeon | ophthalmic |
| 22. Salmonella bacteria is usually found in eggs | salmonella |
| 23. The isosceles triangle has two equal sides | isosceles |
| 24. Hyperbole is exaggeration often used in advertising | hyperbole |
| 25. Onomatopoeia is a word that sounds like it sounds | onomatopoeia |

PROOF READING

Circle and correct all errors in the following text.

Last year, a team of top scientist's went to Africa to look at a rare herd of elephants. They spent eight month filming and watching the animals. they took turns watching while the other members of the team sleep nearby. They were particular interested in the difference types of food that the elephants eat. They found out that these elephants liked to ate the leaves of a bush called the Round Grass Tree. It was its favourite type of food. The scientists was very pleased with their work and are going to make a film about it, It will be on television next month.

Correct version with area where error is in bold

Last year, a team of top **scientists** went to Africa to look at a rare herd of elephants. They spent eight **months** filming and watching the animals. They took turns watching while the other members of the team **slept** nearby. They were **particularly** interested in the **different** types of food that the elephants eat. They found out that these elephants liked to **eat** the leaves of a bush called the Round Grass Tree. It was **their** favourite type of food. The **scientists were** very pleased with their work and are going to make a film about **it**. **It** will be on television next month.

Recent legislation in the European Court of Financial Law could potentially precipitate a outbreak of litigation between multi-national corporations, and nation states. The imminent ruling will facilitate the ability of global companies to financially eradicate less competitive operators and manufacturers: who function at a national level. The ruling will permit international financial institutions to take over smaller national concerns, that are deemed to be unproductive, inefficient and unwilling to deliver new working practices. If this occur, the smaller companies will receive only a minimal level of compensate. "We are attempting to block this ruling by presenting a counter-claim in the International Court Of Human Justice in Geneva, say Lawyers for the national companies and governments. If this counter-claim had fails, state control monopolies will be unable to compete with these omnipresent organisations, who wealth outstrips the total gross national product of numerous nation states.

Correct version with area where error is in bold

Recent legislation in the European Court of Financial Law could potentially precipitate **an** outbreak of litigation between multi-national **corporations and** nation states. The imminent ruling will facilitate the ability of global companies to financially eradicate less competitive operators and **manufacturers who** function at a national level. The ruling will permit international financial institutions to take over smaller national **concerns that** are deemed to be unproductive, inefficient and unwilling to deliver new working practices. If this **occurs**, the smaller companies will receive only a minimal level of **compensation**. "We are attempting to block this ruling by presenting a counter-claim in the International Court Of Human Justice in Geneva," say Lawyers for the national companies and governments. If this counter-claim (**had**) fails, state **controlled** monopolies will be unable to compete with these omnipresent organisations, **whose** wealth outstrips the total gross national product of numerous nation states.

PSEUDOHOMOPHONE

Below is a number of letter strings, one of which sounds like a real word. For example, if you sound out 'PHOCKS' it sounds like the word 'fox'. Your task is to circle on the letter string that sounds like a real word.

For example, if the items are: nale pult

The answer is 'nale' because it sounds like 'nail' whereas 'pult' does not sound like a real word.

Test items:

- | | |
|------------------|--------------|
| 1. dore | warg |
| 2. katch | gruss |
| 3. neet | maif |
| 4. groe | swad |
| 5. sed | wef |
| 6. poar | hign |
| 7. skert | sworf |
| 8. onor | toab |
| 9. reeth | calch |
| 10. orlthoe | hausage |
| 11. sellestiall | inbigerted |
| 12. misselani | ambrahili |
| 13. dyarea | fongue |
| 14. ensiklopedya | delikeraties |

NON WORD Reading

In this exercise I would like you read out the nonsense words on the sheet that I give you. First I will show you some practice items.

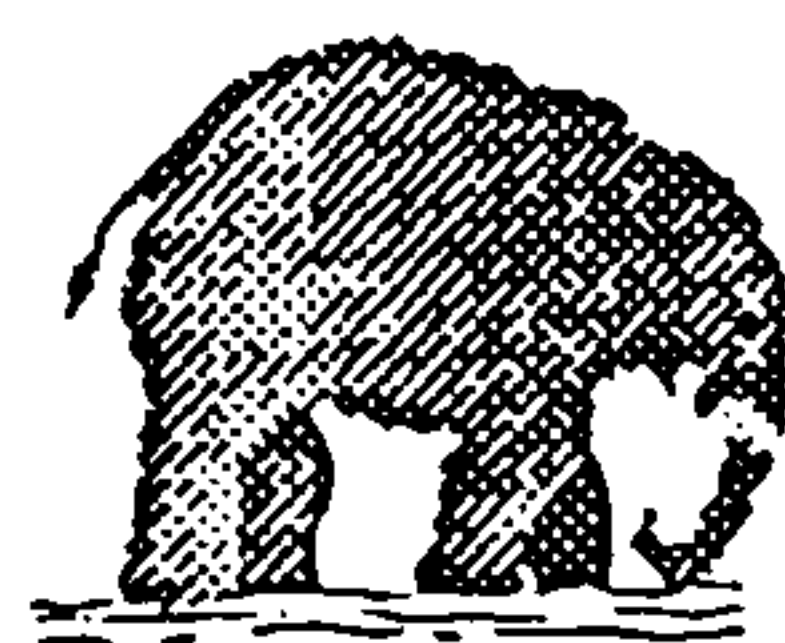
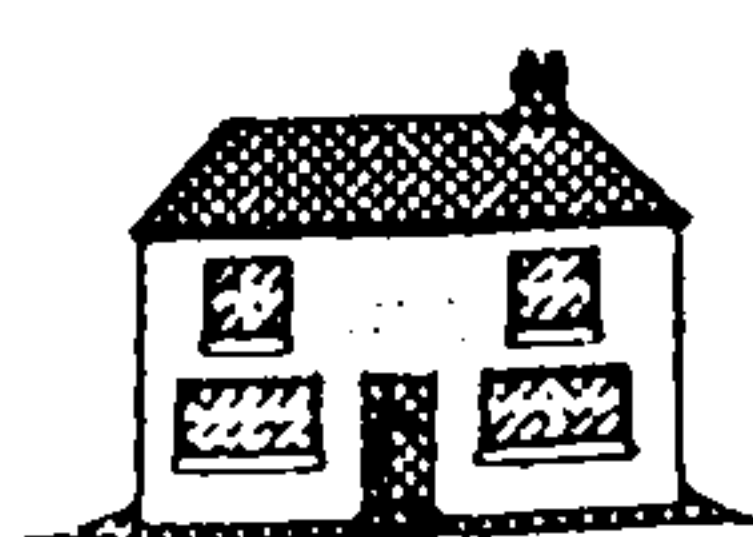
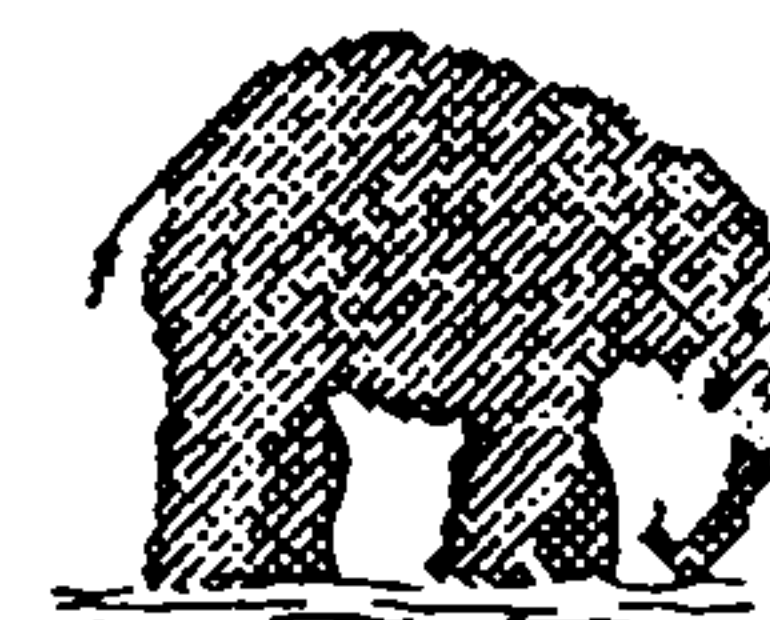
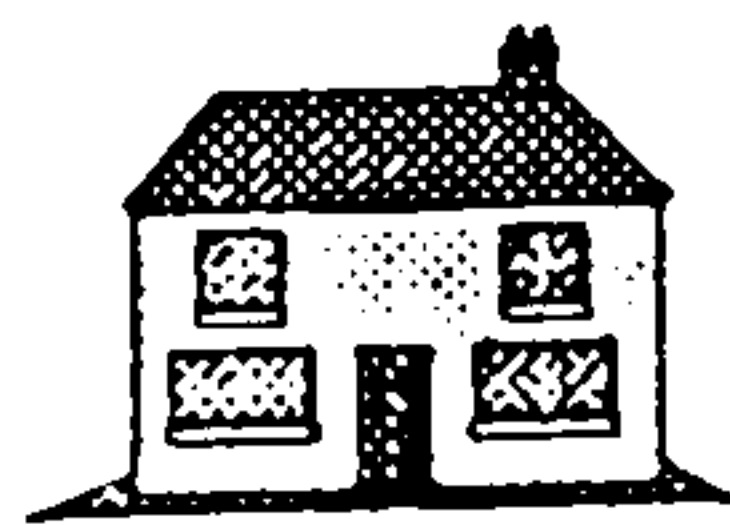
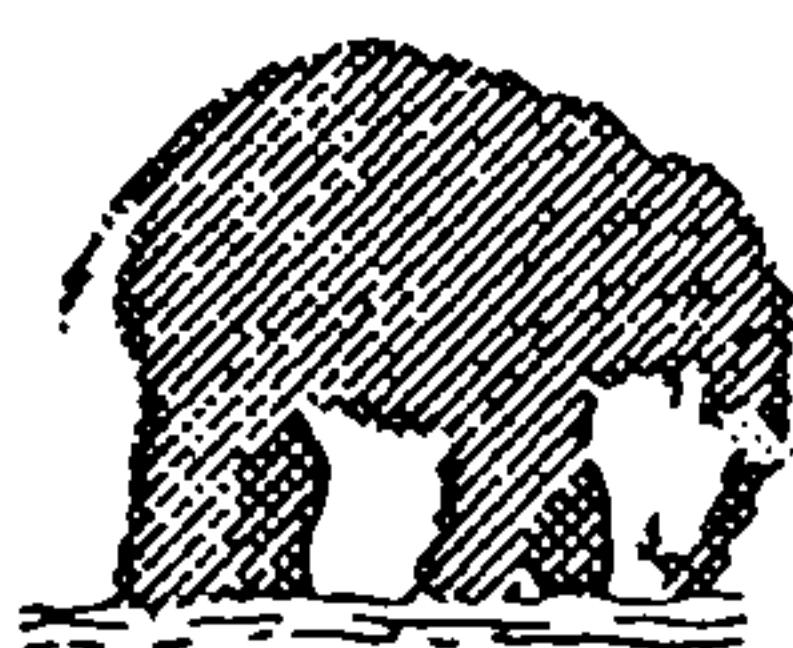
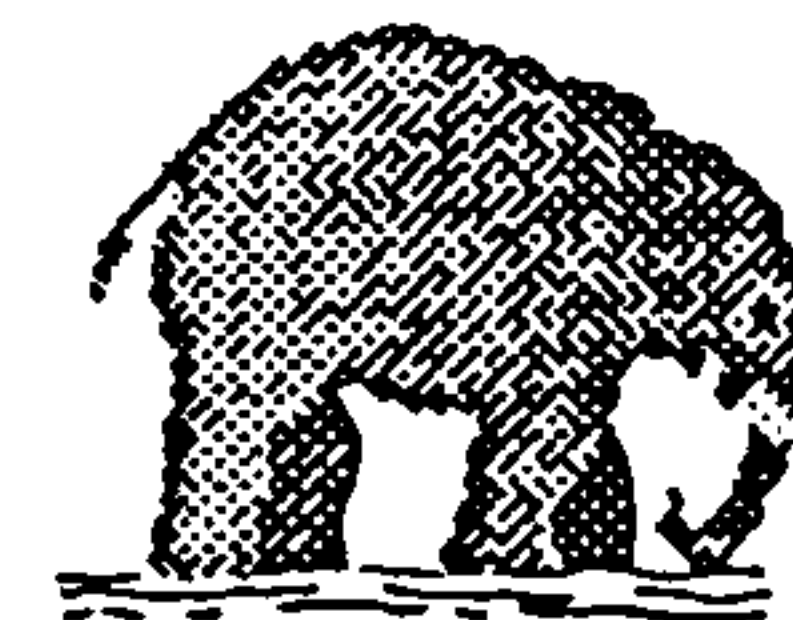
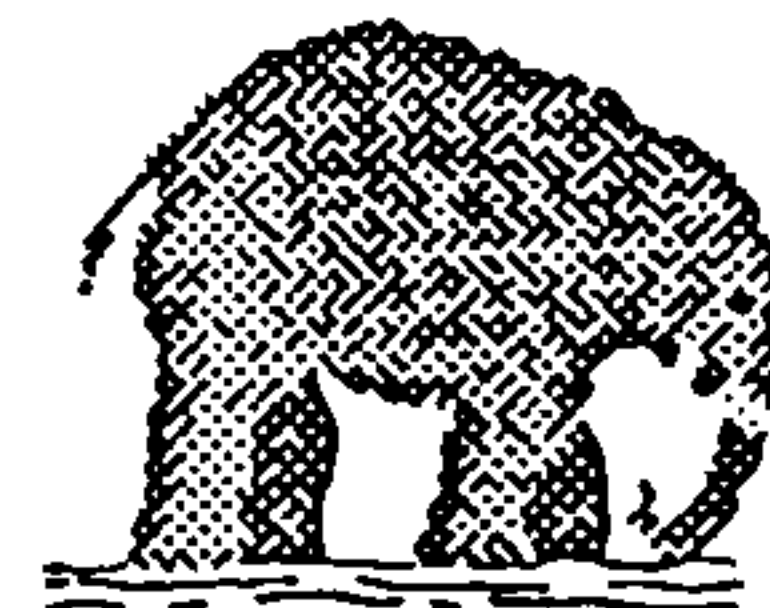
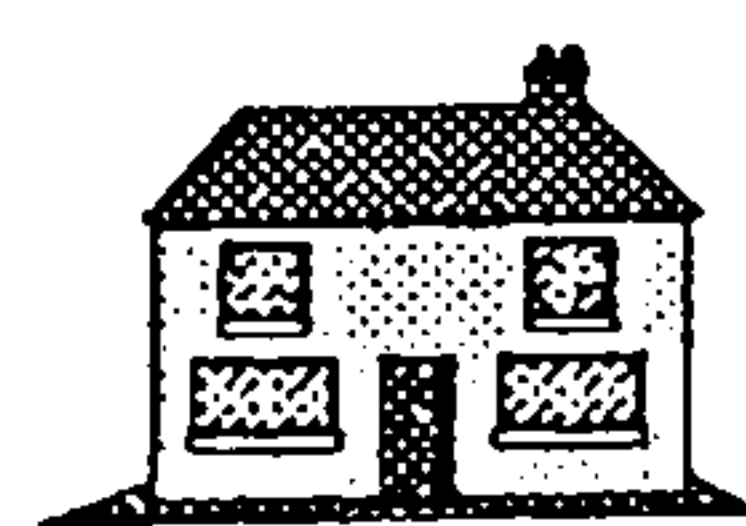
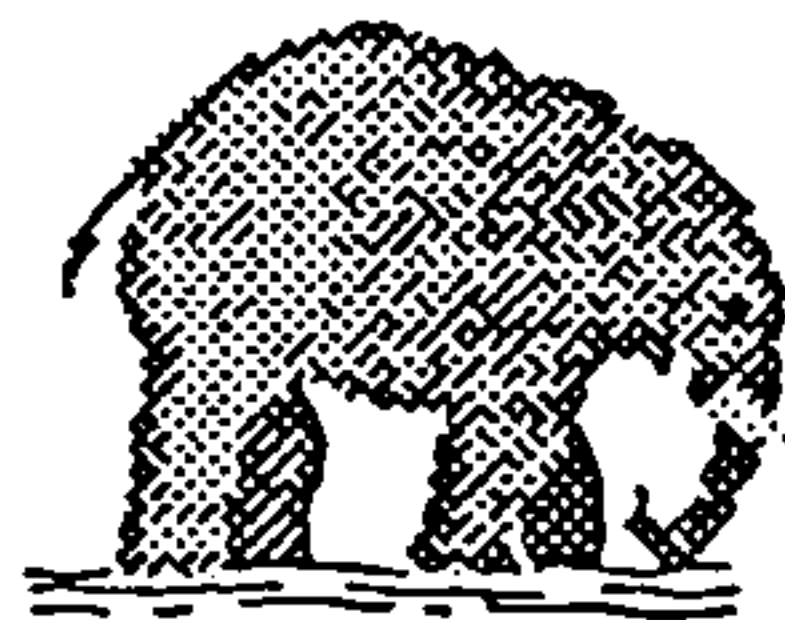
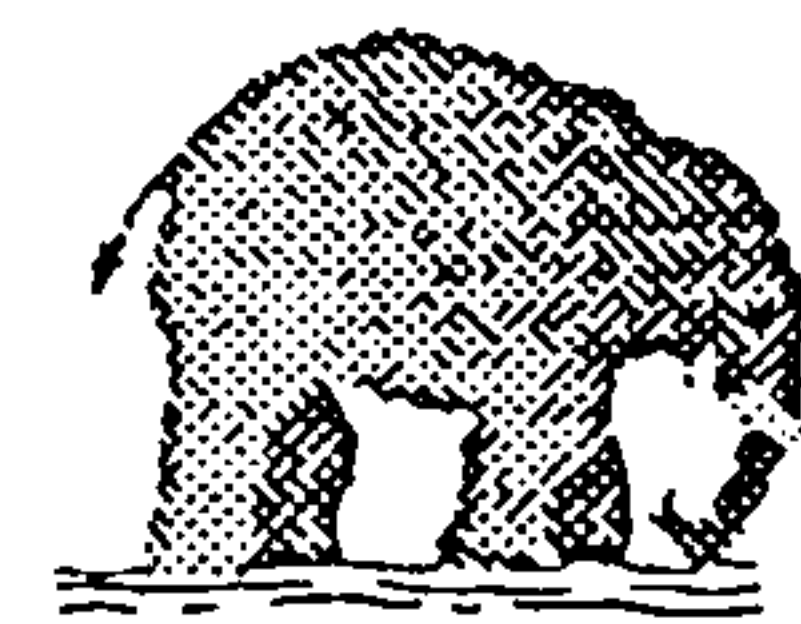
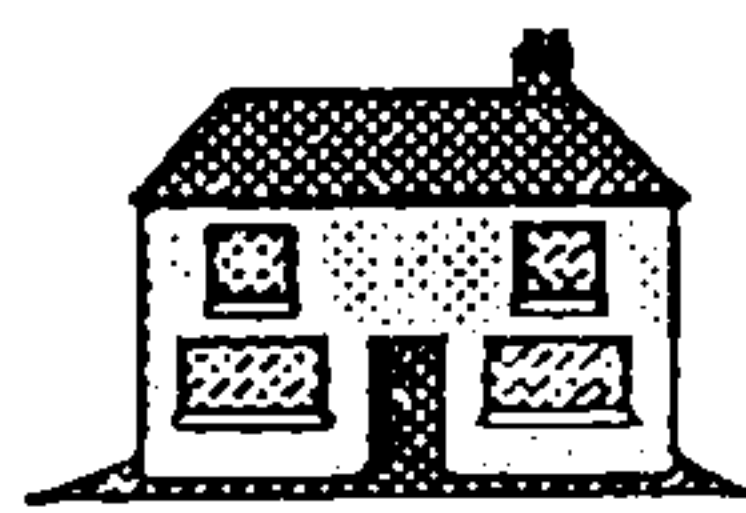
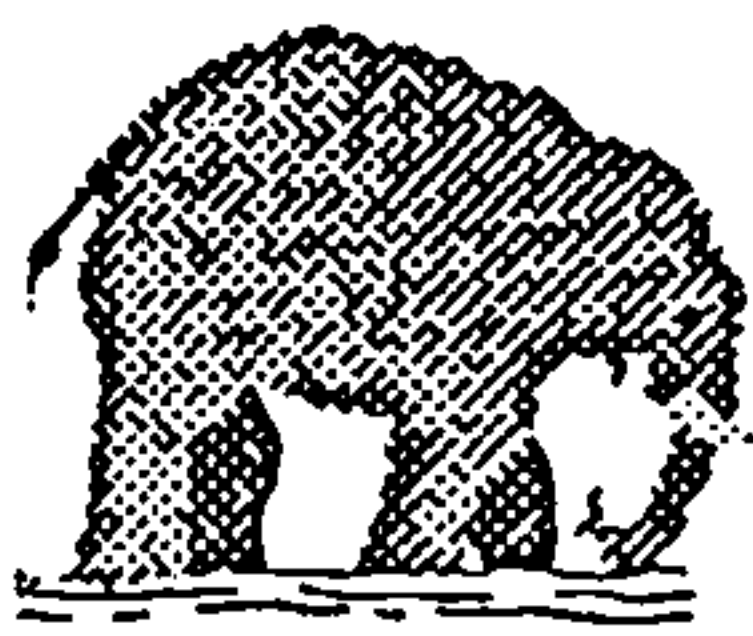
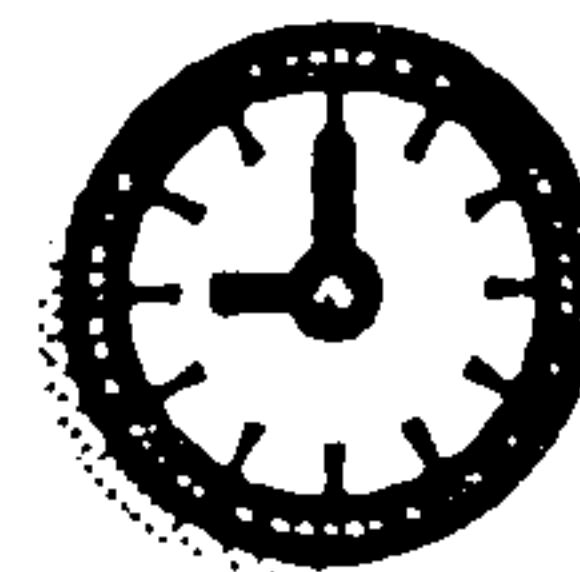
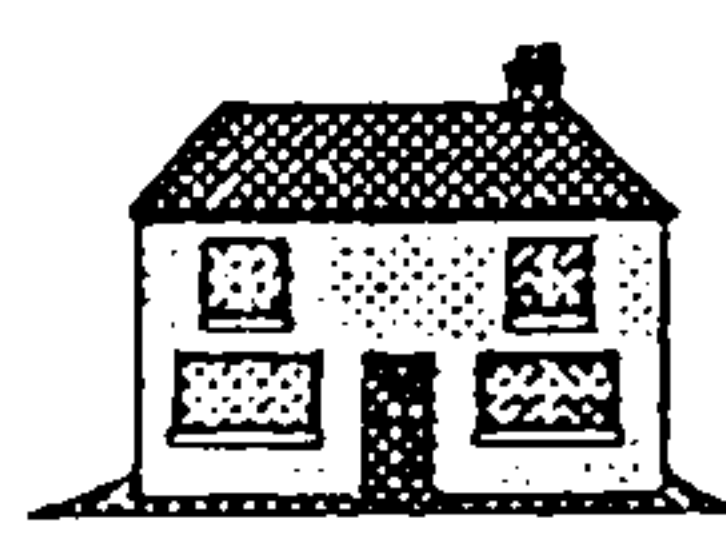
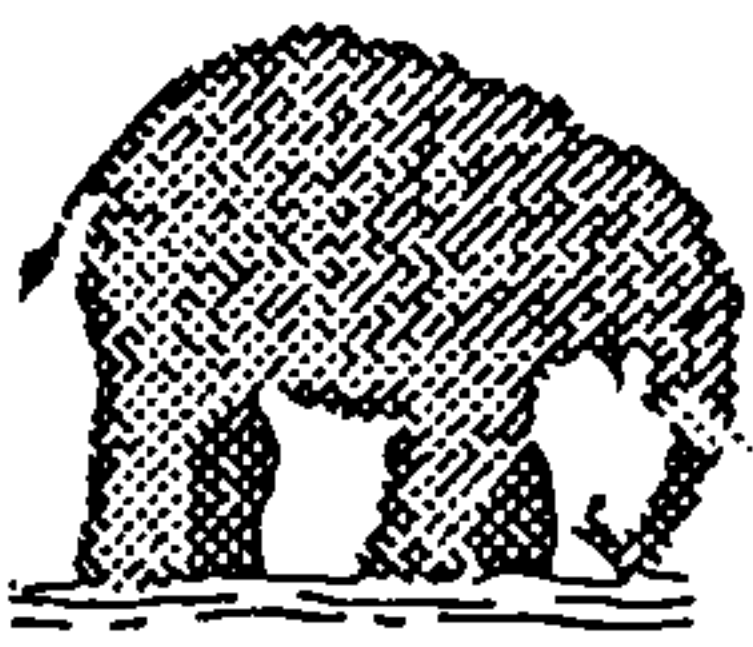
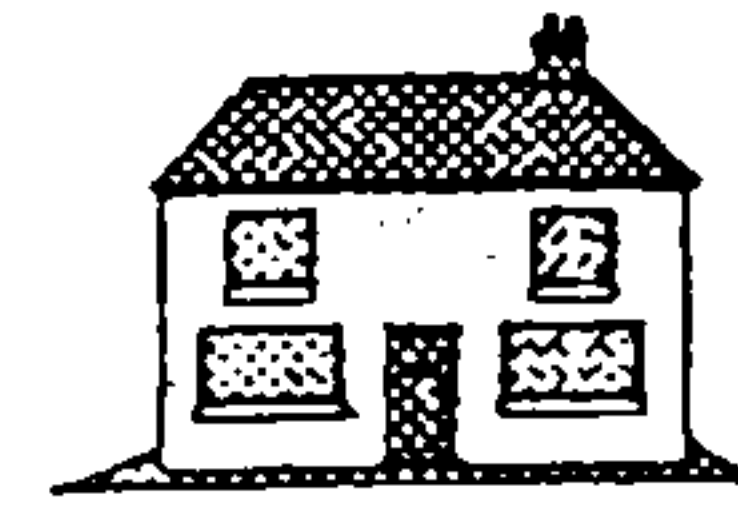
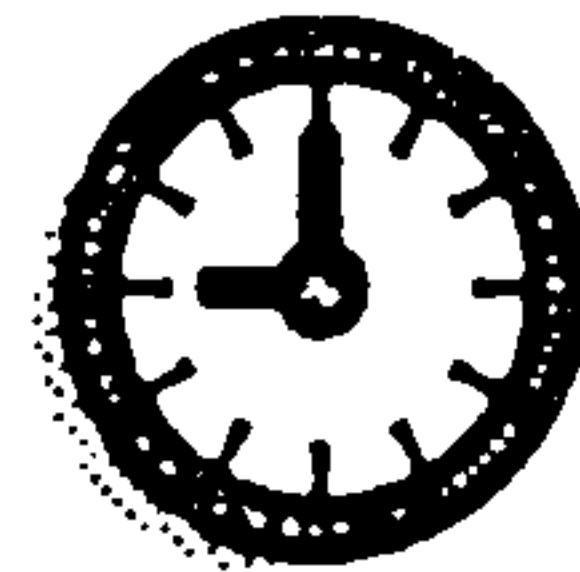
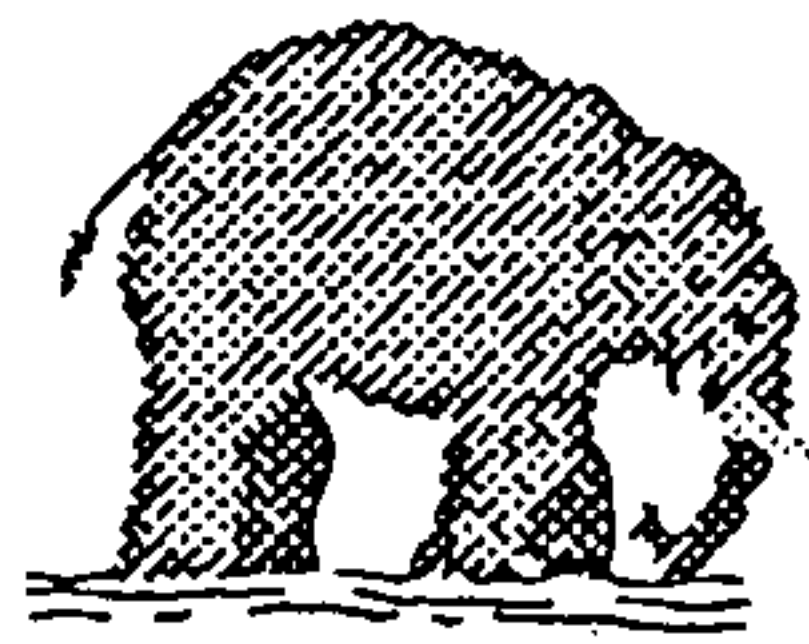
Word	Response	Word	Response
feg		twesk	
kib		twanket	
prab			

Now try these. Work as quickly as you can while being as accurate as possible.

Word	Response	Word	Response
wut		molsmitt	
hin		molcrid	
mot		stansert	
hast		hinshink	
kisp		chamgalp	
mosp		kipthirm	
drant		sloskon	
sted		bannifer	
gromp		brasterer	
trolb		doppelate	
snid		glistering	
tegwap		thickery	
balras			
		Time	

RAPID NAMING

Name the drawings as quickly and accurately as possible going from left to right of the page. You will be timed from the first time (top, left hand side of the page) to the last item (bottom, right hand side of the page).



Appendix 2

Passages and comprehension questions used in Study 4

Passage 1

Film

Maria Tipsot is, perhaps, the best-known female film director of the last century. Her films include “The Unbearable Darkness of Living”, “The Shrinking Violet” and “A Portrait of a Jealous Man”. She studied at the Vienna School of Film and Drama for five years under the great master of avant-garde film, Sam Green. Many believe that she developed her own unique style of filmmaking by absorbing the theoretical teachings of Green, and then re-interpreting them by using her own cultural influences. This has led to the film critic Stephen Vergot to describe her as “an individual who has broken the conventional barriers of modern film-making”.

She first came to the attention of the public when she filmed a real bank robbery as it took place in the main shopping area of West Berlin. Unfortunately for her, the authorities viewed her knowledge of the planned robbery with disdain, and the court rejected her defense of freedom through art. She was sentenced to two years in jail, but only served nine months and was released for good behaviour.

She was heavily influenced by the ideas of Victor Krontz, who collaborated with her on the groundbreaking series of short films entitled “Visions of an Electric Era”. In 1984, she won the Glunk International Film Award for best director for “The Shrinking Violet”. Nine years later, she made her last and most notorious film, “A Portrait of a Jealous Man”. Although rumours abound regarding her re-emergence from retirement, there are no known plans for a forthcoming movie.

253 words

Questions - Film

1. Was the name of the female director Maria Tilsot?	NO (Fn)
2. Was one of her films called The Unbearable Darkness of Living?	YES (Fw)
3. Did she study in Berlin?	NO (Fw)
4. Did she admire the work of Sam Green?	YES (Is)
5. Do you think her films would be described as fringe or alternative?	YES (Ig)
6. Did she re-interpret Sam Green's work using her own cultural influences?	YES (Fw)
7. Was she sent to prison because she filmed a robbery?	NO (Ig)
8. Did she get a year off for good behaviour?	NO (Fw)
9. Did she serve her prison sentence in Germany?	YES (Is)
10. Did she make films with a man called Krontz?	YES (Fn)
11. Did she receive the Blunk International Film Award?	NO (Fn)
12. Is she currently making a movie?	NO (Is)
13. Was her last film infamous?	YES (Ig)
14. Was the film critic's name Stephen Vergot?	YES (Fn)
15. Did she make her last film in the late 1990s?	NO (Is)
16. Was Visions of an Electric Era described as too long?	NO (Ig)

Fw (Factual word) total _____

Fn (Factual non-word) total _____

Is (Inference from story) total _____

Ig (Inference from general knowledge) total _____

Passage 2

Gases

When two non-inert gases are mixed together, a number of possible reactions could occur. This obviously depends upon the chemical composition of the gases involved, and, indeed, some combinations can have lethal consequences. Take, for example, the mixing of Trophine with Oxyhyphate. When this takes place at room temperature, an explosive combustion ensues that can cause serious damage to anyone who is in the vicinity of this fusion. However, when these two gases are merged together at minus forty degrees Celsius, there is no evidence of a reaction taking place at all. This is because the atoms present in the Trophine are unable to destabilise at this temperature and the combination of the two gases is rendered safe.

Rocket scientists, including the eminent Professor Bims, are now investigating the properties of these two gases to see if there is a proportional relationship between their level of combustibility and temperature. If this is the case, they may be able to apply this knowledge to increase the likelihood of success of the Olsak mission to Mars. If, however, combustion occurs at a critical point, then the scientists will have to re-think their plans. The success of using the mixture will then depend upon being able to keep the gases at a low enough temperature to make them safe. Initial tests have found that some combustion occurs at minus 35 degrees, but then the explosiveness of the mixture seems to increase rapidly. One school of thought is that the way forward may lie in controlling the temperature of the Oxyhyphate, rather than the combined fusion of the two gases. It appears that it is the molecular structure of the Oxyhyphate that is prone to destabilisation, and its control under exact temperature conditions is of critical importance to the success of this project. Professor Bims' team is due to report next Spring.

308 words

Questions - Gases

1. Was the name of one of the gases Trophate?	NO (Fn)
2. Does an explosive combustion occur between the two gases at room temperature?	YES (Fw)
3. Should the gases be stored at low temperatures?	YES (Is)
4. Would it be dangerous to keep these chemicals in your fridge?	YES (Ig)
5. Does some combustion occur at 45 degrees?	NO (Fw)
6. Does the story suggest that inactive gases are a problem for the space programme?	NO (Ig)
7. Does the success of the mission to Mars rely on using inert gases?	NO (Is)
8. Is the person investigating the gases a rocket scientist?	YES (Fw)
9. Was Bims the name of the professor?	YES (Fn)
10. Is the professor highly regarded?	YES (Ig)
11. Is the report of the professor's team due in December?	NO (Ig)
12. Are they attempting to control the temperature of Oxyhypholide?	NO (Fn)
13. Is it the Olsak mission that is planned to go to Mars?	YES (Fn)
14. Is the mission to Mars planning on using the two gases?	YES (Is)
15. Are the atoms in both gases prone to instability?	NO (Is)
16. Is controlling the combined fusion the way forward?	NO (Fw)

Fw (Factual word) total _____

Fn (Factual non-word) total _____

Is (Inference from story) total _____

Ig (Inference from general knowledge) total _____

Appendix 3

English and Greek background questionnaires for Studies 5 and 6

English background questionnaire

Institution name:

Course of study:

Level of course:

Sex: (ring) M F

Age:years months.....

First language:

Length of time spoken English as a second language (if applicable):years

Do you have special educational needs? (ring) Yes No

If yes, please specify.....

Have you ever received any extra literacy support? (ring) Yes No

If yes, please specify.....

Do you think you currently have any literacy difficulties? (ring) Yes No

If yes, please specify.....

Greek background questions- Ερωτήσεις ιστορικού

Σπουδές /Έτος σπουδών.....

Φύλο Α Θ

Ηλικία

Ποια είναι η μητρική σου γλώσσα;

Πόσα χρόνια μιλάς Αγγλικά;

Πότε αρχισες να μαθαίνεις Αγγλικά σαν ξένη γλώσσα;

Έχεις ποτέ διαγνωστεί για δυσλεξία ή κάποια άλλη μαθησιακή δυσκολία στο σχολείο/πανεπιστήμιο ή κατά τη διάρκεια εκμάθησης Αγγλικών; Ν Ο

Αν ναι εξηγήστε.....

Έχεις ποτέ λαβει συμπληρωματικά μαθήματα για δυσκολίες στη γραφή, ανάγνωση ή ορθογραφία;
Ν Ο

Αν ναι εξηγήστε.....

Πιστεύεις ότι τώρα αντιμετωπίζεις δυσκολίες στην ανάγνωση, γραφή ή ορθογραφία;
Ν Ο

Αν ναι εξηγήστε

Appendix 4

Greek versions of passages and comprehension questions and non-word reading test used in Study 5

Greek reading comprehension task

Κείμενο 1 (Passage 1)

Κινηματογράφος (Film)

Η Μαρία Τίπσοτ είναι ίσως η πλέον γνωστή σκηνοθέτρια του τελευταίου αιώνα. Μεταξύ των ταινιών της συμπεριλαμβάνονται οι: «Το αβάσταχτο σκοτάδι της ζωής», «Η μαραμμένη βιολέτα» και «Το πορτραίτο ενός ζηλιάρη». Σπούδασε στη Σχολή Κινηματογράφου και Δραματικής Τέχνης στη Βιέννη για διάστημα πέντε ετών υπό την εποπτεία του μεγάλου καλλιτέχνη του αβάν-γκαρντ κινηματογράφου, Σαμ Γκρήν. Πολλοί πιστεύουν ότι ανέπτυξε το δικό της, μοναδικό σκηνοθετικό ύφος αφομοιώνοντας τις θεωρητικές διδασκαλίες του Γκρήν, μεθερμηνεύοντάς τις στη συνέχεια χρησιμοποιώντας τις δικές της πολιτισμικές επιρροές. Το γεγονός αυτό ανάγκασε τον κριτικό κινηματογράφου Στήβεν Βέργκοτ να την περιγράψει ως «ένα άτομο που έχει σπάσει τους φραγμούς της συμβατικότητας στη σύγχρονη κινηματογραφία».

Για πρώτη φορά προσέλκυσε την προσοχή του κοινού όταν κινηματογράφησε μία πραγματική ληστεία τράπεζας, ενώ αυτή βρισκόταν σε εξέλιξη, στην κεντρική αγορά του Δυτικού Βερολίνου. Δυστυχώς για εκείνην, οι αρχές την κατέκριναν για το γεγονός ότι γνώριζε εκ των προτέρων τη σχεδιασμένη ληστεία και το δικαστήριο απέρριψε την υπεράσπισή της για ελευθερία μέσω της τέχνης. Καταδικάστηκε σε φυλάκιση δύο ετών, αλλά αποφυλακίστηκε μετά από εννιά μήνες λόγω καλής διαγωγής.

Είχε δεχτεί έντονες επιρροές από τις ιδέες του Βίκτωρ Κρόντς, ο οποίος συνεργάστηκε μαζί της στην πρωτοποριακή σειρά ταινιών μικρού μήκους με τίτλο «Οράματα μιας ηλεκτρικής εποχής». Το 1984 κέρδισε το διεθνές βραβείο κινηματογράφου Γκλάνκ καλύτερης σκηνοθεσίας για την ταινία της «Η μαραμμένη βιολέτα». Εννιά χρόνια αργότερα, γύρισε την τελευταία και διασημότερη ταινία της, «Το πορτραίτο ενός ζηλιάρη». Αν και κυκλοφορούν έντονες φήμες για μία τυχόν επάνοδό της, δεν έχουν γίνει γνωστά σχέδια για κάποια ταινία στο άμεσο μέλλον.

Κείμενο 2 (Passage 2)

Αέρια (Gases)

Όταν αναμιχθούν δύο μη αδρανή αέρια μπορεί να λάβει χώρα ένας αριθμός διαφορετικών αντιδράσεων. Αυτό προφανώς εξαρτάται από τη χημική σύσταση των αερίων και, φυσικά, κάποιοι συνδυασμοί μπορεί να έχουν θανάσιμες επιπτώσεις. Ας πάρουμε ως παράδειγμα την ανάμειξη τροφίνης και οξυφάτης. Όταν αυτή η ανάμειξη πραγματοποιηθεί σε θερμοκρασία δωματίου, ακολουθεί μία εκρηκτική καύση που μπορεί να προκαλέσει σημαντικές βλάβες σε οποιονδήποτε βρίσκεται κοντά στο πεδίο αυτής της σύντηξης. Αντίθετα, όταν αυτά τα δύο αέρια αναμιχθούν σε θερμοκρασία -40 βαθμών Κελσίου δεν υπάρχει καμία ένδειξη για την πραγματοποίηση κάποιας αντίδρασης. Αυτό οφείλεται στο ότι τα άτομα της τροφίνης αδυνατούν να αποσταθεροποιηθούν σε αυτή τη θερμοκρασία και έτσι ο συνδυασμός των δύο αερίων είναι ασφαλής.

Οι επιστήμονες της πυραυλικής μηχανικής, μεταξύ αυτών και ο διακεκριμένος καθηγητής Μπιμς, ερευνούν τώρα τις ιδιότητες αυτών των δύο αερίων προκειμένου να διαπιστώσουν αν υπάρχει κάποια αναλογική σχέση ανάμεσα στο επίπεδο καύσης τους και στη θερμοκρασία. Εάν αυτό όντως ισχύει, μπορεί να χρησιμοποιήσουν αυτή τη γνώση ώστε να βελτιώσουν τις πιθανότητες επιτυχίας της αποστολής Όλσακ στον Άρη. Εάν, όμως, η καύση πραγματοποιείται σε κάποιο κρίσιμο σημείο, τότε οι επιστήμονες θα πρέπει να αναθεωρήσουν τα σχέδιά τους. Σε αυτή την περίπτωση, η επιτυχία στη χρήση ενός τέτοιου μίγματος θα εξαρτηθεί από το κατά πόσον θα είναι σε θέση να διατηρήσουν τα αέρια σε αρκετά χαμηλή θερμοκρασία ώστε να είναι ασφαλή. Οι αρχικές δοκιμές δείχνουν ότι πραγματοποιείται κάποια καύση στους -35 βαθμούς, αλλά τότε η εκρηκτικότητα του μίγματος δείχνει να αυξάνεται απότομα. Μία ομάδα από αυτούς επιστήμονες θεωρεί ότι θα ήταν ίσως αποτελεσματικότερο να ελέγξουν τη θερμοκρασία της οξυφάτης παρά αυτή του συνδυασμένου μίγματος των δύο αερίων. Φαίνεται ότι η μοριακή δομή της οξυφάτης είναι αυτή που έχει τις μεγαλύτερες τάσεις αποσταθεροποίησης και ο έλεγχός της κάτω από ακριβείς συνθήκες θερμοκρασίας είναι εξαιρετικής σημασίας για την επιτυχία αυτού του προγράμματος. Η έκθεση της ομάδας του καθηγητή Μπιμς αναμένεται την ερχόμενη άνοιξη.

Ερωτήσεις περιεχομένου (Comprehension questions)

1. Κινηματογράφος (Film)

Question	Answer	Question type
1. Ήταν το όνομα της σκηνοθέτριας Μαρία Τίλσοτ;	OXI	(Fn)
2. Ονομαζόταν μία από τις ταινίες της Το αβάσταχτο σκοτάδι της ζωής;	NAI	(Fw)
3. Σπούδασε στο Βερολίνο;	OXI	(Fw)
4. Ήταν θαυμάστρια του έργου του Σαμ Γκρην;	NAI	(Is)
5. Πιστεύετε ότι οι ταινίες της μπορούν να περιγραφούν ως περιθωριακές ή εναλλακτικές;	NAI	(Ig)
6. Ερμήνευσε εκ νέου το έργο του Σαμ Γκρην χρησιμοποιώντας τις δικές της πολιτισμικές επιρροές;	NAI	(Fw)
7. Φυλακίστηκε λόγω του ότι κινηματογράφησε μία ληστεία;	OXI	(Ig)
8. Γλίτωσε έναν χρόνο από την ποινή της λόγω καλής διαγωγής;	OXI	(Fw)
9. Εξέτισε την ποινή φυλάκισης στη Γερμανία;	NAI	(Is)
10. Γύρισε ταινίες με κάποιον ονόματι Κροντς;	NAI	(Fn)
11. Της απονεμήθηκε το διεθνές βραβείο κινηματογράφου Γκλάνκ;	OXI	(Fn)
12. Γυρίζει αυτή τη στιγμή κάποια ταινία;	OXI	(Is)
13. Η τελευταία της ταινία ήταν διάσημη;	NAI	(Ig)
14. Ήταν το όνομα του κριτικού κινηματογράφου Στήβεν Βέργκοτ;	NAI	(Fn)
15. Γύρισε την τελευταία της ταινία στα τέλη της δεκαετίας του 1990;	OXI	(Is)
16. Περιγράφηκε η ταινία της Οράματα μιας ηλεκτρικής εποχής ως υπερβολικά μεγάλης διάρκειας;	OXI	(Ig)

Key to question type:

Fw (Factual word)

Fn (Factual non-word)

Is (Inference from story)

Ig (Inference from general knowledge)

2. Αέρια (Gases)

Question	Answer	Question type
1. Ήταν το όνομα ενός από τα δύο αέρια τροφάτη;	OXI	(Fn)
2. Υπάρχει εκρηκτική καύση ανάμεσα στα δύο αέρια σε θερμοκρασία δωματίου;	NAI	(Fw)
3. Θα πρέπει τα δύο αέρια να διατηρούνται σε χαμηλές θερμοκρασίες;	NAI	(Is)
4. Θα ήταν επικίνδυνο να διατηρηθούν αυτές οι χημικές ουσίες στο ψυγείο;	NAI	(Ig)
5. Πραγματοποιείται κάποια καύση στους 45 βαθμούς;	OXI	(Fw)
6. Αφήνεται να εννοηθεί στην ιστορία ότι τα αδρανή αέρια αποτελούν πρόβλημα για το διαστημικό πρόγραμμα;	OXI	(Ig)
7. Εξαρτάται η επιτυχία της αποστολής στον Άρη από τη χρησιμοποίηση αδρανών αερίων;	OXI	(Is)
8. Είναι το άτομο που ερευνά τις ιδιότητες των αερίων επιστήμονας της πυραυλικής μηχανικής;	NAI	(Fw)
9. Ήταν το όνομα του καθηγητή, Μπιμς;	NAI	(Fn)
10. Είναι ο καθηγητής ευρέως αναγνωρισμένος;	NAI	(Ig)
11. Αναμένεται η έκθεση της ομάδας του καθηγητή τον Δεκέμβριο;	OXI	(Ig)
12. Προσπαθούν να ελέγξουν τη θερμοκρασία της οξυφολίδης;	OXI	(Fn)
13. Είναι η αποστολή Όλσακ αυτή που σχεδιάζεται για τον Άρη;	NAI	(Fn)
14. Προβλέπεται να χρησιμοποιηθούν τα δύο αέρια στην αποστολή προς τον Άρη;	NAI	(Is)
15. Έχουν τα άτομα και των δύο αερίων τάσεις αποσταθεροποίησης;	OXI	(Is)
16. Είναι ο έλεγχος του συνδυασμένου μίγματος η μόνη οδός προόδου;	OXI	(Fw)

Key to question type:

Fw (Factual word)

Fn (Factual non-word)

Is (Inference from story)

Ig (Inference from general knowledge)

Non-word reading task-Greek version

Παρακαλώ διάβασε τις παρακάτω σειρές γραμμάτων όσο το δυνατόν πιο γρήγορα και με όσο το δυνατό μεγαλύτερη ακρίβεια (Please read the following letter strings as fast and as accurately as possible)

1. φαρίζω

2. σβουρεύοντας

3. πιανεύομαι

4. χασμαρώνω

5. σγουδίκι

6. κρήδο

7. σλόγισμα

8. σωαδεύω

9. χοδέσι

10. ζασίνω

11. σπλόι

12. στράπολα

13. κίλχω

14. φράτι

15. λόβγι

16. βήτρομαι

17. σώσρυ

18. ισλιμώνω

19. τρέπικα

20. σκέδεσι

Appendix 5

Test materials used in Study 6

Test 1

PART A. Orthographic choice task

bean

goat

blume

ski

thum

tortace

guard

feud

relevent

believe

separate

peice

neccesary

thred

quarter

benefit

graphite

cacophony

miscellanious

beneficial

bene

gote

bloom

skee

thumb

tortoise

gaurd

fude

relevant

beleive

seperate

piece

necessary

thread

quorter

benifit

graffite

cacofony

miscellaneous

beneficial

PART B. Pseudohomophone task

dore	warg
jint	dert
glev	bern
gruss	katch
neet	maif
groe	swad
chove	furst
bleme	peech
sed	wef
poar	hign
sworf	skert
toab	onor
reeth	calch
hausage	orlthoe
inbigerted	sellestiall
insashabul	polonelist
bemonthaty	rynosserus
misselani	ambrahili
fongue	dyarea
ensiklopedya	delikeraties

Test 3. Proof-reading

Passage 1

Last year, a team of top scientist's went to Africa to look at a rair herd of elephants. They spent eigth months filming and watching the animals. they took turn watching while the other members of the team sleep nearby. They were particularly interested in the difference types of food, that the elephants eat. They found out that these elephants liked to eat the leves of a bush called the Round Grass Tree. It was their favourate type of food. The scientists was very pleased with their work and are going to make a film about it, It will be on television next month.

Passage 2

Reggie Smiths rule as lord of finance in the UK looks short-lived. Shocking secrets reveiled by troubled Fiona over the past weeks have not been denied. Reggie's image as a man about town has blown up in his face. His family have moved to their country home in yorkshire to avoid the press. Reggie has stayed in the Hampstead pentouse. Two secretaries and three escorts have told of their feelings for the minister. Helen Black was horrific by finding that her love was shared with many others

Late last night, Reggie's accounts are seized by CID officers from the Fraud Squid. It is said that; cars, jewellery, holidays and cash were placed into the accounts by forein businessmen over the last four years. They may have been used to ease foreign products being brought into the UK despite current laws about their use. Magnus Browne is expecting to receive Reggie's resignation today, or he faces a instant sack. The Prime-minister's office was not available for comment last night.

Passage 3

Recent legislation in the European Court of Financial Law could potentially precipitate a outbreak of litigation between multi-national corporations, and nation states. The imminent ruling will facilitate the ability of global companies to financially eradicate less competitive operators and manufacturers: who function at a national level. The ruling will permit international financial institutions to take over smaller national concerns, that are deemed to be unproductive, inefficient and unwilling to deliver new working practices. If this occurs the smaller companies will receive only a minimal level of compensate. “We are attempting to block this ruling by presenting a counter-claim in the International Court of Human Justice in Geneva, say Lawyers for the national companies and governments. If this counter-claim had fails, state controled monopolies will be unable to compete with these omnipresent organisations, whose welth outstrips the total gross national product of numerous nation states.

Test 2. Cloze-spelling

1. A hand has f _ _ _ fingers and a thumb
2. The musicians played at the Hollywood B _ _ _
3. He turned on the l _ _ _ _ because it was dark
4. We didn't know w _ _ he was
5. The lawn was wet with the d _ _
6. The car is w _ _ _ _ a thousand pounds
7. She threaded the cotton t _ _ _ _ _ the needle
8. In an emergency d _ _ _ 999
9. She h _ _ _ _ him whisper the secret message
10. He wrote out a bank c _ _ _ _ _ for fifty pounds
11. The boat was moored by the q _ _ _ _
12. The lounge s _ _ _ _ comprised a sofa and two chairs
13. The doctor will i _ _ _ _ _ with a sterile syringe
14. A _ _ _ _ _ watches have a dial, hands and numbers
15. The cells developing from an egg are called an e _ _ _ _ _
16. Surgery on the eye is performed by an o _ _ _ _ _ surgeon
17. S _ _ _ _ _ bacteria is usually found in eggs
18. The i _ _ _ _ _ triangle has two equal sides
19. H _ _ _ _ _ is exaggeration often used in advertising
20. O _ _ _ _ _ is a word that sounds like it sounds

Test 4. Semantic reasoning (association task)

Items		Options			
robin	eagle	hood	nest	sparrow	fly
nose	eyes	leg	elbow	arm	mouth
bake	boil	sun	fry	cake	heat
-	+	?	0	x	%
jacket	boot	bag	foot	cap	hair
brown	orange	apple	green	blue	phone
dress	skirt	blouse	trousers	socks	shoes
horse	elephant	snake	dolphin	ant	penguin
football	hockey	chess	jogging	polo	sailing
lion	tiger	dog	leopard	cat	mouse
guitar	violin	drum	trumpet	oboe	cello
2	8	14	15	12	18
potato	carrot	tomato	spinach	parsnip	broccoli
poetry	novel	prose	score	programme	statue
democracy	capitalism	liberty	society	organisation	communism
oil	electricity	gas	water	power	account
sociology	anthropology	medicine	politics	zoology	socialism
epilogue	prologue	corpus	rhyme	sonnet	verse
typhoon	gale	flood	snow	tornado	breeze
Times New Roman	Courier	Postman	Satelite	DingDong	Arial

Greek Orthographic choice task

εξτρατεία	εκστρατεία
κατεφθίαν	κατευθείαν
σβήνω	σβύνω
συγχαριτήρια	συγχαρητήρια
μήνυμα	μύνυμα
στρείδι	στρίδι
δύσπνια	δύσπνοια
υγεινός	υγιεινός
θυμήθηκα	θυμύθηκα
ψυθίρισμα	ψιθύρισμα
ταξιδιώτισσα	ταξιδιώτισα
βηθός	βυθός
φθινοπωρινός	φθινωπωρινός
παλίρροια	παλλοίρροια
βύχας	βήχας
κουρείο	κουρίο
ναυβαγοσώστης	ναυαγασώστης
δεκαετία	δεκαετεία
συγκενής	συγγενής
κομμάτι	κομάτι

Greek pseudohomophone choice task

κλεύω	σπλοί
σγουδίκι	φασόλοι
σποιλειά	φράτι
φαρίζω	κσένος
ταλέπωρρος	ορίβι
σλόγισμα	βάναφσο
εκσελλίσομαι	κίλχω
αφκσάνετε	στράπολα
χόδεσι	πίοισι
ένδοικση	ισλιμώνω
τενία	κρήδο
λόβγι	αικσεραιτικώς
λυστοία	σβουρεύοντασ
αιποπτοία	τρέπικα
σβαδεύω	πρωσελκειο
ζασίνω	τελεφταίο
επορτεία	εμοσταγοίς
στρεπλώνω	σήντιξι
προσορεινώς	σώστρι
βιγερός	υπενιγμώς

Spoonerisms task-Greek version

Γλωσσικές παραδρομές

Μέρος 1°

1. μήλο με φ (φήλο)
2. κάπα με τ (ταπα)
3. ρόδι με π (πόδι)
4. τρένο με φ (φρένο)
5. χρόνος με κλ (κλόνος)
6. σπάζω με φρ (φράζω)
7. τότε με π (πότε)
8. κάλτσα με σ (σάλτσα)
9. αλάτι με π (πλάτι)
10. μέλι με χ (χέλι)

Μέρος 2°

1. χώρα δώρο (δώρα χώρο)
2. πηγή νερό (νηγή περό)
3. πικρή σκλαβιά (σκικρή πλαβιά)
4. χωράφι τώρα (τώραφι χώρα)
5. χέρι βαρύ (βέρι χαρύ)
6. νροπή προκοπή (προπή ντροκοπή)
7. βουνό λαιμό (λουνό βαιμό)
8. χρυσά μαλλιά (μυσά χραλλιά)
9. γερή σέλα (σελή γέλα)
10. κύμα ψάρι (ψύμα κάρι)

Greek proof-reading task

Κείμενο 1 (Passage 1)

Το περασμένο έτος μια ομάδα κορυφών επιστημόνων πήγαν στην Αφρική για να μελετήσουν ένα σπάνιο είδος από ελέφαντες. Διέμειναν εκεί οκτώ μήνες για να κινηματογραφήσουν και να παρατηρήσουν τους ελέφαντες. τους παρατηρούσαν ο καθ'ενας με τη σειρά ενώ τα υπόλοιπα μέλη της ομάδας κοιμώταν παραδίπλα. Αυτό που ενδιέφερε ιδιαίτερα τους επιστήμονες ήταν τα διάφορα είδη φαγητά όπου έτρωγαν οι ελέφαντες. Ανακάλυψαν ότι οι ελέφαντες αυτοί προτιμούσαν ιδιαίτερα να τρώνε τα φύλλα ενός δέντρου με το όνομα *Το Στρογγυλό Χορταρένιο Δέντρο*. Αυτό ήταν το αγαπημένο τους φαγητό. Οι επιστήμονες ήταν πολύ ευχαριστημένος με τη δουλειά τους, και σκοπεύουν να ετοιμάσουν ένα κινηματογραφικό έργο το οποίο πρόκειται να παιχτεί στην τηλεόραση τον ερχόμενο μήνα.