

# Phonological and Spelling Mistakes among Dyslexic and Non-Dyslexic Children Learning Two Different Languages: Greek vs English

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The aim of our study was to examine the phonological and spelling errors made by dyslexic and non-dyslexic children in two different languages, one (Greek, L1) much more transparent than the other (English, L2). For these purposes, our subjects (poor spellers officially diagnosed as dyslexics) composed two picture elicited narratives, one in Greek and one in English with the aid of Script Log, an online recording tool for experimental research on the process of writing. Our results showed that dyslexics generally made statistically significant ( $p < .05$ ) more mistakes in both languages in comparison to non-dyslexics and statistically significant more phonological mistakes in English than in Greek. In addition, dyslexics made a great number of spelling mistakes in both languages, though of different nature depending on the language in which they occurred. Thus, the dyslexics in our study presented different error profiles in English and in Greek and implications are made that instruction methods should be language specific.

**Keywords:** Dyslexia; Poor Spelling Skills; Transparent Language; Language Learning

## Introduction

It is generally accepted that not all languages are equal in terms of their complexity in phonology, spelling/orthography or grammar and the more complex a language system is the harder it is to acquire for both normally developing and dyslexic children. The regularity of orthographic and phonological representations in a language is a linguistic factor that can affect both the nature and degree of reading and spelling difficulties (Caravolas & Bruck, 1993; Georgiou, Parrila, & Papadopoulos, 2008; Seymour, Aro, & Erskine, 2003; Wimmer, 1993; Wydell, 2003).

A language with a “perfect” spelling is one that has no alternative spellings for the same sound and no overlap in the code where one spelling pattern stands for different sounds (Spencer, 2000: p. 155). This means that in a perfect orthography each phoneme (sound) would be represented by just one letter and each letter would represent just one phoneme so, the number of sounds would exactly match the number of letters. According to Spencer (2001), transparent orthographies are very efficient because they do not make heavy demands on memory and require a much more limited activation of brain regions, making them more accessible to dyslexic children; deeper orthographies being more memory dependent and requiring greater activation of the brain may actually prevent dyslexic children from achieving reading and writing fluency.

According to Miles (2000), it is the *inconsistencies* in representation in opaque languages that make it difficult for dyslexics to acquire the code. Many studies have clearly suggested that complex, “deep” orthographies hinder children’s progress in spelling and reading and the assumption is that reading and writing in other languages that are more regular will not be

inhibited to the same extent (German: Landerl & Wimmer, 2000, Italian: Barca, Burani, Di Filippo, & Zocolotti, 2006; Cossu et al., 1995, Turkish: Oney & Goldman, 1984, French: Alegria & Mousty, 1994, 1996 in Spencer, 2000, 2001; Caravolas & Volin, 2001; Miles, 2000; Greek: Georgiou, Parrila, & Papadopoulos, 2008; Hatzidaki et al., 2011).

For example, the German dyslexics’ success in learning their native language efficiently is ascribed to two main factors: learning the relatively transparent German orthography and learning to read and spell by a phonics method (Landerl & Wimmer, 2000). More specifically, it is argued that when the grapheme-phoneme correspondences of an orthography are highly consistent and regular, as they are in the German language, and when they are taught via a systematic phonics method, children can resolve their early phonemic awareness and phonological spelling difficulties. Besides, Landerl and Wimmer (2000) argue that dyslexic children using transparent orthographies via a special phonics method of instruction can and do spell with phonological accuracy but they appear to have persistent “orthographic” spelling deficits in that many of their spellings continue to be unconventional. This means that in more transparent languages “phonemic unawareness” does not appear to be the core deficit in dyslexic children.

Most of the studies comparing the development of literacy in different orthographies have been concerned with reading development. This does not mean that the serious and persistent spelling problems dyslexics face should be underestimated (Harris & Hattano, 1999). According to Miles (1993), many dyslexics learn to read with reasonable success, but their spelling regularly remains weak.

The present study focuses on spelling development of Greek poor spellers and children with normally developed spelling

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skills, in their first language (Greek) and in English (foreign language). We compare phonological and spelling errors made by the two groups of students in these two languages to detect similarities and differences between the two groups' error profiles and draw conclusions about the nature of the problem and more effective teaching methods.

### The Greek Orthography vs the English Orthography

In the *Greek* language spelling is based on historical orthography. This means that, as far as possible, Greek words or morphemes that derive from ancient Greek are spelled as they have been since ancient times. Through the centuries the pronunciation of some phonemes has changed while the letters which represent them have remained the same. Thus, Greek writing system has lost some of its phonetic character and reflects the etymology of words rather than their phonetic components (Mavrommati & Miles, 2002: p. 87). This is what Miles (2000: p. 198) means when he says that "although pronunciation of Greek vowel graphemes has been simplified in modern times, the old spelling has been largely retained".

Thus, in the Greek orthography every letter consistently represents the same sound, but the same sound can be represented by different letters or pairs of letters. This makes spelling more difficult than reading (Mavrommati & Miles, 2002; Miles, 2000). According to Protopapas and Vlahou (2009), the grapheme-phoneme correspondences are as high as 95.1% in reading and 80.3% in spelling. The Greek alphabet has 25 letters and a small number of digraphs (where two graphemes represent a single sound). There are regular correspondences between graphemes and phonemes so that all letters consistently represent the same sounds (apart from very few exceptions that we will mention later); the problem is, therefore, that there are several sounds which can be represented by more than one letter or digraph.

Moreover, the stability that Greek language retained in its written form is not matched by a similar stability in its spoken form. This divergence has led to the occurrence of a number of inconsistencies in the way sounds are represented. For example, different letters or digraphs can be used to represent the same sound:

/i/ is represented by five graphemes: ι, η, υ, ει, οι;

/o/ is represented by two graphemes: ο, ω;

/e/ is represented by two graphemes: ε, αι.

The reverse situation (where the same letter can represent different sounds) is very rare in Greek, but it 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 the grapheme /nt/ to sound it as nd ("εντάξει" (endaksi)) but not in "exception" words such as "αυτίο" (adio) where it should be sounded as d. Double consonants are normally pronounced as if they were single consonants; an exception is gg which is pronounced as /g/ instead of g which is the normal sound of the letter g. Furthermore, there are examples of letters within words which remain more or less silent (e.g. the letter υ in "Εύβοια"/-evia/). Of course, we should say that although Greek has not an entirely transparent orthography (since in the oral-to-written direction it is somewhat opaque (Miles, 2000)), it is much less obscure in its sound-spelling correspondences in comparison to other alphabetical systems, such as English or French.

Furthermore, Greek orthography is considered to be difficult to acquire since Greek is a very heavily inflected language containing (three) different genders, cases, declensions and conjugations. Thus, in many words the writer has to be aware of the (complex) grammatical rules or the historical derivation of a particular word (etymology) in order to use the right grapheme. This is the main reason why many Greek children find spelling such a hard task and not because of inconsistencies of grapheme-phoneme correspondence that cause the main difficulties in deep orthographies such as English.

*English*, on the other hand, is known to be a deviant language. According to Spencer (2000, 2001), recent evidence has shown that normal English-speaking children have reading and spelling deficits in the range associated with same age dyslexic German-speaking children for less frequently used words, and English orthography has been identified as a contributing factor. Two main factors have been identified (apart from the frequency of occurrence of the word): consistency of sound representation and inclusion of redundant letters in English words (ibid. 2000, 2001). Actually, the system of association between the sounds of speech and the written symbols is indeed a complex one.

Research has shown that different characteristics of orthographic structure of languages affect the developments of literacy skills (Beaton, 2004; Landerl & Wimmer 2000; Nikolopoulos, Goulandris, & Snowling, 2003). Of course, English is not a language as heavily inflected as Greek, so the orthographic feature that mainly affects the literacy skills development is the lack of transparency of grapheme—phoneme relations (Landerl, Wimmer, & Frith, 1997). This is what Spencer (2000: p. 161) means when he mentions that 'if English pupils are so damaged by their orthography that their performance is worse than dyslexic pupils' performance in other more orthographically transparent languages, then English can truly be said to be a dyslexic language.

However, since the bulk of the research into problems dyslexics face has been conducted mainly among those whose first language is English, only assumptions have been made about the nature of dyslexia, which are depended on the complex features of this language.

In view of the above, we conducted a research in order to find out the kind of errors made by Greek dyslexics and Greek non-dyslexics in two different languages, Greek (L1) and English (L2), the former (Greek) much more transparent than the latter (English), how significant the difference is between the number of errors made in L1 and in L2 and how different the subjects' error profiles are in each language. More specifically, our hypotheses are 1) that dyslexics make much more errors than non-dyslexics and 2) that dyslexics make more phonological errors in English (L2) than in Greek (L1).

## Method

### Subjects

Our study included eight subjects, four dyslexics and four non dyslexics. All of the subjects had Greek as their first language (L1) and learnt English as a foreign language (L2) and they also had good typing skills since computers were part of their everyday life as they were encouraged to compose written texts on the computer both at school and at the specialist centre they attended, as far as the dyslexics are concerned. Dyslexics were all diagnosed with mixed dyslexia and they were poor

spellers. Concerning their first language (Greek) dyslexics had serious spelling problems according to their school teachers and their special instructors' reports. As far as L2 is concerned our dyslexic subjects were poor spellers according to South Australian Spelling Test -they all attained a low (above average) score. Our subjects were between 12 and 14 years old at the time of the data collection. Non-dyslexic children were about two years younger than dyslexic children so that the control group would remain closely matched to the dyslexic group concerning their L1 (Greek) and L2 (English) proficiency (Bourassa & Treiman, 2003; Hoefl et al., 2007). Regarding L1, even the younger children had been taught the main grammatical and syntactic rules at school according to the School Curriculum in Greece. As far as their L2 level (all the subjects had a language proficiency of Level A2 according to the Common European Framework of Reference for Languages). This means that all the subjects had been tested and matched on the basis of standardized spelling-writing, listening, speaking and reading test scores.

Dyslexic participants came from a specialist center in Greece and they were diagnosed with mixed dyslexia at KEDDY evaluation centres (Differential Diagnosis, and Support for Special Educational Needs Centres) which provide and coordinate services for children with special educational needs at the local level, operating as decentralised units of the Ministry of Education. They participated in mainstream education while the specialist centre provided structured intervention. The four of them had been in the particular private institution for two years and had been attending English classes for about four years.

The non-dyslexic subjects were matched for socio-economic background with dyslexics participated in mainstream education. They had also been learning English as a foreign language for about four years. Furthermore, all our subjects' overall IQ was within normal range and they were free from any gross physical disability and free, in the judgment of their teachers and according to their parents' report, from any severe psychiatric or emotional problems.

## Materials and Procedure

Each subject undertook two writing tasks, one in Greek and another one in English. It should be mentioned that we had our subjects do the activity in Greek before the one in English. This happened since we wanted our subjects to start with the less demanding task (the one in their native language) because a difficult activity could inhibit them from continuing with a second activity. Besides, we tried to eliminate the possibility of direct transfer and translation between the two languages since the writing activity was not the same in Greek and English.

Our subjects composed two picture elicited narratives on the computer. We thought that the production of a picture elicited story would be more interesting and motivating than a simple personal narrative, a description of a single picture or a composition based on a composition topic. For this purpose we chose a series of pictures taken from one of Greek teenagers' comics, *Asterix*. All the subjects were based on the same series of pictures (cartoons without text) to produce their story, a fact that would lead to the production of more "similar" texts in terms of content, structure and vocabulary so that the similarities and differences among the texts would appear to be more striking (Thomson, 1982).

Through a "free writing" task we had the chance to examine our subjects' spelling skills in real time. We preferred this task

to a simple spelling test because as Moats (1996) argues "samples of spontaneous writing are a natural expression of students' linguistic processing and linguistic knowledge, and are less contrived than dictated spelling tests which may include words not in the students' writing vocabularies".

For these purposes, we used *ScriptLog* which is an on-line recording tool for experimental research on the process of writing. By means of *ScriptLog* you can record a writing activity that takes place on a computer (word processor). *ScriptLog* keeps a record of all events on the keyboard (i.e. the pressing of alphabetical and numerical keys, cursor keys, the delete key, space bar etc, and mouse clicks), the screen position of these events and their temporal distribution. From a *ScriptLog* record, you can then derive not only the finally edited text from a writing session but also the 'linear' text with its temporal patterning, pauses and editing operation (Wengelin, 2002). It has two kinds of output: you can "replay" a writing session in real time (or by fast forward), and several different analyses files can be generated (Final Edited Text, Log Text, Linear Text, Editing Distance, Pause Time Data, Statistics, Transition Times, Transition Times-Pause Interval, Transition Times-String Context, Deletion List-Linear and Deletion List-Data) (for more details see Wengelin, 2002 and Stromqvist & Karlsson, 2002). In this paper we examine the participants' written texts as final products since we have initially been interested in the participants' error profiles, while *ScriptLog*'s other module results remain to be examined and presented in future papers.

Our error analysis focused on 1) phonological errors and 2) spelling/orthographic errors. Phonological errors included grapheme omissions (i.e. omissions of single consonants, consonant cluster reductions and vowel omissions), grapheme additions, grapheme transpositions and vowel or consonant alterations. Besides, our phonological error category included misspellings where the error is a word in its own right but is not homophonic (e.g. can (kind)), on the assumption that these are instances of phonological confusions in short term memory (Conrad, 1964; Sterling et al., 1998).

Spelling/orthographic errors included firstly, errors that are defined as violations of spelling/etymological rules (violation of etymological rules is a serious cause of errors especially in Greek that its orthography is a historical one), e.g. if a writer writes "μωπό" instead of "μωπό" (baby) an etymological rule has been violated since the word "mwro" derives from the ancient Greek adjective "μωρός, -ή, -ό" (naive, silly). This error is counted as the same type of error if the writer wrote "laidies" instead of "ladies" in English. Secondly, they included errors defined as violations of (intra-word) grammatical rules e.g. if the writer writes "σκύλως" instead of "σκύλος" (dog) a grammatical rule has been violated since in Greek all masculine nouns in -ος are spelled with "ο" (όμικρον). It would be the same if someone writes "partys" (as the plural noun for "party") instead of "parties" in English.

For the statistical evaluation of our data, independent samples t tests were performed on the number of errors made by dyslexics and non-dyslexics in order to detect possible statistically significant ( $p < .05$ ) differences between the errors made in the two different languages (L1 vs L2) and between the two different types of errors (phonological vs. spelling/orthographic). The analysis was done with the SPSS statistical programme.

## Results

Statistically significant ( $p < .05$ ) differences were found in

both languages in almost all types of errors made by dyslexics in comparison to non-dyslexics (**Table 1**). In addition, dyslexics made statistically significant ( $p = .018$ ) more phonological mistakes in English than in Greek (**Table 2**).

### Discussion

In our study dyslexics generally made more errors, both phonological and spelling/orthographic, than non-dyslexics in both the Greek and the English text as it was expected. More specifically, our data showed that dyslexics made a great number of phonological errors in English in comparison to the very small number of phonological mistakes they made in Greek, something that could be of great importance and could be due to difficulties inherent in the English phonological system. These possibilities should be further investigated so that we could get a clearer picture of the nature of dyslexic difficulties.

In addition, we cannot underestimate the fact that non-dyslexics also made more phonological mistakes in English. We should mention though that the difference between the number of phonological mistakes non-dyslexics made in Greek versus English is not a statistically significant one. However, their mistakes in English are still more than the mistakes they made in Greek something that can be partly due to the opaque English language and should initiate further research on the effect of different languages' features on learners' linguistic performance.

On the other hand, dyslexics made spelling/orthographic errors in both their Greek and English texts which means that spelling seems to be a core problem not only in L2 but in their L1 as well. We should mention though that their orthographic mistakes were of different nature depending on the language in which they occurred. When it comes to Greek, both groups of subjects and especially dyslexics made orthographic mistakes after having violated etymological (*γιτονιας, πιραζαν, γηνεκα* etc.) or grammatical/morphological rules (*αγνοι, μιλαι, τσακοθικαν* etc.) they had already been taught. On the other hand, in English especially dyslexics (and sometimes non-dyslexics) appeared to over-rely on a "spelling-by-ear" strategy that resulted in the correct pronunciation but in unconventional spellings (*pix* for *picks*, *solgers* for *soldiers*, *heits* for *hates*, *tok* for *talk* etc.). It is

**Table 1.**

Mean scores of errors made by dyslexics and non-dyslexics in their L1 and L2.

	Dyslexics	Non-dyslexics	<i>p</i> value
L1 spelling	7.75	.75	.027
L2 spelling	7.00	1.75	.019
L1 phonology	1.50	.25	.067
L2 phonology	8.50	1.25	.015

**Table 2.**

Mean scores for dyslexics and non-dyslexics' phonological and spelling errors in L1 vs L2.

	L1	L2	<i>p</i> value
Dyslexics' phonology	1.50	8.50	.018
Dyslexics' spelling	7.75	7.00	.792
Non-dyslexics' phonology	.25	1.25	.114
Non-dyslexics' spelling	.75	1.75	.382

very interesting to see that spelling mistakes in English lead to the production of almost "new"-phonologically plausible-words something that is far different from spelling mistakes which occur as one or more incorrect graphemes in a word and should be further investigated as a possible characteristic of dyslexics' spelling in deep orthographies.

Focusing on dyslexics' errors we laid emphasis on the distinction between their phonological and spelling/orthographic errors. According to Snowling (1982), the distinction between a spelling/orthographic error, a phonetic error, which correctly preserves the sound sequence of a word (e.g. *speshull* for *special*, *traffick* for *traffic*) and a phonological error (a nonphonetic error), in which the sound sequence is not preserved (e.g. *deter* for *doubt*, *heyou* for *hay*) is an important one since it has been shown by many investigators to be of diagnostic significance and shows the impact of different orthographic systems on spelling ability (Boder, 1971; Caravolas, Bruck, & Genesee, 2003; Frith, 1979; Nelson & Warrington, 1974). Spelling/orthographic errors are usually assumed to be less serious than phonological errors because they are easily deciphered. A more liberal approach to spelling would regard these versions as acceptable. Furthermore, an individual who makes primarily spelling errors shows evidence of the ability to segment the target words into appropriate speech units (phonemes) and of being able to translate these units into letters using phoneme-grapheme rules (Frith, 1980). In contrast, an individual whose errors are primarily phonological may have difficulties at either or both of these initial stages.

Thus, it is important to distinguish these two basic error types because they might point out the need for different sorts of remedial intervention. Whereas individuals who make primarily spelling errors may require only a systematic introduction to conventional spelling patterns and spelling rules, individuals whose errors are primarily phonological may require more specialized auditory skills training.

In our study, dyslexics made a great number of both phonological and spelling mistakes in both languages. However, there are two reasons why we think our dyslexics' spelling mistakes are the ones we should mainly focus on. Firstly because it was in more difficult words they tended to make spelling mistakes since they resorted to "spelling by ear" method while they tended to make phonological mistakes in easier words confusing simpler letters such as *b-d*, *ful-flu*, *far-fra*, *ts-st* etc. This means that they have the ability, even though not fully automated (errors in easier/shorter words), to break up words into phonemes and turn them into graphemes (letters) (Nikolopoulos, Goulandris, & Snowling, 2003) but they are lacking in the ability to retrieve and implement spelling, grammatical and etymological rules. The second reason why remedial intervention should focus on spelling mistakes is that when it comes to the Greek language there are hardly any phonological mistakes but there are still spelling mistakes resulting from the violation of spelling and grammatical rules. This is something that dictates the dyslexics' need for a well structured teaching method that concentrates on repetition, practice and phonics not because they necessarily suffer from a lack of ability to represent the phonological skeleton of words (Alegria & Mousty, 1994; Nikolopoulos, Goulandris, & Snowling, 2003) but because they find it so hard to retrieve rules (grammatical/etymological/phonological) and correspondences (for example, sound-letter) and get them automated.

In conclusion, we can say that dyslexics generally made

more spelling/orthographic mistakes in both languages in comparison to non dyslexics as we had expected. They also made more phonological mistakes in English but there was no statistically significant difference between the number of phonological mistakes made by the two groups in Greek, something that confirms our assumption that the orthographic transparency of the Greek language and the phonics-based instruction of reading and spelling at the schools in Greece facilitate the development of literacy skills in comparison to the inconsistent English orthographic system that poses difficulties for young learners.

Furthermore, the English orthographic system seriously affects the kind of spelling/orthographic mistakes our subjects made. Their tendency to spell “by ear” made them come up with really weird spellings which nevertheless preserved the word’s pronunciation something that requires further research that could shed light on the nature of the problems dyslexics experience. On the other hand, they made many spelling mistakes in Greek as well but these mistakes were not of the same type. They were spelling mistakes that confirm the subjects’ problems with the particular language’s really complex and demanding historic orthography and grammatical rules.

According to Pierson (1989), spelling studies have determined that Greek children use phonological strategies at the phoneme and syllable level from the earliest stages (Porpodas, 2001), gradually augmented with morphological strategies to allow spelling of grammatical morphemes (Nunes, Aidinis, & Bryant, 2006), and are sensitive also to morpheme frequency in applying such strategies (Diakogiorgi, Baris, & Valmas, 2006). Dyslexics find it hard to apply and automate such strategies. This does not mean that instruction in etymology would not be of great help. Even in the foreign language curriculum it could offer meaningful linguistic information and principles to the students. As Pierson (1989) states, etymology, the study of word origins, has all the attributes of what educational psychologists term meaningful learning. This is a type of learning connected to prior learning, more highly retainable and generalizable, making it superior to simple rote learning of vocabulary. This “meaningful learning” (Ausubel, 1968, 1967), connecting new information to something already learned, is more likely to be remembered and generalized to other contexts. These known words serve as a reference point for new words with the same forms met later in the lesson.

Based on our dyslexics’ error profiles in the foreign language, we could say that these students need structured and systematic direct instruction in the rule systems of an L2 that would apparently run contrary to the “natural” communicative’ approach (Krashen, 1982; Krashen & Terrel, 1983) that has dominated L2 instruction since 1980s. Our question, though, is if this kind of method is similarly appropriate for dyslexics’ spelling in various languages. If we think about the errors made by our dyslexics in L1 and L2 we will see that they were of different types. The most striking difference among these mistakes is that when writing in English our subjects made many phonological errors while they made very few phonological errors in Greek. It is obvious thus, that instruction methods should be language specific. In our case, English uses a “deep” orthography so that an explicit, structured, multisensory teaching method would be more appropriate than it would be in Greek that is a more transparent alphabetical system (Mavrommati & Miles, 2002) as far as phonology is concerned. Of course, we should not underestimate the difficulties that the Greek language poses for learners in terms of morphology and grammar, something that

dictates the need for an explicit and well-structured teaching method when it comes to Greek grammar and spelling.

Therefore, further research on different aspects of languages and their apparent effect on dyslexics is needed to widen our understanding of the nature of dyslexic difficulties (Miles, 2000). We should bear in mind that some of the features that we now associate with dyslexia seem to be particularly influenced by the very complex phoneme-grapheme correspondence of the English language.

For these reasons, more research studies should be carried out with more subjects, maybe better matched in terms of their level of proficiency in the languages under investigation, severity of dyslexia, and reading age. It would be useful if we could have two control groups, one at the same chronological age and with the same time spent on learning their L2 and another one at the same reading age so that the comparison would be more interesting. More than one writing tasks could also be used in both languages so that the effect of the task would come out. Also, phonological awareness was not assessed so phonological awareness or processing difficulties cannot be necessarily ruled out because of phonologically accurate spellings (Landerl, Wimmer, & Frith, 1997). Besides, other ScriptLog applications (pause analysis, revision analysis, editing analysis, statistical analyses etc.) remain to be exploited and presented in future papers. Finally, some research on bilingual dyslexics could also lead to reliable findings about the complex syndrome of dyslexia.

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