1 Introduction: a cross-linguistic perspective on learning to read and write

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For many years the development of theories about the way children learn to read and write was dominated by studies of English-speaking populations. As we have always been aware, English has an exceptionally irregular orthography both for reading and spelling, in that the relationship between graphemes and phonemes is highly inconsistent. As we have learned more about the way that children learn to read and write other scripts – which have less irregularity in their grapheme–phoneme correspondences or do not even make use of alphabetical letters at all – it has become clear that many of the difficulties that confront children who are learning to read and write English are less evident, or even non-existent, in other populations. At the same time it has also become clear that some aspects of learning to read and write are very similar across scripts. A cross-linguistic perspective thus provides a unique opportunity to discover how the processes of learning to read and spell are affected by the characteristics of the writing system that children are learning to master.

When we invited contributions to this volume we hoped that the authors would raise issues in common about the processes involved in learning to read and write different scripts. We were delighted to find that they had done so, but such was the commonality of themes across chapters that we were presented with a problem in organising the book. Our original plan had been to divide the book into sections but, in the light of the many inter-related issues that are discussed, we decided that sub-dividing the chapters would be misleading. Instead, what we have tried to do is to arrange them so that scripts that are most similar to each other occur in close proximity.

The first five chapters are all concerned with learning to read and spell alphabetic scripts where there are highly consistent letter–sound correspondences. Chapter 2 deals with Italian which the author, Giuseppe Cossu, describes as the equivalent in studies of reading to the *Drosophila*

in the study of genetics because of its simplicity. Italian has fewer vowels than English, fewer syllable types and a predominantly open syllable structure (where the majority of syllables end with vowels). These features, together with an almost completely regular pairing of phonemes and graphemes, make Italian a highly transparent orthography.

Cossu reports that Italian children (who start school at the age of six) learn to read very rapidly and, only six months after the start of formal reading instruction, they are highly accurate at reading both words and non-words. The main change that occurs across the first grade is in reading speed which gradually increases towards the end of the school year. Spelling is not nearly so accurate, however, even though the correspondence between phonemes and graphemes is equally regular for reading and spelling. This evidence about discrepancies between reading and spelling in a transparent orthography is interesting because it suggests that, even where there are biunivocal correspondences between graphemes and phonemes, children are not initially able to spell every word that they can read. Cossu also discusses evidence from children who experience severe difficulties with reading and/or spelling following brain injury. He concludes that there are developmental dissociations between reading and spelling even in a transparent orthography.

Chapter 3, by Heinz Wimmer, Karin Landerl and Uta Frith, also considers evidence from children who have difficulties in reading. Their chapter focuses on German which, although less transparent than Italian, has very consistent grapheme–phoneme correspondences. The teaching of reading in German schools uses an explicit phonics programme in which the main grapheme–phoneme correspondences are taught and children are given explicit training in how to read words using grapheme–phoneme translation and blending. The orthographic regularity of German means that use of grapheme–phoneme correspondences yields a reasonably accurate pronunciation for most words. Contrast this with English where the same 'sounding out' strategy often does not produce an approximate pronunciation. This is a particular problem for beginning readers because many of the highly frequent words that young English children encounter in their first reading books cannot easily be sounded out.

A comparison between the non-word reading of young German and English readers showed that German-speaking children were very much better at applying letter–sound correspondences to read non-words than English children of the same age, even though the latter had had one additional year of reading instruction. German children thus seem to find the mastery of phonological coding for reading much easier than their English-speaking peers. This difference was also reflected in the performance of dyslexic children in the two populations. German-speaking

dyslexics showed much greater accuracy in their use of grapheme–phoneme correspondences to read non-words and rare words than English dyslexics. Wimmer, Landerl and Frith argue that the demands placed on working memory in successfully applying grapheme–phoneme correspondences to reading are much lower for a regular orthography than an irregular orthography like English. Thus two dyslexic children, who have identically impoverished working memories, will have greater or lesser success in learning to apply grapheme–phoneme correspondences, depending on the transparency of the orthography.

The chapter by Margaret Harris and Vicky Giannouli examines learning to read and spell in Greek. Greek is unusual is having an orthography that is possibly even more transparent than Italian for reading but much less transparent for spelling. Like Italian, it has a small number of vowels and a predominantly open syllable structure. As in Italian and German schools, an explicitly phonics approach is used to teach reading and children make rapid progress. However, progress in spelling is much slower and, at the end of first grade, while children are highly accurate at reading words and non-words, they make many mistakes in spelling real words.

The main difficulty presented by Greek spelling lies in the ambiguity of vowels. Much of this ambiguity is resolved once children have a grasp of the extensive system of morphologically based spelling rules that appear in Greek. These rules govern the spelling of morphological word endings which vary according to the grammatical status of a word. Grasp of these rules is best predicted by children's pre-school syllabic awareness but the application of the rules appears to be a rather gradual process. Other Greek words, which reflect aspects of ancient Greek that are not present in the modern form, are exceptions to these morphological rules and the mastery of their spelling continues well past the end of third grade at school.

The chapter by Lucia Lins Browne Rego describes the acquisition of two different kinds of spelling rules in Brazilian Portuguese. Portuguese has a regular orthography but the level of regularity does not lie at the level of grapheme–phoneme correspondences alone: indeed there are only nine cases of unique mapping between letters and phonemes. However, for many other letters and phonemes, the ambiguity of mapping can be resolved by conditional rules, based on sound or letter position or on stress patterns. Portuguese also has morphological spelling rules that are somewhat similar to those found in Greek. Rego shows that, as in the case of Italian, Greek and German, mastering phoneme–grapheme correspondences is relatively easy for children. However, the acquisition of conditional and morphologically based spelling rules is a much more

complex task in which learning is gradual rather than sudden. Application of morphological rules to spelling was better in children who had good morpho-syntactic awareness, echoing what Harris and Giannouli found for Greek. Rego also reports that children were usually able to acquire a rule for reading before they were able to use it in spelling, echoing Cossu's arguments about dissociations between reading and spelling.

Morphological structure plays a key role in the Hebrew script which is described by David Share and Iris Levin. Hebrew has a complex derivational morphology in which most content words consist of a tri-consonantal root together with infixes and/or affixes. For example, among many other words, the root KLT gives rise to KALAT (he grasped), HIKLIT (he recorded), KLITA (absorption) and MIKLAT (shelter). The additions to the semantic root give information about the grammatical status of a word such as person, number and gender. Written Hebrew represents consonants directly but vowels are indicated by diacritical marks in the 'pointed' script used to teach reading. Even preschoolers, who have not yet learned to read, reflect this primacy of consonants in their spontaneous writing. Pointed Hebrew has almost perfect grapheme–phoneme correspondence and so learning to read it is easy (although it takes much longer to be able to read unpointed Hebrew where the reader has to interpolate the vowels between the consonants). By contrast, phoneme–grapheme relationships are more variable and the vast majority of Hebrew words could, in theory, be spelled in more than one way. Indeed, such is the degree of potential ambiguity in Hebrew spelling, that the development of spelling in Hebrew appears to lag behind even that of English.

Share and Levin also discuss the relationship of phonemic awareness to learning to read Hebrew. They conclude that phonemic awareness is a much weaker predictor of early reading success than it is for English. They argue that this is because the unambiguous pronunciation that is provided by the pointed script read by young readers demands less skill and flexibility in phoneme manipulation than is required for English orthography. Share and Levin also argue that sub-syllabic consonant–vowel (CV) units as well as phonemes are important in reading Hebrew. This points to an important cross-linguistic issue because the units that will be important for the reading and spelling of a particular alphabetic script will depend, not only on the regularity of letter–sound correspondences, but also on the regularity of the syllabic and morphological structure.

The issue of morphological structure in spelling is addressed by Peter Bryant, Terezinha Nunes and Athanasios Aidinis. Their chapter is the first of three that compare reading and spelling in alphabetic scripts of

varying transparency. Bryant, Nunes and Aidinis focus on children's developing understanding of morphologically based spelling rules in English, French and Greek. These three scripts provide a very interesting comparison because they vary considerably in their regularity for reading and spelling. Nevertheless they present children with common problems.

Multiple correspondences between graphemes and phonemes are generally more problematic for writing than reading. When there are alternative ways of pronouncing a word, children do not have to rely on morphological strategies for reading. This is because alternative pronunciations are constrained by the need for a word or sentence to make sense. For example, although [ea] could be pronounced as either /e/ or /i:/, children are likely to choose the correct pronunciation of [sweated /swetid/] in a sentence like 'I would like to take a shower because I sweated' since otherwise the sentence will not make sense. However, in writing, such constraints do not work unless children are highly familiar with written forms of sentences. For this reason, morphological knowledge plays a more significant role in writing than in reading. Indeed, the main problem that children face in learning about aspects of both derivational morphology (such as that evident in the relationship between 'know' and 'knowledge' or 'music' and 'musician') and inflectional morphology (such as 'burn – burned') is that the spelling system represents distinctions that are not apparent in the spoken form.

Bryant, Nunes and Aidinis argue that, over a period of about two years, children gradually learn to decide between two or more acceptable spelling patterns, to spell silent morphemes, and adopt the correct (conventional) spellings that violate modal grapheme–phoneme correspondence rules. They show that, in spite of differences between scripts, the course of development in the mastery of morphological principles in spelling is remarkably consistent. For example, where there are alternative spellings, children go through a stage where they have a marked preference for one particular spelling of a sound; and children begin to use morphological distinctions that are respected in spelling before they fully understand the 'logic' of the writing system. They also show that children's use of morphological knowledge in spelling can be predicted from their morpho-syntactic awareness assessed by the word and sentence analogy tasks. This highlights the fact that understanding morphological spelling rules draws on children's more general understanding of the way that morphology functions in the spoken language.

Usha Goswami's chapter offers an excellent summary of the findings on the relationships between varieties of phonological awareness and the ability to read words or pseudo-words for various European languages. According to her, phonological development seems to show the same

sequence across languages – from an awareness of syllable to an awareness of phoneme, through an awareness of sub-syllabic units (e.g., onsets and rimes). However, the level of phonological awareness that is most predictive of reading development may vary with the orthographic transparency in general and with the spelling units at which the regularity is maximal. For example, the strong connection between rhyming and early reading, well known in English, may not be observed in languages in which script–sound correspondence is more or less regular. Only those children who are learning non-transparent scripts develop a larger phonological-orthographic unit at which the correspondence is fairly consistent. That differences in grapheme–phoneme consistency influence reading development in a profound way is supported, as we have seen, by the initial group of chapters. However, as Goswami repeatedly emphasises, these summaries must be taken as tentative. We need more cross-linguistic studies, including non-European languages and non-alphabetic scripts, before we can reach firm conclusions. For example, even though the sequence of phonological development is similar across languages, the sub-syllabic units of which children become aware are likely to vary from language to language.

Ingvar Lundberg's chapter discusses learning to read in Scandinavian countries. These languages provide important points of comparison because they vary in orthographic transparency. Lundberg begins by discussing the role of phonological awareness in learning to read but he then goes on to explain why it is important to remember that reading is a cultural practice. He believes that socio-cultural variables, particularly the status of reading and writing in a society, are at least as important as orthographic–linguistic factors in reading achievement. It is certainly true that informal literacy socialisation, exposure to print, and values attached to literacy – to mention just a few socio-cultural factors – influence children's learning of reading and spelling. Children learn to read because it allows them to better participate in significant or interesting activities. Ease of participation in literacy practice may vary according to orthographic transparency, but without participation in these activities, children will not learn to read even when the orthography is completely regular. Likewise, teaching at school for phonemic awareness may have some effect, but the contribution of schooling *per se* may not, as Lundberg claims, be very large.

In the final set of chapters we move away from alphabetic writing systems, in which the sounds of a word are represented by combinations of letters, to consider how children learn to read Chinese characters. Many of the same issues that were discussed in earlier chapters remain relevant. These include the speed with which children learn to read, the

strategies that they adopt at the initial and later stages of reading, the relationship between learning to read and learning to spell and prerequisites for learning to read. Other issues – notably visual characteristics – are unique to the reading of scripts using Chinese characters.

Chinese characters are used in a number of Asian countries and they are not only visually complex but also large in number because each of them represents a morpheme rather than a phoneme. This suggests that the process of learning to read and write these characters, the phonological and visual readiness for learning, and the nature of informal and formal reading instruction must be different from those for alphabetic scripts. To make the learning of Chinese characters easier, auxiliary phonetic scripts (e.g. Pinyin) are sometime attached to them. These phonetic scripts enable readers to rely on an alphabetic strategy to read unfamiliar characters. The last chapter also deals with Japanese kana syllabaries, which originated as phonetic symbols attached to Chinese characters. Japanese children learn to read a text initially only in kana, and gradually learn to read a text involving Chinese characters with the help of kana. Kana characters each represent a syllable or mora and so their acquisition also poses problems similar to but different from those of alphabet scripts.

The chapter by Rick Hanley, Ovid Tzeng and H.-S. Huang starts with a description of the Chinese writing system and how it is taught in China, Taiwan and Hong Kong. As aptly pointed out by the authors, it is not accurate to refer to Chinese as a logographic writing system. Chinese characters represent morphemes, that is, the characters indicate unique pronunciations as well as meanings. The authors also argue that the underlying cognitive skills and strategies involved in learning Chinese and English are not as different as was once imagined. For example, recent studies they refer to have shown that phonological awareness is an important factor in learning to read Chinese. It is true that visual analytic and memory skills are also important in learning to read Chinese, probably more so than in learning to read alphabetical scripts but this does not reduce the importance of phonological processing skills. This can be seen in the comparison of learning to read in China, Taiwan and Hong Kong. Auxiliary phonetic scripts are used in China and Taiwan, but not in Hong Kong, before children are introduced to Chinese characters. This seems to exert an enormous effect on subsequent reading development: Hong Kong children are not only behind on tests of phonological awareness but also poorer at using the phonetic components in compound characters.

Susan Rickard Liow's chapter, after describing the oral and written languages used in Singapore, compares the development of reading skills

in English between bilingual Mandarin-English- and Malay-English-speaking children. Her basic assumption is that Mandarin-English-speaking children have difficulty in learning to read and write in English because Singapore Chinese children are exposed to a logographic or morphemic script without the support of the auxiliary Pinyin script or phonics teaching. They thus have limited phonological awareness although enhanced visual analytic skills may compensate to some extent. In contrast, because Malay has a shallow alphabetic orthography and the grapheme–phoneme correspondences are explicitly taught in their reading lessons, she assumes that Malay-English-speaking children can acquire English literacy more easily. By reviewing her own, as well as other studies, she examines these assumptions regarding L1 to L2 strategy transfer and generally confirms them. It will be fascinating to examine in further studies whether such transfer will occur when English is a child's first language.

Kyomi Akita and Giyoo Hatano focus on Japanese children's acquisition of hiragana – one of the two kinds of kana syllabaries used with kanji (Chinese characters) in the Japanese writing system. Syllabaries, in which a different character represents a syllable or mora (sub-syllabic rhythmic unit), are extensively used in Japan. The use of syllabaries is appropriate for Japanese because there are fewer kinds of syllable than in European languages. However, the use of a small number of syllabary characters in Japanese (seventy-one) produces many homonyms, and thus educated Japanese use Chinese characters to distinguish them.

Learning to read hiragana is easy and is almost always completed in the lower grades of elementary school at the latest, the authors claim, because it does not presuppose advanced phonological awareness at the phonemic level, and also because the Japanese language has a limited phonological inventory. However, the learning process involves three stages that are highly similar to those proposed by Frith (1985) for English. Moreover, although the script–sound correspondence is generally regular for hiragana, children seem to rely on morphological knowledge to cope with some irregular patterns. Thus we again see more similarities than differences in the acquisition of literacy in different types of script.

It should be noted, though not emphasised in their chapter, that Japanese children have to learn, in addition to hiragana, at least 2,000 kanji that are used daily in Japanese. These are needed to compensate for the shallow hiragana orthography and the language's limited phonological inventory. In fact, there are many homophones in Japanese that can be differentiated only by writing them in kanji. In sharp contrast to the Chinese writing system that, as Akita and Hatano put it, 'may make

life hard for the novices but has clear advantages for the skilled adult readers', the Japanese kana orthography, best suited to children and beginners, may have serious limitations for adult readers.

One of the themes to emerge very clearly from these chapters is that the speed with which children learn to read and spell – and the strategies that they adopt – is a product of many factors. Undoubtedly some scripts – those that are more regular in their representation of sounds – are easier to master. But there are important interactions between the characteristics of a script at the phonological, syllabic and morphological level and many other variables. These include children's pre-reading experience at home and in nursery school, the method of instruction used in school to teach reading and spelling and societal attitudes towards these activities. Cross-cultural comparisons are allowing us to draw a clearer picture of how these factors interact. Ultimately they also present us with an opportunity to discover which – if any – aspects of learning to be literate can really be considered universal.

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2 The acquisition of Italian orthography

Giuseppe Cossu

Introduction

On a hypothetical 'transparency scale' of writing systems, Italian orthography should be placed close to one extreme. The reasons for this eccentric location are to be found in the convergence of a shallow phonology and a highly regular mapping between the visual and the oral language. Indeed, one might suggest that the 'simplicity' of Italian orthography is to reading research what the *Drosophila* has been for genetics: a simplified model to explore the neuro-psychological intricacies of literacy acquisition.

This chapter investigates the idiosyncrasies of a regular orthography of this kind and seeks to highlight the cognitive requirements that have to be met by a child acquiring a transparent orthography. To this end, I will draw on data from normal school children as well as from clinical cases which show developmental dissociations between reading (or writing) and other neuro-psychological functions. From this double perspective, of normality and pathology, I will concentrate on the word level and the cognitive processes of transcoding single words (and non-words). This is not to deny the relevance of other components and levels of the reading processes, such as syntax, or text comprehension and production; rather, the choice is determined by the logical and chronological primacy of single-word decoding for setting up the orthographic system. Furthermore, the tasks of reading and writing at the word/non-word level circumscribe the range of the requisite cognitive resources by selecting those skills specifically involved in the transcoding process and in the access to the orthographic lexicon.

Before exploring the details of this perspective, it is necessary to survey the main features of Italian phonology and, subsequently, the orthographic rules that transcribe phonology into print and vice versa.