A Report of the

OECD-CERI
LEARNING SCIENCES AND BRAIN RESEARCH

Shallow vs Non-shallow Orthographies and Learning to Read Workshop
28-29 September 2005

St. John's College
Cambridge University
UK

Co-hosted by
The Centre for Neuroscience in Education
Cambridge University

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Background information

The goal of this report of this workshop is to:

- Provide an overview of the content of the workshop presentations.
- Present a summary of the discussion on cross-language differences in learning to read and the future of brain science research in this arena.

N.B. The project on "Learning Sciences and Brain Research" was introduced to the OECD's CERI Governing Board on 23 November 1999, outlining proposed work for the future. The purpose of this novel project was to create collaboration between the learning sciences and brain research on the one hand, and researchers and policy makers on the other hand. The CERI Governing Board recognised this as a risk venture, as most innovative programmes are, but with a high potential pay-off. The CERI Secretariat and Governing Board agreed in particular that the project had excellent potential for better understanding learning processes over the lifecycle, but that ethical questions also existed. Together these potentials and concerns highlighted the need for dialogue between the different stakeholders. The project is now in its second phase (2002-2005), and has channelled its activities into 3 networks (literacy, numeracy and lifelong learning) using a three dimensional approach: problem-focused; trans-disciplinary; and international.

This workshop is part of a series of expert meetings specifically designed to bring together a few researchers and practitioners around a particular problem or issue that might lead to cross-fertilisation across research areas and which might eventually drive innovations within the field. This workshop is the first Literacy focus meeting that following the joint Literacy and Numeracy Networks meeting held in 2004 in El Escorial, Spain, in which several scientists (Goswami, Lyytinen, Morrison, Ehri, McCandliss, Paulesu) made the hypothesis that the difference in orthographic transparency might affect the speed of acquisition of grapheme-phoneme translation as well as the emergence of the important skill of phonemic awareness. This meeting examined this hypothesis in different country and language settings, and whether reading disabilities are affected by the orthographic depth of a given language.

Introduction

This workshop set out to look at how great or small a challenge reading acquisition is for the brains of children according to whether their mother tongue is shallow or non-shallow[1], and if this might consequently lessen or accentuate reading difficulties.

Experts in the field were invited from different countries, such as Austria, the Czech Republic, Denmark, Germany, Israel, the Netherlands, Turkey, the United Kingdom and the United States, including several experienced practitioners in the field of teaching literacy.

The relationship between the gaining of orthographic and phonemic, morphological, and semantic[2] awareness for reading development across different languages was discussed in depth.

A "psycholinguistic grain size theory", which has been developed by Usha Goswami and Johannes Ziegler (experts present at the workshop), and which offers an elegant account for differences in the speed of reading acquisition among children learning to read in different alphabetic orthographies, was presented and debated by the different experts to see if it held up against their different language contexts.

In recent years, the use of functional neuroimaging techniques has made progress in the study of reading and reading disability. The OECD Learning Sciences and Brain Research project's Literacy Network has already provided a good deal of research knowledge on the distributed neural circuitry for reading in skilled adult readers in multiple languages. This workshop touched on how reading disabled individuals differ with regard to brain organisation in multiple languages, and how brain science might further advance in this direction for the future.

In the ensuing debates between the different linguistic, neuroscientific and educational experts, some key questions were put on the table at this workshop such as:

- Is there a marked difference in the prevalence of dyslexia in transparent orthographies?
- Is decoding complex orthography a waste of neuronal space?
- Is literacy acquisition a major challenge to brain plasticity in any orthography?
- Is it possible to identify a neural signature of efficient word processing?

[1] It should be noted that the terms "shallow/non-shallow" are often interchanged with "consistent/non-consistent"; "regular/irregular" and "transparent/non-transparent".

[2] **Morphology:** subfield of linguistics that studies word structure and deals with word structure rules across as many languages as possible. **Phonology:** subfield of linguistics associated with phonetics. While phonetics is about the physical production and perception of sounds of speech, phonology describes the way sounds function - within a given language or across languages. **Orthography:** set of rules about how to write correctly in the writing system of a language. **Semantics:** subfield of linguistics traditionally defined as the study of meaning of (parts of) words, phrases, sentences, and texts.

Learning to Read

Reading is the process of decoding and grasping verbal language in print or script. In order to become literate, one has to learn spelling-to-sound mappings: the mapping of written symbols to units of sound (phonology) by a process otherwise referred to as phonological recoding. This phonological recoding works by way of searching out shared orthographic or phonological grain sizes within words.

Children learning to read are faced with three problems: a problem of availability, which is due to the fact that the phonological units required to form connections with units of print are not consciously accessible prior to reading; a problem of consistency, which arises due to the greater or lesser degree that a single unit of print can have multiple pronunciations and spellings; and a problem with granularity, which is present particularly in deep orthographies that require the learning of many more and larger orthographical units.

It appears, in general, that in solving the challenge of building a neural circuitry for reading, the brain “chooses” a remarkably similar solution regardless of the idiosyncrasies of one or another written language system. This would follow from the universal demand of rapid access to phonology. In alphabetical orthographies, children are taught letter-sound correspondences, and gain phoneme awareness. An apparent trade-off between phonological, morphological, and semantic systems is evident in both brain and behavioural data.

As developmental constraints differ with orthographies, it is important to note that skilled reading is a continuous process from childhood to adulthood, development is not over by the age of 10-12, and early developmental processes form the building blocks for skilled reading. Skilled reading is defined as rapid access to words and their meanings. Such rapid access is determined by the efficiency of the phonological assembly process. This process allows the child to learn larger orthographic units including orthographic representations of words as a whole. Thus, even the most “direct” route to words and their meaning is paved by phonological associations.

Examining language differences

Shallow vs non-shallow orthographies

A “shallow” orthography means that the correspondences between letters and sounds (graphemes/phonemes) in the writing system are close to one-to-one. Finnish provides a good example, with 23 associations that match the exact number of letters. This effectively means that a non-Finnish person, who is a fluent reader in his/her own language, would be capable of reading aloud a Finnish text and make it perfectly comprehensible to a Finnish listener.

Written Finnish stands in stark contrast to written English, which in every classification appears as the most inconsistent “deep” orthography in the world. In English the reader has first to be able to make orthographic segmentation of multi-letter and often inconsistent graphemes (*thief - /th/ /ie/ /f/*), where the knowledge of basic letter sounds does not suffice for being able to use the grapheme/phoneme (letter/sound) correspondences. In English, the reader also has to take contextual influences into consideration, and some irregular words completely elude phonemic assembly, e.g. “yacht”.

In successful reading, the brain must first make a correct connection between the orthographic character of the word (i.e. visual appearance) and its sound. In some orthographies, a phoneme can have multiple spellings (English, French, Hebrew), whereas in others it is always spelled the same way. For example, the words cow and bough rhyme in English, as do true and through, though you would not expect it by appearances. On the other hand, some spellings can be pronounced differently, such as “ough” in English, which is sounded differently in bough; through; though and enough.

A comparative study by Seymour *et al.*, undertaken in 2003 (see figures 1 & 2), shows that after one year of instruction, English children show the lowest percentage of correct word reading on a scale in comparison to other European countries, with only 30-40% correct words compared to German, Greek and Finnish, with close to 100%. However, by around 12 years of age English children do catch up to their European peers, and these differences disappear. It has been recognised that English children apparently learn to read more slowly due to the nature of the inconsistent orthography. Educational attempts to address this slow acquisition include implementing early literacy programmes (such as the National Literacy Strategy in the United Kingdom) and starting reading instruction earlier, at 5/6 years of age, compared to 7/8 years in other countries.

Figure 1:

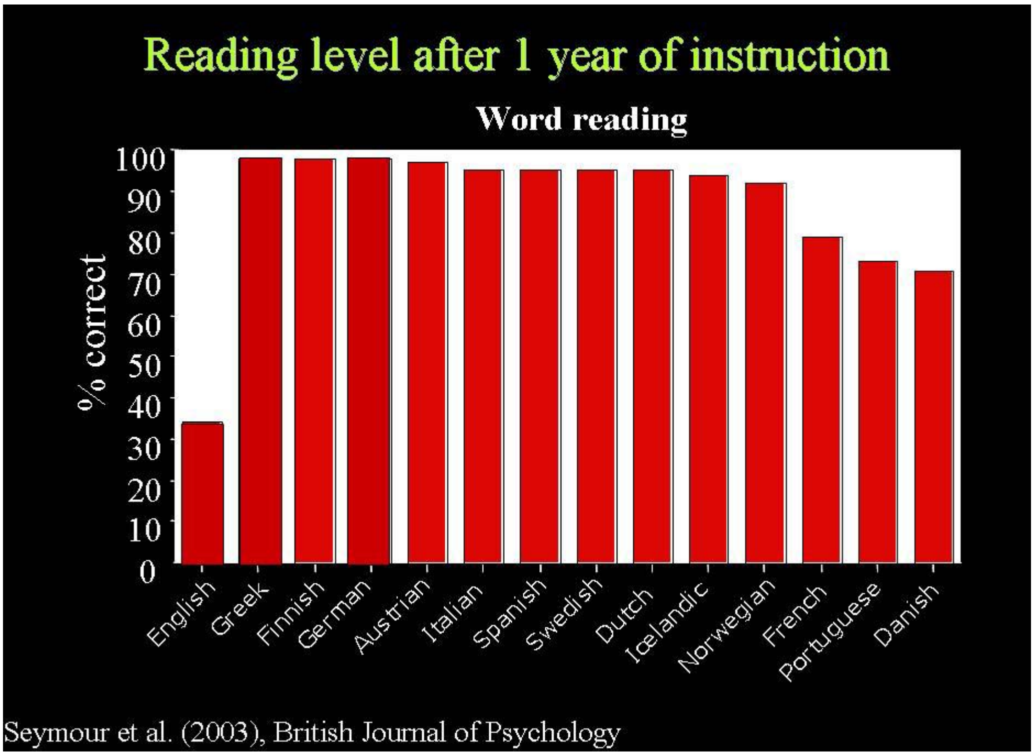
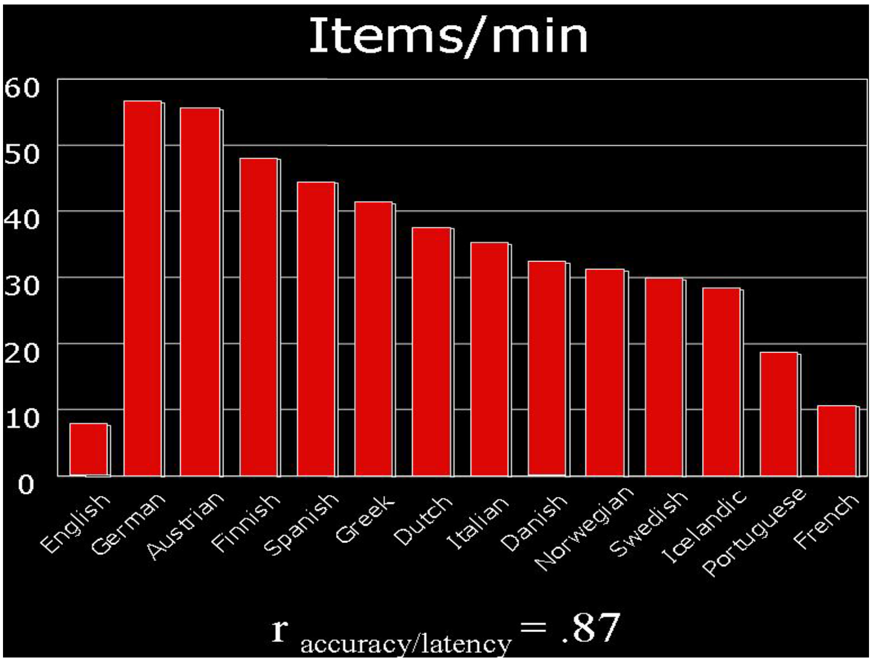


Figure 2:



Phonological awareness is the successful method to understand segments in written languages. Although phonological recoding is a much more efficient strategy than logographic learning, it nevertheless has a few problems of its own. The variation across languages makes it likely that there will be differences in reading development across languages (and probably also in spelling development). It is relatively easy to learn about phonemes if one letter consistently maps onto one and the same phoneme, or if one phoneme consistently maps to one and the same letter.

English children have to supplement the use of grapheme-phoneme based phonological strategies for recognising words by strategies using larger spelling units like those for rhyme patterns and by learning to recognise some words as entire units. In German it is possible to learn fewer simple rules and generalise, making for easy transfer. Italian and Finnish are extremely simple to read, because at the segmental level the relationship print-to-sound is almost 1:1, and a summary of a behavioural study shows that Italian subjects seem faster in all sorts of reading tasks. One of the experts speculated that English readers are not so much disadvantaged in phoneme awareness, but that speakers of other languages may be specifically advantaged by particular word structures and processes.

Morphological language differences

Languages also vary greatly in how they represent morphological information. English is relatively simple when it comes to morphological complexity; however languages like Arabic and Hebrew have triconsonantal[3] roots and many word patterns are created by inserting different phonological information into that root. These roots behave like lexical units, whereas the derived word patterns do not. This means that morphological decomposition has to be part of the word recognition process in such languages.

[3] A root containing a sequence of three consonants

Hebrew, like English, can be considered a deep orthography; however the “depth” of the Hebrew orthography is different in character to that of English orthography. English difficulties are primarily with letter cluster sound inconsistencies, whereas in Hebrew it is due to the absence of phonemic representation (mainly vowel information). When the diacritical marks that hold the phonemic representation are inserted, then Hebrew becomes entirely shallow. Recent studies on the morphological processing of printed Hebrew words show that Hebrew words are decomposed into their constituent morphemes in the course of reading, and that these morphemic units determine lexical organisation and govern lexical access. However, this is only present in single word reading; when fluent Hebrew readers read sentences or full texts the ease of computation becomes less marked, because they draw on full morphological information that is conveyed by a full sentence[4]. Readers of a deep orthography like Hebrew compute a phonological representation from print by using small-size sublinguistic units, and in parallel large-size units, the Hebrew reader automatically decomposes the printed words.

Turkish morphology is highly inflected, with up to 139 possibilities for a simple noun such as “home”. A single word in Turkish can represent 8 different words in English. For such an “agglutinating” language, the morphological complexity presents a different pattern. Morphological awareness has to include probabilistic information about the order of suffixes, because as a word gets more morphologically complex, the possible pool of suffixes that can be added narrows considerably. That’s why in a relatively crude paper-pencil study of morphological knowledge, when children were asked to attach the correct suffix to non-words given in a short paragraph, the children tended to make the base form more complex before adding the appropriate suffix. Although awaiting empirical corroboration, this component of morphological awareness is likely to be dependent on vocabulary, and exposure to many words and their different forms.

Another component of Turkish morphological knowledge has to involve an understanding of the phonological properties of a word so as to choose the appropriate form of a suffix (e.g. to pluralise, use *-ler* for *ev* (home) but *-lar* for *okul* (school). This component is predicted to be closely related to phonological awareness because it requires distinguishing between different forms of the same suffix. In Turkish, phonological awareness develops fast, especially on word endings, so phonemes at word endings are more easily manipulated than those at the beginnings of words.

The Czech language has other interesting phonological and morphological features for comparison. In terms of phonology, Czech has a big variety and frequency of complex onsets relative to most other languages – 258 onset types (while only 32 in English). In addition, in normal speech there exists a set of prepositions of 1 consonant that combine with word onsets (as “clitics”; that is, unstressed words that are incapable of standing on their own and attach to a stressed word to form a single phonological unit). As a consequence, they increase the complexity of word onset structures (e.g. vlak (train) k vlaku→ [kvlaku] (to the train), z vlaku → [zvlaku] (from the train)). It is speculated that the increase of onset complexity may sensitise children to the separability of speech sounds. Studies comparing Czech, English-Canadian and Austrian-German children demonstrate that language-specific characteristics affect phonemic awareness in preliterate children. In comparison to Czech children, for example, English- and German-speaking children have lower levels of phonemic awareness of onsets. Importantly,

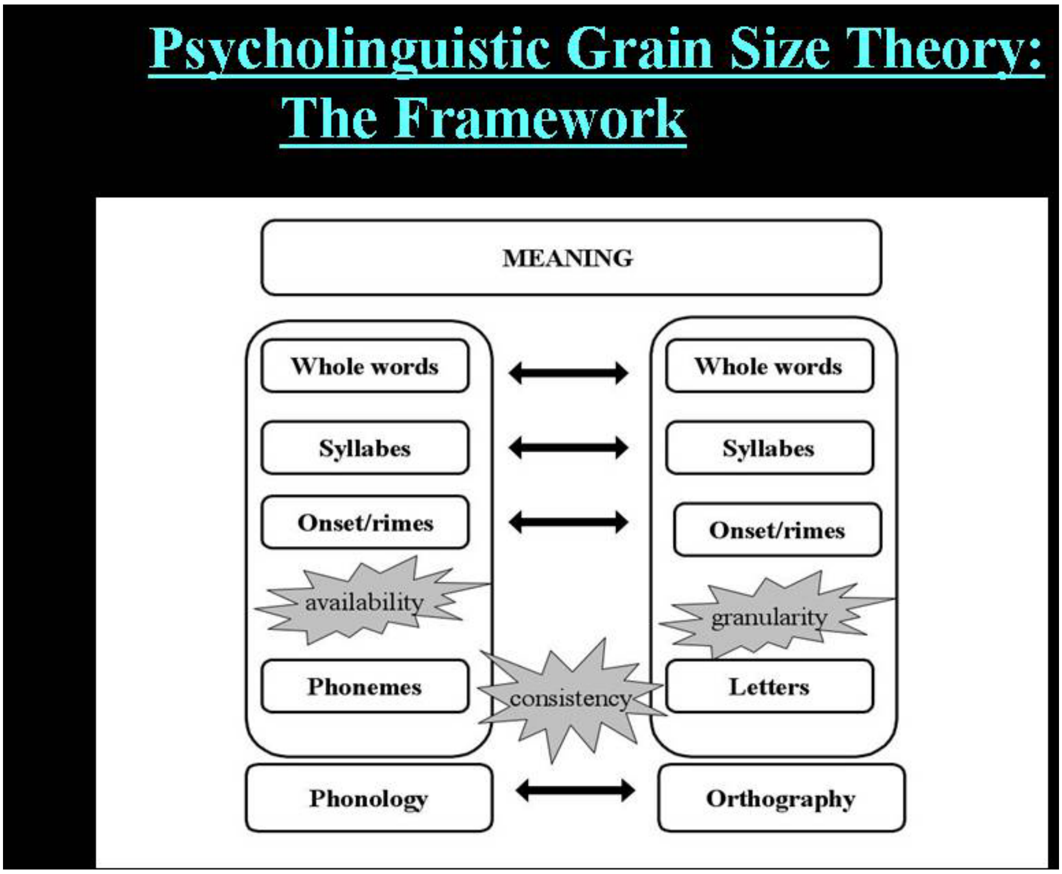
[4] In a study that presented proficient readers of Hebrew with pointed and unpointed print, the readers reported that they read faster in unpointed print. However, their self-perceptions were incorrect as the data showed just the opposite.

children from various linguistic and cultural backgrounds have shown moderate to good levels of phoneme awareness before knowing how to read and write.

Grain size theory

The psycholinguistic grain size theory proposes that because languages vary in the consistency with which phonology is represented in orthography, there are developmental differences in the grain size of lexical representations. It should be noted that as there are also accompanying differences in developmental reading strategies across orthographies, explicit reading strategies can influence the grain sizes that are used.

Figure 3.



The theory rests on the assumption that, during the development of reading, the word reading process is adapted to the orthography. In some orthographies, larger sublexical reading units are formed to resolve inconsistencies in grapheme to phoneme mappings. In other, more consistent, orthographies, this is not necessary.

Reading for meaning in any orthography primarily entails the recovery of the phonological information that is conveyed by the printed symbols. Any cross-language theory of reading should, therefore, focus on the ease or the difficulty of grapheme-to-phoneme computation given the consistency by which graphemic units represent phonological units in a given language. Ziegler and Goswami propose that reading in consistent orthographies involves small linguistic units, whereas reading in inconsistent orthographies requires the use of larger units, as well as smaller units. Hence, the grain size theory seems to present an improved and modern alternative to the Orthographic Depth Hypothesis (which historically emerged from the classical dual-route models). The clear advantage of grain size over dual-route theory is that it examines the size of the computed phonological units and thereby allows the use of a continuous measure rather than a dichotomous concept such as "lexical" or "prelexical" phonology.

As noted above, the reduced consistency of the English writing system shows that English is inconsistent in small letter units. It is, however, much less inconsistent with respect to larger reading units, such as rimes or syllables. This signals that English children may be developing recoding strategies at more than one grain size.

There are more orthographic units to learn when the grain size is big than when the grain size is small. For instance, in order to decode the most frequent 3000 monosyllabic English words at the level of the rime, a child needs to learn mappings between approximately 600 different orthographic patterns and 400 phonological rimes, far more than would be needed if the child could simply learn how to map 26 letters onto 26 phonemes. But relying solely on grapheme-phoneme correspondences leads to the inefficient recoding of English. In contrast, young learners of consistent languages can focus exclusively on the "small" psycholinguistic grain size of the phoneme without making many reading errors. Consistent feedback received in terms of achieving correct pronunciations will further reinforce the acquisition process. Psycholinguistic grain size theory takes these factors into account.

Psycholinguistic grain size theory was seen by this workshop to make a very important contribution to our understanding of literacy development, namely highlighting the importance of "developmental footprints in reading". Children's experiences with oral language and later explicit instruction about written language establish certain foundations for literacy. These foundations can vary depending on the characteristics of the language to which the children are exposed and these developmental footprints can be observed in the skilled readers of that language. The developmental footprint concept has three implications for research:

1. It emphasises the importance of studying literacy development not only in English, but also in other languages around the world. After all, the varying characteristics of languages (in terms of orthography, phonology, morphology and syntax) may require different paths to proficient literacy development.
2. In order to fully understand the cognitive underpinnings of skilled reading, the developmental footprints need to be considered.
3. The developmental paths towards skilled reading can also be surmised by observing atypical development patterns, as in dyslexia.

Lessons learnt from language reforms

Orthographic problems in languages may be compounded by the addition of foreign or newly created words, and changes in pronunciation over time[5]. The burden of these phonemic complexities must be borne by a limited set of alphabetic symbols. Historically, some language orthographies (e.g. Serbo-Croatian) have been purposely simplified.

[5] This also accounts, to a large extent, for differences in shallowness in languages. Languages that have been more recently coded into written script such as Finnish (where the first book was printed in 1488) are therefore more shallow than, for example, Old English, which dates back to 500 AD.

The Turkish language is another example of a language that has a very transparent orthography due to the alphabet reform which took place in 1928, replacing Arabic script with Latin and implementing a very systematic transparent writing system to represent phonological structure.

Apart from such examples of positive changes wrought by language simplification, when changes in methods of learning to read are brought about, these can be seen to sometimes have detrimental effects. One example of this occurred in Israel. In the early 1980s, the ministry of education adopted a policy of promoting "whole-language" as a favourite method for reading acquisition. With this method the conversion of small-size units was not taught, instead teaching focused only on connecting whole, words to meanings. The result was clear in national tests of reading performance in the late 1990s: more than 60% of children in the 6th and 7th grade failed to reach minimal scores in reading comprehension. *The Shapira Report* of 2000 noted that "Whole Language", as promoted by the Ministry of Education, was responsible to a large extent for the poor reading performance in Israel. Consequently, since 2001, new reforms in teaching reading have been implemented.

Whilst orthographies may contribute to reading difficulties, making changes in them would of course require immense political capital, and it is also evident that many cultures like to preserve their languages (and hence their orthographies) for nationalistic, idealistic or other reasons.

Differences in developmental Dyslexia in different orthographies

Developmental dyslexia is defined by the International Dyslexia Association/NICHD Research Definition of Dyslexia, 2002 as follows:

> "Dyslexia is a specific learning disability that is neurological in origin. It is characterised by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge".

While there is some debate concerning the different possible causes of dyslexia[6], several lines of converging evidence suggest that dyslexia is caused by a localised impairment in the phonological areas, the functional parts of the brain responsible for processing sound elements of language. According to this phonological model, dyslexia results from an impaired ability to segment spoken words into phonologic parts and link each letter to its corresponding sound. In individuals with dyslexia, phonemes are less well defined. Functional imaging studies have revealed a potential neural substrate for the phonological deficit thought to underlie dyslexia. There appears to be a disruption of two left hemisphere posterior brain systems, one parieto-temporal, the other occipito-temporal.

The experts in this workshop highlighted that dyslexia has more similarities than differences across countries, with the same phonological deficit. However, there appears to be an advantage

[6] Studies in Finland by Heikki Lyytinen have also shown that children born to families who have members or close relatives with dyslexia are at a highly elevated risk of reading problems, which indicates that there is evidence of a strong genetic component to this brain disorder.

for dyslexics in consistent orthographies. The grain size theorists suggested that the incidence of developmental dyslexia will be very similar across consistent and non-consistent orthographies, but that its manifestation might differ with orthographic consistency. They also suggested that the incidence of developmental phonological dyslexia will not be reduced in any simple way by coarse grain sizes, as phonological awareness of subsyllabic units may still be necessary for the acquisition of the characters or symbols used in course grain-size orthographies. The critical factor for predicting how dyslexia will manifest in a particular language is the transparency of the orthography; but other relationships between orthography and phonology may be important as well.

Although phonological awareness is a critical precursor of reading development, especially in alphabetic languages, a study on the phoneme awareness skills of Czech and English children with dyslexia, found that children with dyslexia in grades 3 to 7 experienced significant and persistent phoneme awareness difficulties regardless of orthographic consistency. One of the presenters demonstrated how, with slower dysfluent German dyslexic children, there is not (as with English dyslexics) a purely phonological deficit, but rather that it is accompanied and predicted by a deficiency in the rapid, automatised naming of visual stimuli.

What was made evident was that phoneme awareness is an equally important, long-term component skill of alphabetic reading (and spelling skills) in normally developing readers and in children with dyslexia, regardless of differences in orthographic consistency.

What brain research has to offer on language comparisons

Recent experiments examining lexicality effects, phonological priming, phonological/semantic trade-offs, and critical factors associated with adaptive learning in reading have yielded findings that allow a more refined picture of the functional neuroanatomy for reading development. Brain studies could tell us what the underlying neurobiological mechanisms associated with the development of reading competence in different orthographies are.

Haskins Labs in the United States are currently collaborating with Finland and Taiwan to develop a core set of behavioural and neurobiological experimental measures to be administered to comparable cohorts of children followed longitudinally in each country. These measures will include:

1. Behavioural tasks, conducted at key points in the course of reading development to measure the efficacy of linguistic representations, as well as to characterise general aspects of learning (e.g. rate and stability) for both verbal and non-verbal materials.
2. Neurobiological tasks to identify both the temporal (EEG) and spatial (fMRI) development of reading-relevant functional circuitry over the course of reading acquisition.
3. Computational modelling to help integrate our findings at each level of analysis into a unified cross-linguistic account.

A key focus in this study is on the development of reading specialisation in the LH ventral cortex, and the time course of this activation with reading development. The study will try to investigate whether the developmental course is similar across languages and whether delays in ventral specialisation are universally related to dysfluent reading across languages. The central neurobiological hypothesis is that the initial neurocircuitry for reading will show a good deal of language variation for typically developing children, but that with development a common circuit (with language-specific tuning characteristics) will emerge across languages; a second hypothesis is that for children with reading disabilities, in the absence of developing a fullyspecified ventral system, some of these early language differences will be maintained and will be associated with the failure to obtain rapid and automatic word identification skills.

To date, few cross-linguistic studies of literacy acquisition have employed well-matched longitudinal designs and samples, and none have yet included integrated neurobiological and behavioural measures. As a result, it has not been possible to identify universal versus language-specific aspects of skill acquisition by typically developing children and those with reading disabilities at the neurocognitive level of analysis; such knowledge is crucial to a full theoretical and practical account of reading acquisition and disability.

Neurobiologically-grounded computational models of reading development are needed to help make sense of complex brain/behaviour relations. Dutch studies have shown that reading accuracy is acquired quickly, but vast individual differences in fluency remain. Brain studies could provide illumination on these individual differences and more adequately account for language and/or individual differences.

A mediating level of analysis in linking behavioural variation to the genetic variation is critical for the future. As functional brain imaging is a descriptive tool, not explanatory, further multiple levels of analysis and a transdisciplinary approach are essential.

One potential problem to bear in mind with cross-language comparisons are socio-cultural differences across languages. For example, there may be differences in school systems, curricula, teaching methods and demographic distributions, so these aspects need to be taken also into consideration.

Conclusions & take home messages

Environmental factors should be taken into consideration

As reading ability emerges prior to reading instruction, home/background, cognition/metacognition (individual differences), schooling, and language are vital factors. Studies have shown that maternal education is a big predictor in literacy achievement.

Phoneme awareness

Phoneme awareness plays an important role in consistent and inconsistent systems over the course of development. When equivalent predictors are assessed, core component skills of reading and spelling are highly similar and strengths of their associations are very similar across alphabetic orthographies.

Phoneme awareness is a long-term predictor of reading problems in the earliest and the later stages of learning, and this also applies to dyslexia.

The development of reading in different orthographies appears to converge as lexical influences on the reading process increases, although some footprints of different developmental trajectories appear to remain.

The need for cross-language research

As 80% of reading research to date is from Anglo-Saxon countries, and because English is an inconsistent orthography, we do not have an accurate picture of the phonological decoding story. More cross-language comparisons are, therefore, needed. Brain imaging research could study systemic comparisons across languages.

The application of grain size theory

The grain size theory and morphological and orthographic transparency differences in languages emphasise the necessity for more cross-language and also longitudinal development research. Small grain size teaching works well in languages with consistent letter-sound correspondences, such as Italian, but less well in English. Hebrew, like English, uses a larger grain size for decoding.

Overall, the cognitive underpinnings of reading and writing ability in alphabetic orthographies seem to be remarkably similar, brain studies could highlight the similarities and individual differences.

Reading failure

Despite the fact that orthographic consistency affects the rate of reading acquisition, reading problems are common and quite similar across all languages. The universal hallmark is slow and laborious reading. Deficits in the use and representation of phonological information at various grain sizes seem to be the universal cause of reading problems in all languages. Brain imaging suggests that the similar neural deficits (underactivation of temporal brain regions in the left hemisphere) underlie dyslexia in all alphabetic languages, shallow as well as deep.

There is hard evidence that appropriate training has a normalising effect on the neurobiological trajectory in emergent "at risk" readers[7]. Neural systems are more plastic than previously believed: if the intervention targets the appropriate skills and is sufficiently intense to have an impact on the brain, reading difficulties can be reversed.

Non-alphabetical languages

As noted in this report, in alphabetical orthographies children are taught letter-sound correspondences, and gain phoneme awareness. However, in non-alphabetical languages, such as Chinese, children have to learn large numbers of characters by rote. Although this workshop examined differences in alphabetic languages only, it would be interesting to expand future cross-cultural linguistic studies to include non-alphabetical decoding and whether it poses a bigger neuronal challenge for these children, and to compare alphabetical and non-alphabetical readers. Recent brain research indeed suggested that in logographic systems writing skills might be a more important predictor for reading success than phonological awareness.

[7] Work by Heikki Lyytinen in Finland with a computerised intervention tool that works on the core phonological difficulties associated with dyslexia, has proven that this type of remediation is effective in providing preventive training for pre-readers at risk of developing dyslexia in Finnish. The researchers believe this method will work on less shallow orthographies and are working on adapting it into other languages accordingly.

The importance of developmental footprints on skilled reading

Traditionally, researchers have designed their experiments as though skilled reading was unaffected by reading and language development. Future research needs to construct critical manipulations that can track the mutual dependencies across these domains at different points in development and across different language environments. This is particularly important if the teaching of reading in different languages is to be informed by an effective evidence base.

This workshop could not go into the interesting question of transfer of reading skills from one language to another. In the globalised economy with many migrants in the school classroom, this is an important topic for future examination by OECD and will be proposed as an OECD-CERI project in its next programme of work.

Shallow vs non-shallow?

The studies so far undertaken in individual countries are building evidence for the hypothesis that shallow orthographies are a real advantage in terms of acquiring reading proficiency for both normal and dyslexic children. Countries with deep orthographies might possibly begin to consider the political and societal feasibility of implementing orthographic reforms.