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Extricating Reading Science From Entrenched Anglocentricism, Eurocentricism, and Alphabetism and Embracing Global Diversity: A Personal Journey

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Abstract

The following semi-autobiographical essay tells a cautionary tale about the entrenched Anglocentrism, Eurocentrism, and Alphabetism in reading and reading disabilities (dyslexia) research. Having been born, raised, and educated in an entirely monolingual English-speaking environment, I later migrated to a country where non-European languages (Hebrew and Arabic) were the linguae francae and, furthermore, written in a non-alphabetic script. Over the period of a decade or so, I gradually, and sometimes painfully, came to understand that I needed to revise or discard many of my Anglophone insights into reading and reading disabilities. The culmination of this "awakening" came with the writing of my Anglocentricities critique (Share, 2008), where I argued that the extreme ambiguity of English spelling-sound correspondence had confined reading science to an insular, Anglocentric research agenda addressing theoretical and applied issues with limited relevance for the majority of the world's literacy learners. I subsequently extended this argument to Eurocentricism and Alphabetism – the misguided belief that alphabets are inherently superior to non-alphabetic writing systems (Share, 2014). More recently, together with Peter T. Daniels, a linguist specializing in writing systems, I have been exploring writing system diversity and its implications for learning to read around the world (Daniels & Share, 2018). I hope my story will help raise awareness of the need to move our field a step closer toward embracing global diversity.

Keywords: reading, reading disabilities, learning disabilities, Anglocentrism, Eurocentrism, Alphabetism, writing systems

Growing up in an Anglocentric Bubble

I was born, raised, and educated in an entirely monolingual English-speaking environment. Although my parents spoke no fewer than 11 languages between them, English was the only common tongue in my family, and in London in the late 1950s and early '60s that was the only language I recall hearing. We moved to Sydney, Australia, when I was six years old, and although the local children made fun of my accent, English, once again, was the only language I heard at home, on the television and radio, around the neighborhood, and at school. There were sizeable Italian- and Greek-speaking communities in Sydney, but that was a distant part of a sprawling metropolis. I have no memories of exposure to any other (spoken) language.

In (Jewish heritage) Sunday school, I learned to decode Hebrew in preparation for my Bar-Mitzvah at age 13, but recitation, not comprehension, was paramount, so I had negligible understanding of what I was decoding. In fact, no one actually spoke Hebrew at the Sunday school. In high school, we briefly studied some "foreign" languages, including Latin, French, and German. I elected to study French and German for matriculation, but the status of "foreign" languages was so low, and the teaching so poor (I don't think our German teacher ever spoke German with us – perhaps he couldn't), that even after some six years of study, I still couldn't speak, read, or write either language at a basic functional level.

Academic Socialization in the Anglocentric Bubble

During my four-year undergraduate studies in psychology at the University of New South Wales, I don't recall ever hearing anything about L2 (second language), English as a Foreign Language (EFL), or bilingualism. My very first "experiment" (looking at the role of phonological recoding in young children's word reading) – my BSc Honors thesis – was carried out in a private Catholic school not far from the university. It never occurred to me to ask if the children (grades 3 and 6) were native English speakers/readers or bilingual, although it's quite possible that the teachers avoided sending me children who were not native English speakers. My PhD research, a large-scale longitudinal study of reading acquisition from kindergarten to grade 2, was undertaken in Geelong, in the state of Victoria – a smallish town of just over 100,000 residents. It never occurred to us that some of our sample of 543 children (Share, Jorm, Maclean, &

Matthews, 1984) might not be native-English speakers, perhaps bilingual, or perhaps had learned to read in a script other than English. It is quite possible there were no such outliers in our sample because Geelong, at least in the early 1980s, was considered to be a rural or "country" town, whereas "minorities" speaking "foreign" languages lived in the big cities like Melbourne and Sydney.

The first two years of my three-year post-doc were spent at Otago University in Dunedin, New Zealand, studying the now world-famous Dunedin longitudinal sample. This sample was a birth cohort – all the babies born in the local hospital during 1972-1973 – so all were native-born English-speaking New Zealanders. Again, I don't ever recall the question of bilingualism or additional languages ever arising in our research unit. Unlike the northern parts of New Zealand, I doubt there were any indigenous Maoris in this sample either. I was still in an Anglophone "bubble" studying monolingual English speakers learning to read their native English.

Unsurprisingly, my entire academic socialization/orientation, and all my own research in reading and reading disabilities, was entirely about monolingual English-speakers learning to read their native English. What's more, all our theoretical frameworks were exclusively focused on English. Max Coltheart's dual-route masterpiece (Coltheart, 1978) had burst onto the scene in 1978; the questions that empirical research into reading needed to address were: Were there two routes or one? Was phonology an essential or non-essential component of skilled word recognition? Was phonics or whole language the optimal method for teaching reading? And, back then (in the 1980s), phonemic awareness was fast becoming the hot topic in reading acquisition, culminating in Marilyn Adams' blockbuster, *Beginning to Read* (Adams, 1990).

First Steps Outside the Anglophone Bubble

After completing my post-doc, I migrated to Israel in 1988, taking an academic post at the University of Haifa. This was the Middle East (although a partly Westernized and Americanized version); Israelis spoke non-European Semitic languages – Hebrew and Arabic – and the writing wasn't the familiar Roman alphabet. As an aside, it's worth mentioning that almost all reading research that has addressed bilingualism, bidialectism, biscriptism, and multilingualism has been written by (primarily) mono-

lingual English speakers tackling the challenges of migrants from non-Anglophone countries arriving in English-speaking countries learning to speak and to read English.

I was different, here was an English-speaker arriving in a non-English-speaking country learning to be literate in a non-European language and script. I was embarking on an academic career unaware of the ramifications of these cultural, linguistic, and graphonomic differences (*graphonomy* is the latest name for the study of writing systems; Daniels, 2018). Such was my hubris that I made a bet with my friend and co-author Linda Siegel (the prominent Canadian LD researcher) that, within one year, my spoken Hebrew would be indistinguishably native. I not only lost the bet with Linda, but even now, 30 years later, my children enjoy poking fun at my faulty Hebrew. (It's grammatical gender that poses insurmountable obstacles for English speakers, at least late-learning ones like me!)

A reading researcher needs a solid grounding in the language and the writing system that children are learning to read. I expected this would take a year, perhaps two. I had allowed myself a full six months of intensive Hebrew studies before I commenced teaching (in Hebrew) at Haifa University. Looking back, I realize it took me more than a decade to understand the language and the writing system. From the very outset, colleagues at Haifa University in the reading field as well as Ministry of Education officials were gently reminding me that Hebrew is not quite like English.

One of my first research projects was to determine if phonemic awareness was relevant to Hebrew. I drew up a proposal for an experimental training study and submitted my request for ethical approval to the national supervisor of kindergartens. My proposal was promptly rejected, but the supervisor was considerate enough to invite me to discuss the proposal in person. She did her best to explain that phonological awareness in Hebrew is not the same as in English. I don't recall the specifics of her argument, but I came away confused and frustrated (although she was very obliging to this naïve young newcomer and granted the official approval I needed to carry out my Anglocentric study). I now understand that neither Hebrew nor Arabic phonological awareness (PA) can be regarded as a linear "string" of phonemes in the same way that the letters in the Roman alphabet you are now reading line up neatly in a single row.

Other colleagues, such as Zvia Breznitz (2006) and, later, Tami Katzir were talking about the construct of fluency the "neglected" aspect of reading (Allington, 1983) that was "rediscovered" in the National Reading Panel Report (2000). All our reading measures in both Australia and New Zealand were accuracy measures such as the Burt Word Reading Test. There was one speed/rate measure in the Neale Reading Analysis (Neale, 1999) that assessed text reading errors, passage reading time, and comprehension. But for single-word reading, all our measures were accuracy alone, which made perfect sense for a language in which a list of words ranging from short, high-frequency words to long low-frequency irregular words discriminates all levels of reading ability – from novices through to experts – and where no one reaches ceiling!

In the Deakin longitudinal study (Share et al., 1984), we developed a list of "sight words" – simple high-frequency words – and a list of pseudowords, but recorded only reading accuracy, not rate/time. And, in the course of numerous publications submitted to British, Australian, and U.S. journals (every one, of course, Anglophone), no reviewer questioned our reliance on word reading accuracy alone or asked to see what predicted word reading *rate*. Studies in more regular orthographies, on the other hand, typically rely on measures of reading rate or fluency rather than accuracy for the simple reason that after grade 1, children reach near-ceiling levels of accuracy. Generations of English-speaking dyslexics have been diagnosed with the Wide-Ranging Achievement Test (WRAT) (Jastak & Wilkinson, 1984) and/or the Woodcock Word Attack measures (Woodcock, McGrew, & Mathers, 2000) and the reading disability/dyslexia status determined solely on the basis of word reading accuracy. This is finally changing with the availability of the TOWRE (Torgesen, Rashotte, & Wagner, 1999) and the DIBELS (Kaminsky & Good, 1998).

First Misgivings

At a symposium chaired by the prominent Australian LD researcher Brian Byrne on the topic of universal and language-specific aspects of developmental dyslexia held at the International Congress of Psychology in Stockholm in 2000, I presented some of these "misgivings" in a talk entitled *Confessions of an ex-Anglocentric Reading Researcher*. My presentation was not well received. But undeterred, I eventually wrote up these ideas in my Anglocentricities critique in 2008, arguing that much of the then-current theoretical and applied research in our field was driven by an insular Anglocentric research agenda preoccupied with the challenges posed by the extreme ambiguity of English spelling-sound correspondence. As a consequence, I suggested that the Anglophone literature may have only limited relevance for other languages

and orthographies. In the following, I return to the arguments raised a decade ago, updating and refining a number of the points.

The Coltheart/Baron version of dual-route theory. In my 2008 critique, I began by noting that the classic Coltheart/Baron dual-route model (Baron & Strawson, 1976; Coltheart, 1978) was originally a response to the challenges of correctly pronouncing irregular words such as *was, some, yacht,* and *choir* because applying spelling-sound rules (GPCs) (in English) will result in an incorrect ("regularized") pronunciation. Hence the need for a second mechanism or "lexical" route that circumvents reliance on rules.

Many authors have re-interpreted (indeed *mis*interpreted) dual-route theory in a somewhat less Anglocentric way, proposing (erroneously) that the two routes represent phonological vs. orthographic mechanisms. However, as I clarify in the 2008 paper, this was not Coltheart's concern. Nor was it his intention to draw a distinction between familiar and unfamiliar word strings. Indeed, he clearly and knowingly eschewed the older familiar/unfamiliar distinction, "this is not quite the right distinction, at least for English" (Coltheart, 2005, p. 205).

As noted by Ziegler and Goswami (2005), many, indeed most, alphabetic writing systems are highly regular (at least from spelling to sound [e.g., German or Spanish]), and have few irregular spellings, so who needs a second route? The focus on regular spellings (pronounceable via rules) as opposed to irregular spellings (inaccessible to the rules) diverted attention away from the original familiar vs. unfamiliar distinction which, I maintain, is a crucial and overarching dualism relevant to all words in all possible orthographies. This is the developmental, item-based unfamiliar-to-familiar dualism that was briefly outlined in Share 2008 and further elaborated in Share [2019]; it draws a distinction between a slower, effortful, serial, letter-by-letter reading process in the case of unfamiliar words and a rapid, effortless, holistic, one-step process for reading familiar words. Furthermore, there is evidence that this dualism is a universal property of learning to read (Share, 2019).

Preoccupation with accuracy and neglect of rate and fluency. The fact that accurate pronunciation of "irregular" spellings permeates all levels of the English lexicon may explain the preoccupation with (oral) reading accuracy and the relative neglect by researchers and educators alike of the question of reading rate and fluency (at least until the National Reading Panel Report, 2000). Even Wolf and Bowers' (1999)

double-deficit model of dyslexia (which foregrounded reading fluency and not just reading accuracy) was probably on the sidelines of dyslexia research owing to the Anglocentric preoccupation with accuracy. As discussed below, the focus on accuracy profoundly influenced definitions of reading disability/dyslexia (Lyon et al., 2005). As I noted above, the only word reading tests I was aware of in my academic socialization were accuracy measures, such as the Burt, WRAT, and Woodcock. It was only the recent Anglicization of European fluency measures such as the Dutch One-Minute Test (Brus & Voeten, 1973), reincarnated as the TOWRE, that finally brought reading fluency into the classroom and clinic, and still our field debates the nature of fluency and automaticity. So it appears that the overwhelming problems of reading accuracy in English helped shackle the study of fluency and its operationalization.

It is now common knowledge among reading researchers that in regular orthographies, accuracy reaches ceiling performance early, and reading speed/fluency becomes the critical measure for assessing individual and developmental differences. The case of adult English-speaking dyslexics reinforces this picture. Like young German-speaking dyslexics, English adult dyslexics make relatively few accuracy errors, but a slow reading *rate* is the essential sign of dyslexia, and perhaps also late-acquired L2 English. My own late-acquired L2 Hebrew reading accuracy is fine, but I read a single page of Hebrew in about the same time it takes a native speaker to read three pages.

The special problems of pronouncing irregular English spellings may also have biased our field toward oral reading measures at the expense of (rapid) silent reading, which, of course, is the true benchmark of skilled word and text reading. I must admit that there are other (historical and pedagogical) reasons for the bias toward oral as opposed to silent reading, but it seems fair to say that English spelling irregularity did not help to remedy the oral reading bias.

Phonological awareness: Rethinking the linear Anglocentric/alphabetic "string-of-beads" view. It is now universally accepted that awareness of the phonological units in speech that are represented in the written symbols (whether phonemes, sub-syllabic units, or whole syllables) is crucial for learning to read, although the strength and timing of the reading-PA connection may vary across orthographies. However, the Anglophone literature has promoted a very particular notion of PA, one that I call a linear, "alphabetic" "string-of-beads" view. Much like the letters in English spellings, neatly sitting in a row like a string of beads,

the Anglocentric view of phonological awareness depicts each of the sounds in a spoken word (phonemes) as strung along a single (acoustic) axis, thereby promoting the view of PA as awareness of a (linear) string of (discrete) phonemes. But many writing systems exhibit substantial non-linearity (Daniels & Share, 2018), or rather multilinearity with multiple axes. Even in many European alphabets (e.g., French and German) and non-European alphabets such as Vietnamese, extra-lineal diacritics are common.

Beyond Europe, non-linearity is a fundamental feature of most non-alphabetic scripts such as Semitic abjads – Arabic and Hebrew, Brahmi-derived Indic abugidas (also called *akshara* scripts or alphasyllabaries), and Chinese characters, which are found not only in Chinese, but also in Korean and Japanese. Phonological awareness in these scripts both reflects and reinforces a non-linear conceptualization of PA. For example, Hebrew and Arabic have a very different phonological structure (primarily "core [CV] syllables" plus consonantal phonemes) that calls for a different non-alphabetic (and non-linear) approach to the question of PA and instruction.

The late Professor Dina Feitelson, a distinguished Israeli reading teacher and researcher in my department at Haifa, vehemently asserted that these core syllables (called *tserufim* in Hebrew) should be taught to beginning readers in first grade. According to Feitelson, the combinations of consonant and appended vowel signs, which form an integral unit in the *vertical* (not horizontal) dimension, were an *indivisible* unit, hence teaching children to divide the word *bag* into three units, /b/ /a/ /g/, made no sense pedagogically in Hebrew and (by extension) Arabic.

Similarly, Buckley (2018) makes a strong case that not only Hebrew and Arabic but almost all so-called syllabic or moraic scripts represent core syllables. In the Brahmi-derived Indic abugidas of South and Southeast Asia or askhara scripts, syllabic awareness, not phoneme awareness, is crucial in the initial years of learning to read; only later, around grade 5 does awareness of individual phonemes become a necessity (Nag, 2017; Share & Daniels, 2014). As for Chinese, the initial/final (C/V, C/VV/, CVC) subdivision of the Chinese syllable (not to be confused with the controversial onset-rime notion debated in the Anglophone literature) (Goswami & Mead, 1992; Nation & Hulme, 1997) is also at odds with the linear string-of-beads view of PA.

The definition and diagnosis of reading disability and the wait-to-fail model. Definitions of dyslexia in the English-speaking world have traditionally been operationalized with measures of ac-

curacy, specifically oral reading accuracy (see, e.g., Siegel, 1999; Stanovich, 1999). Writing on this topic, Lyon and colleagues (2005) noted,

> [R]eading fluency is rarely assessed in current identification procedures … Slow-reading students who score within the average range on both the untimed reading measures and the IQ/test will typically be denied services because there is no discrepancy – even though they also have a disability that requires specialized services and/or accommodations. (p. 267)

It was only around the turn of the 21st century that learning disabilities (LD) researchers recognized that reading fluency and not just accuracy was a crucial aspect of reading disability (RD) and began to incorporate fluency into definitions of RD/dyslexia (American Psychiatric Association, 2013; British Psychological Association, 1999; Lyon, Shaywitz, & Shaywitz, 2003).

It has long been considered common knowledge (perhaps myth) that it takes three years to learn to read English before children can read to learn (Chall, 1983; Singer, 1978). We now know that in "normal" alphabetic orthographies, it takes only a single year to master the basics of decoding (Seymour, Aro, & Erskine, 2003). The same applies to the highly regular pointed Hebrew and *mashkul* Arabic (Saiegh-Haddad, 2018; Share, 2017).

The unusually prolonged phase of learning to read in English was institutionalized in the British and Australian systems in the form of the infants school – kindergarten to grade 2. If the child was deemed "ready," s/he graduated to the primary school – grades 3 to 6. Accordingly, grade 3 was considered the appropriate time to establish remedial reading centers on the premise that until that point a child was still learning to read, so earlier identification of a reading difficulty would be premature. I have wondered whether the traditional reluctance to "intervene" earlier than grade 3 might be attributable to the well-entrenched belief in the three-year learning-to-read phase. The IQ-reading discrepancies and two-year gaps required to diagnose an RD all seem to match this model, hence the wait-to-fail model (Lyon et al., 2003) may be yet another casualty of the complex spelling-sound system of English.

Reading development: Stages and phases. Models of word reading acquisition developed by English language researchers almost invariably include one or more phases, or stages, in which the novice

reader is unable to exploit all the grapheme-phoneme information available in a printed word, relying instead either on partial letter-sound cues (e.g., the initial letter or initial and final letters, often in conjunction with contextual cues) or on purely global visual information, such as word length and envelope, or salient visual (non-phonological) features of selected letters. The best-known terms for these stages or strategies are *partial alphabetic* (Ehri, 1995) and *logographic* (Frith, 1985). These phenomena appear to be a product of an unusually protracted period of early reading development jointly attributable to encouragement of early literacy during the preschool years followed by a prolonged period of code learning. In many more regular orthographies, these phenomena appear to be far less prevalent (see, e.g., Landerl, 2000; Wimmer & Hummer, 1990).

Reading instruction. Much of the debate on methods of reading instruction has centered on the "villain" of spelling-sound irregularity (Snow & Juel, 2005). The complexities of English spelling and the difficulties of decoding have been prominent in whole language theories of reading (Smith, 1978). In regular alphabets, phonics instruction is typically the dominant approach with less or no emphasis on "preparatory," "early," or "emergent" literacy activities such as letter knowledge (see Share, 2008, pp. 601-603).

Has the Field Moved Forward?

The Anglocentricities paper (Share, 2008) was conceived two decades ago, and the published version is now over a decade old. Is our field less Anglocentric today? Yes and no. There has unquestionably been important progress toward developing a more wide-angled perspective on reading and RD. A growing proportion of theoretical and empirical work is addressing basic issues in languages and orthographies other than English or Western European languages (e.g., Joshi & McBride, 2019; Saiegh-Haddad & Joshi, 2014; Verhoeven & Perfetti, 2017; Verhoeven, Pugh, & Perfetti, 2019).

However, the theoretical and applied frameworks developed for English are still all too often generalized to other languages and writing systems without due consideration for linguistic and writing system diversity. Almost all publications by English-language researchers continue to omit any "… in English" qualification in the titles of their papers – *A New Whiz-Bang+++ Model of Learning to Read … in English?* – as if the results of studies conducted in English alone enjoy the privileged status of universal applicability, unlike researchers investigating other languages, who are obliged to qualify their findings by adding the … *in Chinese/Arabic/Korean,* etc., disclaimer that automatically demarcates the findings as language-specific and hence not necessarily universally applicable. But Anglocentrism is not the only form of ethnocentrism in our field. There is another obstacle to progress, which I call Alphabetism, itself an expression of Eurocentrism.

Eurocentrism and Alphabetism

When reading researchers today seek enlightenment on the subject of writing systems, they look to Gelb (1952), the founding father of the field of grammatology, now relabeled *graphonomy*. Like Taylor (1883) before him, Gelb (1952) was a proponent of an evolutionary view of writing systems history, from "primitive" pre-alphabetic systems to the venerated alphabet. Consistent with the "ontogeny recapitulates phylogeny" idea, Gelb's inexorable "three great steps [logographic-to-syllabic-to-alphabetic] by which writing evolved from the primitive stages to a full alphabet" (p. 203) was embraced by almost all reading researchers, despite its repudiation by recent scholarship in the field of writing systems research (Coulmas, 2009; Daniels, 1992, 2018; Mattingly, 1985; Olson, 1994; Rogers, 2005).

It needs to be pointed out, however, that the "culture" of Alphabetism, like culture in general, is often invisible; that is, its presence is more often discernible in acts of omission than commission. Nonetheless, this alphabetic bias is ubiquitous, and is manifest in the following:

1. Unqualified generalizations about reading across languages and/or across orthographies in papers that refer almost exclusively to English or to European alphabets (see, e.g., Caravolas et al., 2013; Ziegler et al., 2010; Ziegler & Goswami, 2005).

2. Implicit or explicit acceptance of Gelb's evolutionary theory in leading texts on reading development aimed at educators,

    Taking the final step toward the creation of a true alphabetic writing system, the Greeks assigned a symbol to each consonant and vowel of their language … In many ways, the individual development of the children who are discovering the alphabetic principle in English writing recapitulates human history. (Moats, 2000, pp. 82-83)

3. Continued reiteration of Gelb's views in even the most up-to-date and authoritative texts on the psychology of reading (e.g., Dehaene, 2009; Rayner, Pollatsek, Ashby, & Clifton, 2012).

> [I]n an evolutionary sense, the alphabet is the "fittest ..." (Rayner et al, 2012, p. 37)
> The history of writing suggests a clear evolutionary trend ...These systems evolved to a logographic system, which in turn evolved to syllabic systems and finally to alphabetic systems ... Such an evolutionary argument suggests that alphabets are fitter (in the Darwinian sense). (Rayner et al., 2012, pp. 46-47)

4. Reference to non-alphabetic systems as imperfect or defective (e.g., Hannas, 2003; Rayner et al., 2012).

> The Semitic writing systems ... and the languages of India still incompletely represent vowels (Rayner et al., 2012, p. 36) ... In this sense, many of these scripts are not fully alphabetic. (Rayner et al., 2012, p. 37
> The Phoenician system, however, was not perfect. It failed to represent all vowels ... It was the Greeks who finally created the alphabet as we know it … For the first time in the history of mankind, the alphabet allowed the Greeks to have a complete graphic inventory of their language sounds. (Dehaene, 2009, p. 193)

Moving slightly further afield, consider what one eminent sociolinguist wrote about the marvels of alphabetic writing.

> The basic difference between Western alphabetic and East Asian syllabic writing acts on several levels to promote or inhibit creativity, particularly that associated with breakthroughs in science … syllabic literacy entails a diminished propensity for abstract and analytical thought … Certain Asian characteristics credited with blocking creativity, such as conservative political and social institutions and group-oriented behavior, derive in part from effects that the orthography has had on the minds of individuals. (Hannas, 2003, p. 203)

5. The use of alphabetic terminology (e.g., *letters, graphemes*) to describe and label the functional architecture (and even the anatomical brain structures) of reading (letter detectors, letterbox area, universal letter shapes; Dehaene, 2009) purported to be universal in reading. Whereas the concept of a letter (or grapheme) is widely used (but not entirely unproblematic) in European alphabets, it has questionable applicability to many writing systems, including Chinese characters, Japanese Kanji, Brahmi-derived Indic ak-

sharas or Mayan glyphs. Even the notion of the phoneme as the fundamental unit of analysis of speech may be an artifact of West European alphabetic literacy (Daniels, 2018).

As a postscript to this section on Eurocentrism and Alphabetism, it is worth keeping in mind that the alphabet, a uniquely European creation, was first disseminated throughout Europe with the spread of Christianity, then across the globe by European colonizers, traders, and, above all, missionaries, who never thought to question whether their own writing systems would be optimal for non-European languages. They took it for granted that the ideal orthography was alphabetic, operating on the principle of one letter for one sound (phoneme) for both consonants and vowels under the motto "consonants as in English, vowels as in Italian" (Gleason, 1996).

But are alphabets optimal? The evidence is still too scarce to make a call, but there are several lines of counter-evidence (reviewed in Share, 2014) converging on the conclusion that syllable-based writing systems are, in many cases, superior to alphabets. And we can hardly ignore the recent 2018 PISA (Programme for International Student Assessment; Organisation of Economic Co-operation and Development [OECD], 2019) results showing that the Chinese topped the international league tables in reading comprehension.

Embracing Global Diversity

Some years ago, one of my PhD students brought to my attention a volume on *The World's Writing Systems* (Daniels & Bright, 1996). It was a revelation for me: I couldn't put it down – all 900 pages! It remains the world's most comprehensive and authoritative exposition of the world's writing systems – a work that is surprisingly un-encyclopedic in the way it weaves a coherent narrative throughout a 900-page mosaic. Mid-way through reading this volume, I got an email from none other than Peter Daniels asking if I would be interested in writing a chapter on literacy across orthographies for a revision of *The World's Writing Systems.* Daniels opened the door to an entire world of writing systems – ancient, modern, exotic. I came to understand that any theory about how children learn to read and write requires a deep understanding not only of the language, but of the particular writing system.

Learning about the amazing diversity of writing systems (compare Ogham, Mayan, and Arabic), I came to appreciate that a majority of children around the globe do not learn to read in European languages and

alphabetic scripts. And, furthermore, only a small minority are monolingual speakers learning to read their native tongue.

Dissatisfied with the one-dimensional approaches to orthographic variety (*Orthographic Depth*, Katz & Feldman, 1981; Katz, & Frost, 1992; Frost, 2005; and *Psycholinguistic Grain-Size Theory*, Ziegler & Goswami, 2005), which dwell almost exclusively on spelling-sound irregularity and ignore many other important dimensions of orthographic complexity, Daniels and I began exploring the implications of writing system variation for theories of learning to read and dyslexia. Building on a set of five dimensions originally presented by Daniels at a workshop in Haifa in 2012, we expanded this set to 10 dimensions of orthographic complexity, summarized below, each of which is liable to create obstacles for the learner.

1. *Linguistic distance*
   Possibly the most potent factor in learning to read across the globe, *linguistic distance,* refers to the situation in which the language or dialect spoken by the literacy learner is not the same as the language of written texts. The dimension of linguistic distance may be regarded as a continuum of varying degrees of spoken/written divergence. This ranges from the extreme case of speakers of one language learning to read in a totally different language (such as Arabic speakers learning to read in English or French), through diglossic situations, in which two distinct varieties of the same language exist side by side in a single speech community but are used for different purposes. Alongside a low-prestige everyday conversational dialect (or dialects), there exists a high-prestige, typically grammatically more complex variety used in formal spoken settings and, in the case of literate communities, written settings. Dialect variation (such as African-American Vernacular English [AAVE]) represents yet another case of linguistic distance.

   The evidence is overwhelming that linguistic distance has a profoundly detrimental impact on learning to read (August, Shanahan, & Escamilla, 2009; Gatlin & Wanzek, 2015; Myhill, 2009; Saiegh-Haddad & Schiff, 2016).

2. *Non-linearity*
   In many scripts, symbols are not arrayed along a single axis. Extra-lineal diacritics are found in many European alphabets, but in non-alphabetic scripts, symbols commonly appear above, below, within, or even surrounding, other symbols. We know very little about the implications of different

forms of non-linearity. In Devanagari, for example, a noninitial /i/ is written *before* the consonant after which it is pronounced, and this non-linearity appears to create problems for the learner (Kandahai & Sproat, 2010). In some scripts, characters are nested in syllabic units such as Indic aksharas and Korean syllable blocks, which may facilitate reading acquisition (at least initially) by obviating the need to access phonemes.

Chinese semantic-phonetic character compounding typically positions the semantic component to the left of the phonetic, but this component can also appear to the right, above, below, or surrounding the phonetic. Learning the many positional regularities (and exceptions) of a script would be expected to tax visual-spatial skills.

3. *Visual confusability*
   The shapes of individual letters and characters in scripts – their ductus – represent another neglected aspect of orthography that has been shown to impact symbol discriminability, learnability, and processing speed. Visual complexity has been shown to contribute significantly to variation in symbol learning among beginning readers (Nag, Snowling, Quinlan, & Hulme, 2014) and to processing speed among skilled adult readers (Chang et al., 2018; Pelli et al., 2014).

4. *Historical change: Retention of historical spellings despite pronunciation change*
   Any living language is constantly changing, but orthographies are altered or reformed only occasionally, if at all. If not realigned, pronunciation will drift further and further away from spelling over time. (This is a prime cause of what Liberman et al. [1980] labeled *orthographic depth*, as well as of Ziegler and Goswami's *inconsistency* and Coltheart's dual-route *irregularity*.) This category includes two subtypes: words spelled the same but pronounced differently (*bough/cough/dough/through/tough*, which once all rhymed), as well as words spelled differently but pronounced the same (*meet/meat/mete*). Even many "shallow" scripts often have multiple options for spelling sounds (e.g., Spanish). In most orthographies, sound-to-spelling consistency is typically more complex than spelling-to-sound consistency, with the result that spelling is typically more challenging than reading.

5. *Spelling constancy despite morphophonemic alternation*
   In many writing systems, another source of spell-

ing-sound and sound-spelling inconsistency is morphophonemic: namely, the orthography does not change when either morphemes or phonemes undergo conditioned alternations: /haws/ *(house)* becomes /hawz/ when the plural suffix is added, but the spelling does not change *(houses)*.

6. *Omission of phonological elements*
   In most writing systems in which phoneme-level information is explicit or potentially extractable, consonant representation often takes precedence over vowel representation (consider English abbreviations and text messaging), probably because consonants are less predictable and convey more information about lexical identity (see Adams, 1990; Gnanadesikan, 2017; Shimron, 1993). In Brahmi-derived Indic abugidas, the most common (default) vowel is not explicitly marked in post-initial positions but is inherent in all simple consonant aksharas. In Hebrew and Arabic, many or most vowels are normally not written, creating extensive homography. And in many languages, stress is not marked *contráct* (v.)/*cóntract* (n.). For example, the four accent marks that designate the four tones of Mandarin Chinese in pinyin romanization are hardly ever written, yet tonal awareness has been shown to differentiate good and poor readers in mainland China (Ding, Liu, McBride, & Zhang, 2015). In many African tone languages, especially those in which tone carries a high functional load, good and poor readers alike struggle with the lack of tone marking in the Roman orthographies imposed by the Europeans (Coulmas, 1989; Roberts, Walter, & Snider, 2016).

7. *Allography*
   Many upper- and lowercase letter pairs in English are identical (Ss, or near-identical Ff), but others (Ee, Bb, Gg) seem unrelated. In Indic scripts, initial forms of vowels can differ considerably from post-initial forms (*matras*). Similarly, many Indic consonant ligatures (see Dimension 9) may not all be readily recognizable as allographs of the full, unreduced radical. For example, in Chinese, many of the some 200+ semantic radicals assume reduced forms when juxtaposed in semantic-phonetic compounds. In Arabic, it is commonly assumed that many letters alter their form depending on their position in a word (initial, medial, final, and separate). For many sets of allographs, the common letter form is easily discerned, for others the similarity is harder to discern, and for some, the letters seem entirely unrelated.

8. *Dual-purpose letters*
   In Semitic scripts some letters serve multiple purposes, representing either a vowel or consonant. For example, the letter H in English serves as both a consonant and a diacritic in the digraphs (th, sh, ph, wh, ch).

9. *Ligaturing*
   Ligaturing, the joining of letters, is often considered a source of difficulty in a number of scripts (e.g., Arabic and Indic scripts). Whereas in Arabic, ligaturing usually involves letter shapes augmented by the addition of connecting strokes, ligaturing may also involve diminished or reduced forms, as in Indic scripts. Consonants can be ligatured horizontally, or vertically, sometimes with identifiable components but sometimes with unpredictable modifications.

10. *Inventory size*
    The difference between scripts in the total number of letters or characters has been termed by Nag (2007) the *contained-extensive* dimension of writing system variation (also *orthographic breadth*). The number of characters in phonemic writing systems (alphabets and abjads) are typically in the region of a few dozen, but if Indic consonantal compounds or the Korean syllable blocks are taught and learned (at least initially) as undivided wholes, then they number in the hundreds. The many thousands of Chinese characters reduce to some 200 radicals/semantic components and 700–800 phonetic components.

Summary

This multidimensional framework is no more than a starting point for discussion of writing system diversity. Other dimensions may need to be added, or perhaps some can be coalesced. It might be possible to reduce all 10 dimensions to a three-dimensional framework based on (a) visual-orthographic factors, (b) phonology, and (c) morphology/meaning. This scheme also suggests that any one script's complexity may be a unique combination of some or all of the 10 dimensions above. This explains why a script (e.g., Arabic) might have near-perfect spelling-sound consistency – a presumably "shallow" or "transparent" script – yet be complex for very different reasons. At the very least, the proposed 10 dimensions make it clear that a one-dimensional (one-size-fits-all) approach is untenable once we move beyond European alphabets.

Concluding Remarks

In the age of globalization and the internet, falling borders and barriers have revealed a remarkable panoply of cultural, linguistic, and script diversity. Western monolingual Anglophone reading science, which has dominated reading research until recently, is now waking up to the fact that most of the world does not speak English or any other European language, is not monolingual, and, furthermore, does not become literate in an alphabetic script. Nor is there compelling evidence that this uniquely European creation – the alphabet – is inherently superior to other non-alphabetic writing systems. Western reading science has made undeniably significant advances, but we cannot indiscriminately generalize our theories and findings to other languages and writing systems. Current one-dimensional frameworks for conceptualizing the challenges of learning to read across languages and orthographies (e.g., *orthographic depth* and *psycholinguistic grain-size theory*) need rethinking. Consideration of the full spectrum of the world's writing systems reveals multiple dimensions of orthographic complexity, each liable to create obstacles for children learning to read and write. The time has come to extricate reading science from entrenched Anglocentricism, Eurocentricism and Alphabetism and embrace global diversity.

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