

## *Chapter 1*

# ***An Introduction to Researching Second Language Writing Systems***

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Over the past ten years, literacy in the second language has emerged as a significant topic of enquiry in research into language processes and educational policy. This book provides an overview of the emerging field of Second Language Writing Systems (L2WS) research, written by researchers with a wide range of interests, languages and backgrounds, who give a varied picture of how second language reading and writing relates to characteristics of writing systems (WSs), and who address fundamental questions about the relationships between bilingualism, biliteracy and writing systems. It brings together different disciplines with their own theoretical and methodological insights – cognitive, linguistic, educational and social factors of reading – and it contains both research reports and theoretical papers. It will interest a variety of readers in different areas of psychology, education, linguistics and second language acquisition research.

### **What this Book is About**

Vast numbers of people all over the world are using or learning a second language writing system. According to the British Council (1999), a billion people are learning English as a Second Language (ESL), and perhaps as many are using it for science, business and travel. Yet English is only one of the second languages in widespread use, although undoubtedly the largest. For many of these people – whether students, scientists or computer users browsing the internet – the ability to read and write the second language is the most important skill.

The learning of a L2 writing system is in a sense distinct from learning the language and is by no means an easy task in itself, say for Chinese people learning to read and write English, or for the reverse case of English people learning to read and write Chinese. Italian learners of English still face the problem to some extent since, even if both English

and Italian are written with the Roman alphabet, they are read and spelled in different ways. When L2 learners become fully-fledged L2WS users, they still differ from native users of the target writing system. From one perspective, they are less efficient than first language writing system (L1WS) users; they are slower at reading the second language than people who read only one writing system and often have problems with comprehension and memorising due to inefficient decoding. From a more positive perspective, they are simply different from L1WS reader-writers of the target writing system, with different reading and writing processes that result from the interaction of previously developed reading and writing processes with the characteristics of the new writing system. Not only do L2 researchers and teachers need to bear in mind these differences between L1 and L2 users of writing systems but so do those working in the psycholinguistics and neurolinguistics of reading and writing.

Research on L2 writing systems is at present scattered across different research areas within applied linguistics, psycholinguistics and other disciplines. This book aims to present this interdisciplinary research area to students, teachers and researchers in different fields of second language acquisition or writing system research. This introduction sketches the common background and terminology of writing systems research in general, concentrating on the cross-linguistic aspects, as a basis for outlining some of the previous achievements of L2WS research. It provides an introduction to the whole of this field, for those who are unaware of its scope and achievements, as well as to the papers in this volume. It is intended partly as a reference source that readers can go back to while reading the following chapters.

## **The Nature of Writing Systems**

Before looking at how L2WSs work, we first need to establish the basis for the concept of writing system itself. This section provides an overall view of writing systems, together with some of the crucial terms. First we outline the major types of writing system in terms of the meaning-based versus sound-based division, then the variations in sound-based systems, particularly in terms of phonological 'transparency'. Next we outline some other variable characteristics of writing systems relevant to their acquisition and use. More detailed accounts of writing systems can be found in Coulmas (1989, 2003), Cook (2004a) and Sampson (1985).

### **What is a writing system?**

The term 'writing system' has two distinct meanings, one attached to general ideas of writing, one to specific languages. In the first sense, a writing system is 'a set of visible or tactile signs used to represent units

of language in a systematic way' (Coulmas, 1999: 560). The various types of writing system are primarily distinguished by the type of linguistic unit represented, whether consonants (consonantal WSs), morphemes (morphemic WSs), phonemes (alphabetic WSs) or syllables (syllabic writing systems).

In this general sense 'writing system' is related to the terms 'script' and 'orthography'. A 'script' is 'the graphic form of the units of a writing system' (Coulmas, 2003: 35), that is to say, its actual physical form – letters, characters, or whatever. For instance, the Roman alphabet is a script, it is one of the actual physical forms of alphabetic writing systems. A particular type of writing system may in fact employ very different scripts. Alphabetic writing systems take many forms, say, the scripts used in Devanagari, Greek, Cyrillic or Roman alphabets. 'Orthography' on the other hand is the set of rules for using a script in a particular language (e.g. the English or Italian orthography for the Roman alphabet), such as symbol–phoneme correspondences, capitalisation, hyphenation, punctuation, etc. For instance, the Roman alphabet letter <j> is read as /dʒ/ in the English orthography and as /j/ in the Italian orthography. The same script may instantiate orthographic rules of different languages: the Roman alphabet is used in different ways in the English and Italian orthographies.

The second sense of 'writing system' overlaps with orthography by referring to the set of rules employed in a particular language for spelling, punctuation etc, namely 'the English writing system', 'the Japanese writing system', and so on. 'In this sense a writing system is language specific' (Coulmas, 1999: 560). The writing system for a language may include more than one script or general writing system type, as in the Japanese combination of kanji characters, kana syllabic symbols and Roman alphabet script. While Japanese is often considered the classic example of a mixed writing system, writing systems of other languages also have elements of other types nestling within them. For instance, English, which is primarily alphabetic, contains syllabic symbols, as in <c u l8er> ('see you later') and morphemic symbols, such as <£ & ed> (representing the meanings 'pound', 'and' and 'past'). We also feel it is important to distinguish a 'language' from a 'writing system' used to represent a particular language; 'Japanese' is not the same as the 'Japanese writing system'; the English language could logically be written in the roman alphabet or in Braille or in the Shavian alphabet and was indeed for a time taught to children through the initial teaching alphabet (ita) (Pitman, 1961).

Writing system researchers rarely agree on how these terms should be used, in particular shifting between the two meanings of 'writing system'. We will try to adopt a few standard terms here, mostly following Coulmas (1989, 2003). These are intended as a rough working guide rather than representing a theoretical position. We will also adopt the convention of

presenting examples where the actual written form is important between angled brackets, as in <cough>, with the exception of non-Roman alphabet symbols where it becomes awkward; examples of spoken forms will be presented in International Phonetic Alphabet (IPA) transcriptions between slashes, as in /kɒf/ (suprasegmentals such as tone will not be shown); the word itself as a lexical item neutral between speech and writing will be in single quotation marks ‘cough’; it is, however, hard to be consistent in observing this three-way distinction in practice. Contributors to this book who are using different terms and conventions will explain their own usage in their chapters.

### Overall Terms

*Writing system:*

either

- (i) the overall term for the ways in which written symbols connect to the language (e.g. alphabetic, syllabic writing system)

or

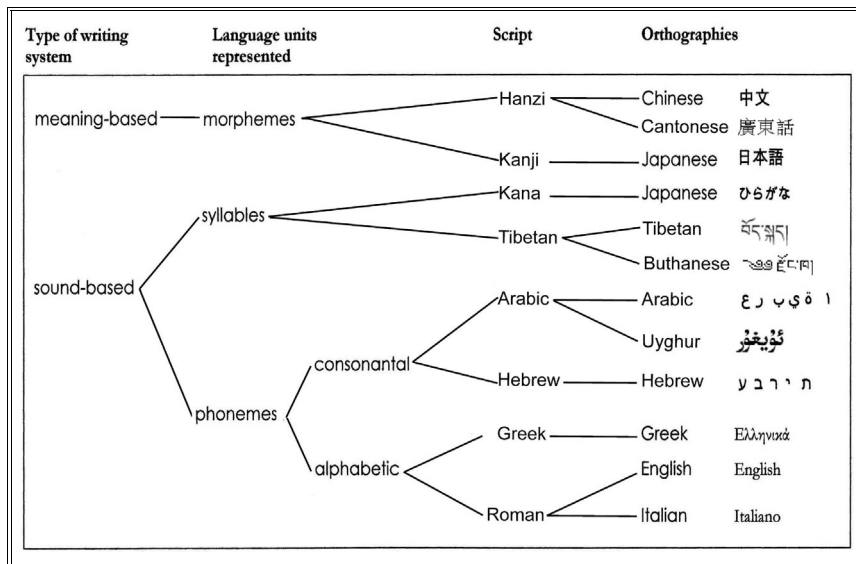
- (ii) the specific rules for writing used in a particular language (the English writing system, the Chinese writing system . . .)

*Script:* the physical implementation of the writing system (e.g. the Roman and Cyrillic alphabets for alphabetic writing systems)

*Orthography:* the rules for using a script in a particular language (e.g. the English or Italian orthography for the Roman alphabet).

### Types of writing system

The smallest units in a writing system are its *graphemes*, or written symbols. Following Sproat (2000), this introduction uses ‘grapheme’ as a convenient term for the smallest unit of a writing system, regardless of any relationships between the words ‘grapheme’ and ‘phoneme’ – essentially as a synonym for ‘written symbol’. The major divide between the writing systems of the world has been seen as whether their graphemes connect with meanings, as in Chinese – 中文 means ‘Chinese’, regardless of how it is said – or connect with sounds, as in Italian – ‘italiano’ is read aloud as /italjano/, regardless of what it means. This fundamental division is central to many of the issues in writing system research, generating massive amounts of research and controversy. A major topic in L2 research concerns people who have acquired a meaning-based L1 writing system, such as that used in Chinese, switching to a sound-based L2WS, as used in English, and vice versa. This overall division is illustrated in Figure 1.1.



**Figure 1.1** Major types of writing system (examples are the names of the language given in the script)

### Meaning-based writing systems

*Meaning-based* writing systems connect graphemes (written symbols) and meaning directly. The main examples are the Chinese characters called hanzi and the Japanese equivalent kanji, which represent morphemes, i.e. units of meaning. For instance, the hanzi 文 represents the morpheme ‘written language’, whose spoken form is /wən/. Many morphemes share the same pronunciation /wən/, but each has a different written form: when /wən/ means ‘to hear’ it is written as 闻; when it means ‘mosquito’ as 蚊; when it means ‘line’ as 纹. These characters have been called ideographic, logographic, morpho-syllabic, etc., drawing attention to alternative concepts of the script as being based on ideas, words and morphemes or syllables. The term preferred here is morphemic, that is to say the representation of morphemes as graphemes (written symbols), distancing the term from the spoken language.

Meaning-based systems can be read by people who do not know the phonology of the language or who indeed speak different languages: 文 means ‘written language’ regardless of whether it is said /wən/, as in Standard Chinese, or /mən/, as in Cantonese. Indeed a Japanese who would read 文 as /bun/ would still understand it as ‘writing, literature’, as would a Korean who would say it as /mun/.

Nevertheless some elements in meaning-based system may be associated with phonology. For example hanzi contain *phonetic radicals*,

components of a character that correspond to some aspects of pronunciation, such as the 隹 /tʃuei/, seen on the right-hand side of 椎 and 锥, both pronounced /tʃuei/. This is not fully reliable since it is also used in 谁 /ʃuei/, 堆 /tuei/, 推 /tʰuei/, 睢 /suei/, etc., where it only indicates part of the pronunciation. Chinese readers can then use this information for guessing the pronunciation of the 80% or so hanzi that contain a phonetic radical. Take the hanzi 勿 /wən/; relying on the pronunciation of its phonetic radical 勿 /wu/ provides the correct first phoneme; analogy with 吻 /wən/ yields the correct pronunciation minus the tone; analogy with 物 /wu/ only provides the first phoneme; etc.

#### *Sound-based writing systems*

'Sound-based' ('phonographic') writing systems connect graphemes with the sounds of speech. The unit of speech that the symbol links to varies in different writing systems. In syllabic writing systems each grapheme links to a syllable of the spoken language: for example Japanese kana represent the morae of speech (mostly equivalent to a syllable, but syllables containing geminate consonants, nasals and long vowels are counted as having an extra mora); the word すべての 'subeteno', meaning 'all' consists of four kana – す /su/, べ /be/, て /te/, の /no/. In other writing systems the grapheme links to phonemes: Arabic and Hebrew writing systems represent primarily spoken consonants; the English, Greek and Nepali writing systems represent all the segmental phonemes including vowels. Sometimes a script may combine symbols for individual sounds into a symbol for a syllable, as in Korean han'gul.

Hence we reserve the term 'alphabet' for scripts that represent *all* the phonemes of speech: 'a writing system characterised by a systematic mapping relation between its signs (graphemes) and the minimal units of speech (phonemes)' (Coulmas, 1999: 9); Arabic is an example of a consonantal, not an alphabetic system. This definition then relates to the so-called alphabetic principle: 'one consistent symbol per phoneme' (Carney, 1994: 474), divided into two sub-principles: the one-to-one principle that letters correspond consistently to phonemes and vice versa; and the linearity principle that the linear order of letters corresponds to the order of phonemes (Cook, 2004a: 12–13). It should also be noted that alphabetic scripts themselves do not usually represent tones, even when phonemic, with some exceptions such as romanised Chinese.

Rules for linking sounds and letters and vice versa are called *correspondence rules*, for instance in English the letter <a> corresponds *inter alia* to the phoneme /æ/, in Japanese the kana か corresponds to the mora /ka/. These are *grapheme–phoneme correspondence rules* (GPC rules) when they indicate how the written symbols represent phonemes – /b/ written as <b>; in the opposite direction, they are called *phoneme–grapheme corre-*

*spondence rules* (PGC rules), when they indicate how phonemes are represented by written symbols – <b> is said as /b/. When the written symbols represent phonological units other than phonemes, they are called *grapheme–sound* (or symbol-to-sound) *correspondence rules*. The notion of correspondence is sometimes shown by the symbol  $\equiv$ , i.e. <a> $\equiv$ /æ/ in English <fat>.

### The phonological transparency of writing systems

Within the same type of writing system and script, different orthographies vary in the regularity of the correspondences between the phonological and written forms, even for the same unit of language. The writing systems of both Italian and English are alphabetic since they are both based on the phoneme and both use the same script, that is to say the Roman alphabet. They differ, however, in the regularity of their correspondence rules. The Italian system is ‘phonologically transparent’ because letter-to-sound and sound-to-letter correspondences are almost always one-to-one (although less so for varieties other than standard Italian); for instance, <pace> corresponds to /patʃe/ letter by letter. Hence Italian is popularly called a ‘phonetic’ writing system. English is an example of a ‘phonologically opaque’ writing system in which the correspondences between sounds and letters are far from regular. This variation is captured by a notion called by researchers variously ‘transparency’, ‘orthographic depth’ or ‘regularity’, the term ‘phonological transparency’ being preferred here.

English has multiple links between sounds and letters and so needs a complex set of correspondence rules. For example the letter <o> corresponds to at least 10 phonemes: /ʌ/ ‘love’, /ʊ/ ‘good’, /ɒ/ ‘cough’, /ɔɪ/ ‘oil’, /ə/ ‘actor’, /uː/ ‘moon’, /ɔː/ ‘floor’, /əʊ/ ‘dough’, /aʊ/ ‘cow’, /wɑː/ ‘memoir’. The phoneme /əʊ/ on the other hand corresponds to at least 8 spellings: <o> ‘cone’, <ow> ‘glow’, <ou> ‘soul’, <au> ‘chauffeur’, <eo> ‘yeoman’, <oh> ‘ohm’, <oo> ‘brooch’, <eau> ‘Beaufort’. English also has non-linear correspondence rules where the order of the information presented in the letters does not correspond to the order in which the sounds are said: the <e> in <dime> shows the preceding <i> corresponds to the ‘free’ vowel /ai/ rather than to the ‘checked’ vowel /i/ in <dim>. In addition many English correspondence rules rely on a knowledge of grammar. For instance, the distinction between function and content words separates the voiced correspondence for <th> /ð/ in function words such as <this> from the unvoiced correspondence /θ/ in content words such as <thesis>; the single spelling <ed> is used for the three different spoken forms of the past tense morpheme ‘ed’ /ɪd/ ‘started’, /t/ ‘liked’ and /d/ ‘stayed’.

The Italian system on the other hand has almost exclusively one-to-one grapheme–phoneme and phoneme–grapheme correspondences, with

some exceptions such as the grapheme <o> which corresponds to both /o/ and /ɔ/. It nevertheless has a few context-determined variants in which the correspondence is based on the presence of other phonemes. /k/ corresponds to <c> before <a> and <o> ('caldo', 'cosa'), but to <ch> before <i> and <e> ('Chianti', 'Marche'), because <ci> and <ce> already represent /tʃi/ and /tʃe/. Since these correspondences are predictable from the following vowel, they are regular despite departing from the strict one-to-one alphabetic principle. Italian has some exception words, in many cases homophonous words distinguished by different spellings (for instance, an extra <i> distinguishes <cielo/celo> 'sky/I hide', both pronounced /tʃelo/). Where Italian uses orthographic rules to determine these variant correspondences, other phonologically transparent writing systems use morphology. In Greek the vowel /i/ can correspond to six different graphemes <ι η υ ει οι υι>; in most cases these variants depend on morphology (Harris & Giannuoli, 1999); when /i/ represents the inflectional ending of a female noun, it is always spelled with <η>. Even an almost totally phonologically transparent system such as Japanese kana has two different symbols for the same sounds /o/ (を/お) and /wa/, (は/わ) depending on whether they are syllables or case particles. The Greek writing system and kana are therefore transparent since, even though their symbol-to-sound correspondences are not one-to-one, they are predictable.

The distinction between phonologically transparent and non-transparent writing systems is not then a matter of either/or but a continuum: English is less phonologically transparent than Italian in that more effort is required to make the connections between letters and sounds in terms both of correspondence rules and orthographic regularities. No writing system is 100% phonologically transparent or 100% opaque, save for phonetic alphabets devised to record spoken language, such as IPA. There is also the issue of dialects: the same writing system usually represents the standard variety more transparently than the various dialects, e.g. RP English <th> corresponds to /ð/ rather than /f/ in 'bath', to the surprise of English-speaking children in Essex who pronounce it as /ba:f/.

The concept of phonological transparency applies to different types of writing system as well as within the same type of writing system; for instance morphemic writing systems can be considered less phonologically transparent than alphabetic writing systems. Both Chinese and Japanese are morphemic in that hanzi and kanji characters correspond to morphemes in their respective languages. Chinese is, however, more phonologically transparent than Japanese since each hanzi has a single reading, whereas kanji have multiple readings that depend on the context. For instance, though 文 corresponds only to /wən/ in Chinese, in Japanese it can be read with four distinct pronunciations /mɔn/, /bun/, /aja/ or /humi/ depending on the context. The pronunciation of a

Chinese hanzi can be determined without knowing the context, whereas reading a Japanese kanji often requires the use of context; in this sense Chinese is more phonologically transparent than Japanese. While it is possible to compare overall writing systems by saying that a morphemic writing system is less phonologically transparent than a phonological writing system, within the morphemic type of writing system itself, Chinese is more phonologically transparent than Japanese, and, within the phonemic type, Italian is more phonologically transparent than English, as illustrated in Figure 1.2.

The same writing system may also vary in phonological transparency according to the kind of activity being performed. While orthography-to-phonology and phonology-to-orthography conversion rules are equally transparent in Japanese kana or in the Italian writing system, French is more transparent in reading than in writing, because the rules relating letters to sounds are more reliable than those relating sounds to letters, and the same applies to Greek (Harris & Giannuli, 1999). Even a consonantal writing system like Hebrew, which is not very phonologically transparent as it does not normally represent vowels, is less transparent for writing than reading, because the phoneme-to-grapheme correspondence rules are complex with many graphemes representing the same phoneme (Share & Levin, 1999). In general, when there is a difference,

	type of writing system	phonological unit	examples	transparency level
<p style="text-align: center;"> <b>more transparent</b>            ↑            ↓  <b>less transparent</b> </p>	alphabetic	phoneme	Finnish, Italian	more ↑
			English, French	less ↓
	syllabic	syllable/mora	Japanese kana	more ↑
			Tibetan	less ↓
consonantal	consonant	Arabic, Hebrew		
	morphemic	1 syllable	Chinese hanzi	more ↑
		1(+) mora(s)	Japanese kanji	less ↓

**Figure 1.2** The phonological transparency continuum

the phoneme-to-grapheme correspondences tend to be less transparent than the grapheme-to-phoneme correspondences.

So far, as in most research, we have used ‘transparency’ in general as a synonym for ‘phonological transparency’ – the correspondence between the symbols and the corresponding sounds (grapheme–phoneme correspondences). But writing systems also vary along a continuum of morphological transparency. Morphemic writing systems represent morphemes with only slight clues to pronunciation; consonantal writing systems focus more on representing the consonantal roots of morphemes and leave out vowels; mixed systems like English sometimes represent underlying morphemes rather than sounds; even one of the most phonologically transparent systems, such as kana, represents morphology to a certain extent, as seen above. For this reason, ‘phonological transparency’ is here preferred to ‘transparency’ to refer to symbol–sound correspondences.

### **Other aspects of writing systems**

As well as the actual letters or characters (graphemes) and the spelling, writing systems also make use of a number of other conventions or devices, which can only be sketched here.

#### *Direction*

The orientation of writing on the page varies. English is normally written in rows from left-to-right and from top-to-bottom of the page. Other alphabetic scripts such as Burmese and Greek are also left-to-right. The two consonantal writing systems, Hebrew and Arabic, are, however, right-to-left. The two morphemic writing systems, Chinese and Japanese, were both traditionally written from top-to-bottom in columns from right-to-left across the page; Chinese has chiefly changed to a left-to-right top-to-bottom arrangement. Direction also applies to the orientation of symbols – in the Roman alphabet <d> and <b> are distinguished by the direction in which they face, as are 人 and 入 in Chinese – and to the sequence of pages: in English and Italian books pages are numbered from left-to-right and are turned from right-to-left; the pages of Hebrew or Japanese books are turned from left-to-right.

#### *Punctuation*

Most writing systems have added a set of punctuation marks to the letters or characters. According to Nunberg (1990: 10), Western alphabetic writing systems have ‘only one system of punctuation ... subject to the fixing of a few parameters’. Full stops <.>, commas <,>, exclamation marks <!> etc. are recognisably similar in many orthographies. Double quotation marks vary noticeably in form, say <" "> in England, <" "> in Germany, and <" "> or goosefeet <« »> in Italy (but <« »> in Switzerland) (Bringinghurst, 1992; Tschichold, 1928). Spanish introduced sentence-initial

<¿> and <¡>. Japanese and Chinese imported punctuation marks over the past 150 years using such distinctive forms as the hollow full stop <。> and the listing comma <、>; Chinese distinguishes between <“ ”> (for quoting) and <« »> (for titles).

Punctuation has two main, often parallel, uses (Cook, 2004a):

- (1) to indicate grammatical features of the text (grammatical punctuation), such as the apostrophe which indicates the grammatical relationship of 'John' and 'wife' in 'John's wife'; or the comma that introduces the non-defining relative clause in 'John's wife, who lives in New York, is called Sally'. In particular the full stop <。> is used to signal the end of a written 'text-sentence', which may differ in many ways from a spoken 'lexical sentence' (Cook, 2004; Nunberg, 1990);
- (2) to indicate phonological features of the text (correspondence punctuation), such as commas that indicate pausing and intonation patterns.

Even if the symbols are similar, punctuation is not used in the same way across writing systems, though few accounts of the punctuation of different writing systems exist as yet.

An aspect of writing systems that can be included here is the use of spaces between written symbols. Chinese and Japanese have an even space between the characters; English has a space between words. Hence English and other writing systems that use word-spaces present the reader with a text pre-analysed into words; Chinese and Japanese do not. Word spaces are not necessarily found in sound-based writing systems: they are not used in some syllabic writing systems such as Thai and Tibetan, nor is their use well-established in some alphabetic writing systems such as Vietnamese. Indeed in some writing systems, such as Thai and Burmese, spacing has the function of separating phrases, breath groups, etc., rather than dividing words.

#### *Orthographic constraints*

Writing systems constrain the position and co-occurrence of symbols: not all graphemes can occur in every position; many are limited in how they may be combined with other graphemes. Alphabetic writing systems may restrict where letters can occur in the word or syllable and what combinations they may take, unrelated to the occurrence of phonemes in the spoken language. English <tch> must be a word-final correspondence as in 'match'; <ch> is its word-initial equivalent 'charm'; English <o> can double as in 'boo', but <a> cannot, with a few exceptions such as 'baa'. In Chinese, the radical 竹 ('bamboo') can only occur at the top of a hanzi, whereas 心 ('hearth') can only occur at the bottom: 箱/想; 答/息.

These 'orthographic regularities' concern purely written conventions of writing systems based on arbitrary restrictions on the occurrence of symbols in particular positions or combinations. They are neither meaning-based nor sound-based but concern properties of the written form alone.

#### *Letter alphabets*

Many alphabetic systems make a distinction between three distinct alphabets (Gill, 1931): lower-case <a b c>, upper-case (capitals) <A B C> and italics <a b c>, each with distinct letter forms. In Japanese a similar distinction is made between different kana syllabaries; hiragana shows that a word is Japanese in origin for example *きれいな* /kiɾe:na/ ('beautiful'), katakana that it is of foreign origin *セックスアピール* /sekkusuapi:ɾu/ ('sex appeal'). In English capitals are used partly to indicate proper nouns <Bill/bill>, partly for emphasis <BILL>, partly for a few special words such as <I> and <Monday> (Cook, 2004). Italic letters have a similar range of functions for emphasis <on *Monday*>, and for particular text types such as stage directions <*Exit pursued by a bear.*>. In Italian capitals are used in much the same way as in English, with some differences: for instance they are not used for the word <io> ('I') but are used for <Lei> (formal 'you') – an interesting difference in the pragmatic use of writing systems. Italics are used in Italian for unusual foreign or technical terms, and for titles of books, magazines, music pieces, theatre pieces and paintings, but not for titles of TV programmes (Lesina, 1986). Upper-case letters are not however found in sound-based alphabets other than those using the Roman alphabet, say Arabic or Burmese, or in character-based systems.

#### *Symbol formation*

The users of a writing system have to master the conventional ways in which the symbols are formed in handwriting; Chinese hanzi for example are written with a predetermined sequence of strokes, which also serve as a method of organising dictionaries: one method to look up a hanzi is to search under its first stroke and then under the number of strokes it contains. Hanzi are written from top to bottom and from left to right, generally starting with a top horizontal stroke or a left or central vertical stroke; angled lines are drawn clockwise. The hanzi has to be inscribed within a square area in order to look right. English letters are written top to bottom, and loops are drawn both clockwise and counter-clockwise; they have descenders and ascenders that go below and above the line – <tdb> versus <pyg>; only capitals are square <TGHLVO>. Modern media are exerting pressure on writing systems, for example by imposing word-spaces on character-based scripts in which they have not previously been used or by making writers of character-based scripts less aware of strokes, since they are all produced simultaneously

on the computer keyboard. Similar adjustments have followed earlier changes in the methods of writing, whether chisels, quill pens, metal nibs, typeface or typewriters.

### **Terms for Types of Writing System**

*Alphabetic*: graphemes (letters or letter clusters) represent all the segmental phonemes

*Syllabic*: graphemes represent syllables or morae

*Consonantal*: graphemes represent primarily consonants

*Morphemic*: graphemes such as Japanese kanji and Chinese hanzi represent morphemes; these are also known as characters, logographs and ideograms

*Phonological transparency* (also known as 'orthographic depth' and 'regularity'): a writing system is phonologically transparent to the extent that its graphemes correspond to the spoken sounds of the language

*Direction*: variously used for the left-to-right direction on the page versus right-to-left, for the direction in which individual letters face, and for the sequence of pages in reading, whether left-to-right or right-to-left

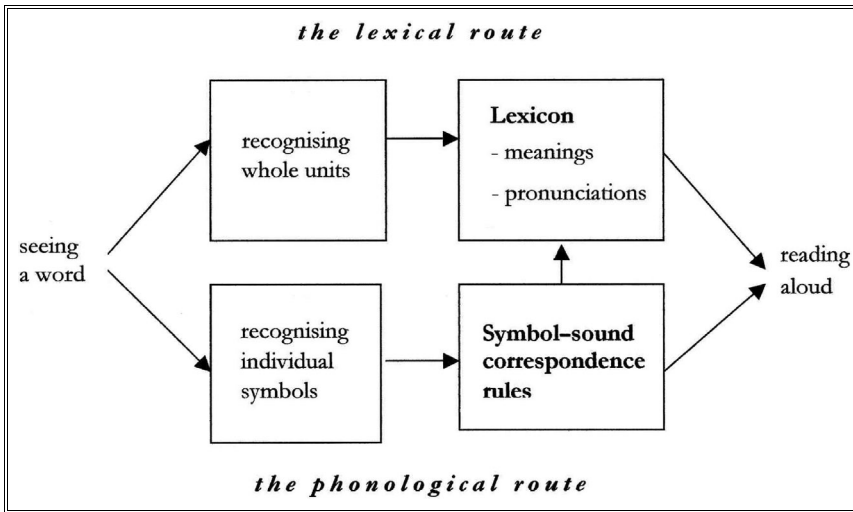
## **Cross-writing-system Differences in Reading, Writing and Metalinguistic Awareness**

The characteristics of writing systems described above result in differences in the reading, writing and awareness of different writing systems, as L1 users of different writing systems decode, encode and are aware of different units of language with different degrees of phonological and morphological transparency. This is not to deny that some aspects in the use of writing systems are universal. Dealing with L2WSs, however, necessarily highlights the differences across writing systems and their consequences for L2WS users.

This section describes the cross-writing-system differences in reading, writing and awareness (with a short mention of non-linguistic activities); their consequences for L2WS users will be presented later.

### **Cross-writing system differences in reading**

Psychologists and psycholinguists have most commonly conceptualised the process of reading English words aloud in terms of a *dual-route model*, given in Figure 1.3, sometimes known as the 'standard' model (Patterson & Morton, 1985) (a 'route' is a sequence of processing



**Figure 1.3** The dual-route model of reading aloud

components). One route relies on rules for finding sounds to correspond to letters, the other on whole words held in a mental lexicon – another version of the perennial discussion of language as rules or as instances, found for example in Pinker (1995).

Following the *lexical route* the string of letters is recognised as a whole and then looked up in a mental lexicon in order to retrieve the pronunciation and meaning of the whole unit. The word <yacht> for instance is recognised as a whole word and then checked in the mental lexicon for its pronunciation /jɒt/ and its meaning ‘boat’; finally it may be said aloud, though this final step is often superfluous, say in silent reading.

Following the *phonological route*, the word is turned letter-by-letter into the spoken form: <tree> becomes /tri:/ by transforming the letter <t> to the phoneme /t/, <r> to /r/ and <ee> to /i:/. Finally either the word can be read aloud, without necessarily knowing its meaning, or the meaning can be consulted in the mental lexicon. The lexical route treats the written symbol as having meaning, which may be connected to sounds; the phonological route treats it as having sounds, which may be connected to meanings.

This basic two route architecture has been verbalised in several different ways. A pair of terms derived from computing is ‘addressed phonology’ versus ‘assembled phonology’ (Coltheart *et al.*, 1993): the pronunciation of the whole item is retrieved from its address in the lexicon, or the pronunciation of the item is assembled bit by bit. Other formulations distinguish the ‘lexical route’ from the ‘sub-lexical route’, stressing the involvement of the lexicon, or the ‘direct route’ from the

indirect route (see Van Heuven, this volume). The differences in phonological transparency of writing systems led to the Orthographic Depth Hypothesis (Frost *et al.*, 1987), according to which 'deep' writing systems have least connection between symbols and sounds, 'shallow' systems have most.

There are obvious parallels between the two routes and the two main types of writing system. Meaning-based systems exploit the lexical route, connecting Chinese 大 with the meaning 'big' and the pronunciation /ta/ without any intermediate stages. Sound-based systems can use the phonological route connecting the four letters in the Italian <pace> with the sounds /patʃe/. In cross-writing-system comparisons, different writing systems can be seen to rely to a greater or a lesser extent on these two routes.

The dual-route model has provided a useful peg for much research. It demonstrates how it is possible in sound-based writing systems to read words aloud without knowing what they mean, hence allowing nonsense words such as 'varg' or invented words such as 'Accenture' to be rendered in speech. In meaning-based writing systems, this option is not available as a new or unknown symbol carries no clue to its pronunciation: a Japanese place name such as 札幌 (Sapporo) has no obvious pronunciation even for a Japanese news-reader unless they happen to know the characters involved – a common problem with proper nouns. Instead, an Italian place name such as 'Marche' can be read aloud by an English-speaking news-reader as /mɑ:kə/ at least recognisably to other English speakers, even if they have never seen or heard it before.

However, the two routes are not restricted exclusively to users of one or the other of the two main types of writing system but can be employed to some extent by users of either system. Frequent English words are probably read as whole items via the lexical route (Seidenberg, 1992); the <e> in <the> is often not noticed by English people as they are processing <the> as a whole by the phonological route (Cook, 2004a). Chinese people similarly have some access to the phonological route, as shown by their use of phonetic radicals.

Even deaf people have been shown to use a phonological route in that they have problems with written tongue-twisters (Hanson *et al.*, 1991). The process of reading probably involves both routes simultaneously. Controversy nevertheless reigns over how the two routes interact, some feeling that the phonological route is primary, even in meaning-based writing systems (Perfetti *et al.*, 1992) – called the 'Universal Phonological Principle' by some – others seeing the routes as a 'horse-race' where one route produces the word quicker than the other (Paap *et al.*, 1992). In general, a distinction should be drawn between reading and recognition: it is commonly agreed that reading texts requires phonological recoding regardless of the writing system, but it is not clear whether single word

or morpheme recognition requires phonological recoding and, if so, at what stage.

As well as linking to the two routes, phonological transparency also results in other differences such as:

- The timing of phonological activation: in reading a meaning-based writing system, phonology may be activated after the hanzi or kanji is recognised rather than from the start.
- The effects of word familiarity and frequency: these are greater in less transparent systems than in more transparent systems because whole-word recognition is affected by frequency but the phonological route is unaffected; hence there will be more effects in reading Japanese kanji or English words than Italian words.
- The skills that correlate with learning different writing systems: these are not the same for various writing systems. In alphabetic writing systems, reading skills correlate with phonemic awareness, in meaning-based writing systems with visual skills. Huang & Hanley (1995) found that Chinese children's reading ability correlates with visual skills tests, not with phonological awareness tests as in English-speaking children.
- The use of letter names: English children find letter-names a convenient way into spelling (Treiman, 1993); letter-names are also used by Hebrew children, but in a different way (Levin *et al.*, 2002).
- The grain size: readers of more phonologically transparent writing systems are also likely to decode words using letter–phoneme conversion; readers of phonologically deeper writing systems rely on strings longer than a letter, such as word body, rime or whole word; this is called the *grain size*, i.e. the amount of orthographic information necessary for phonological recoding, which varies across orthographies depending on their phonological transparency (Goswami *et al.*, 1998, 2003). Furthermore, spelling of less phonologically transparent writing systems requires morphemic awareness (Muter & Snowling, 1997), which may not be necessary in transparent writing systems.
- Neighbourhood effect: cross-linguistic comparisons also showed differences in the neighbourhood effect, that is the fact that a pseudoword is read faster if it has many similar neighbour words differing from it minimally in spelling (e.g. differing in a single letter, say <man> and <mat>) (see Van Heuven, this volume). Cross-linguistic comparison of neighbourhood effects show higher effects in English than in French and in French than in Spanish (Gombert *et al.*, 1997). More phonologically irregular writing systems require greater use of analogy, more phonologically regular ones require less, because grapheme–phoneme correspondence rules are used instead. More

phonologically transparent writing systems are acquired faster: German and Italian children learn to spell their writing systems faster than English children: Italian children reach 97% accuracy in word reading by the middle of their first year of school (Cossu, 1999).

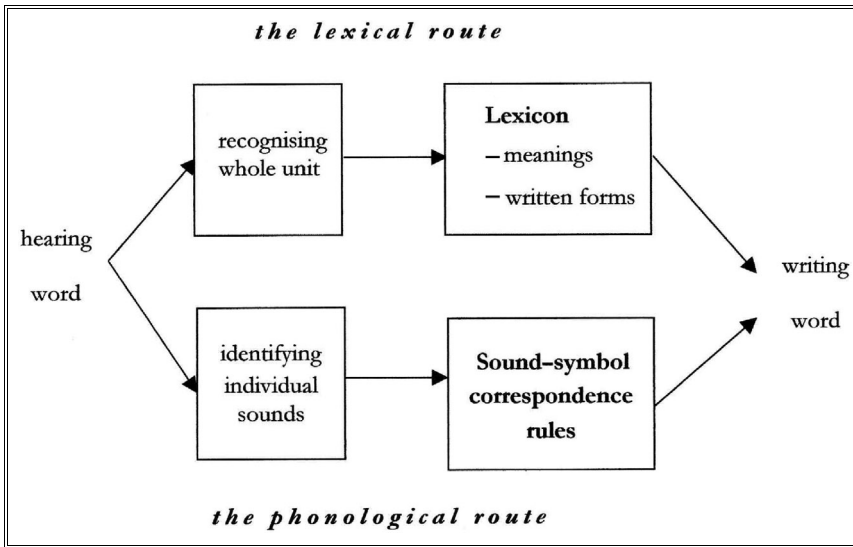
### **Cross-writing-system differences in writing**

Several aspects of writing vary across writing systems. One is spelling, that is to say converting language into writing. Another aspect is the use of punctuation, orthographic conventions, etc. Finally there is the actual production of the written signs: directionality, stroke order, etc; this is non-linguistic in nature and will be dealt with under Other cross-writing-system differences.

The most studied aspect of writing is spelling. There has been much less research on the relationship between writing systems and spelling than on that between writing systems and reading, and the amount of cross-orthographic studies of writing is much smaller than for reading. The most studied aspect of writing is spelling. Spelling is affected by the type of writing system and its phonological and morphological transparency. Research on English spelling, like research on reading, proposed a dual-route model: the assembled or non-lexical route uses phoneme-grapheme conversion; the addressed ('lexical', 'direct') route uses direct retrieval of a word form from the orthographic lexicon (Barry, 1994) (the orthographic lexicon is the mental repository of the written form of words). This route is necessary because it is not possible to spell a word like /jɒt/ using sound-symbol correspondence rules, as this would be more likely to result in <yot> than in <yacht>. There must therefore be an orthographic lexicon that contains orthographic information about the whole word. But, on the other hand, it is possible to make up a spelling for an unknown word or a nonword (or indeed to misspell a known word because of its sound, as in writing <surfdom> for <serfdom> because of the higher frequency of 'surf' these days). The two routes must therefore coexist in English spelling. Figure 1.4 presents the dual-route model of English spelling.

According to this model, irregular and/or frequent English words are spelled using the lexical route, but regular and/or infrequent words are spelled using the phonological route. In more recent approaches, the two routes are seen as simultaneously activated and interacting, with one or the other taking over.

Given the different nature of the linguistic units represented, different writing systems may require increased reliance on one or other of these routes. Writers of Chinese, a morphemic writing system, must retrieve the whole hanzi from memory in order to write it. An unknown hanzi



**Figure 1.4** The dual-route model of spelling

cannot be written down using sound–symbol correspondence rules (apart from experiments in which children are asked to create a hanzi for a new morpheme combining a semantic and a phonetic radical). In consonantal writing systems, Hebrew children, who learn to write Hebrew with diacritics representing vowels, learn to write consonants earlier than vowels, either because of the consonant’s central role as the carrier of meaning in the language or because of their centrality in written Hebrew (Share & Levin, 1999).

The skills necessary to learn to write different writing systems may differ. While both phonological and morphological awareness are important in most writing systems, their relative importance may vary according to the type of writing system. For instance, phonological awareness is highly correlated with spelling skills in English children (Goswami, 1999), but not to the same extent in Hebrew or Chinese children (Hanley *et al.*, 1999); while morphological awareness correlates with spelling skills in Hebrew children (Share & Levin, 1999), it would be totally useless to Italian children since no aspect of their writing system represents morphemes. The stage when these skills are needed could also differ: English children acquire morphemic awareness later than phonemic awareness, for instance misspelling <ed> until the third year of primary school (Bryant *et al.*, 1997).

Within each type of writing system, spelling is also affected by the level of phonological transparency of the orthographies for different languages. For instance:

- German beginner spellers spell differently from English beginners because of the relatively more transparent phonology–orthography correspondence in German: a comparison of German and English first-year schoolchildren spelling cognate words in their respective languages revealed that the English children made more, and more varied, errors, including as many as 22 different spellings for the word <friend> (Wimmer & Landerl, 1997).
- Phonological transparency affects the type of phonological awareness required: for instance, in English children word reading skills correlate with rime awareness, but in Greek children there is no correlation (Goswami *et al.*, 1997), because Greek is read at the grapheme level, English at the level of longer units.
- A less phonologically transparent writing system like English requires not simply the use of sound–symbol correspondence rules but also the use of analogy: for instance, if the English pseudo-word /preɪn/ is presented after /breɪn/ <brain>, it is spelled as <prain>; if it is presented after /kreɪn/ <crane>, it is spelled as <prane> (Campbell, 1983). As Ohala (1992) argues, morphological knowledge helps English spellers: they would not write ‘definate’ or ‘defenite’ for <definite> if they realised the connection with <finite>, or ‘radience’ for <radiance> if they realised the connection with <radiate>.
- Phonological transparency similarly affects the learning process: German children can spell correctly after nine months of schooling (Wimmer & Landerl, 1997). Some L1WSs will therefore be easier to learn than others, other things being equal.

Sometimes learning to spell requires the acquisition of linguistic sub-systems that are not present in the spoken language. For instance, spoken Chinese does not mark gender and it has only one third person singular pronoun /t<sup>h</sup>a/, but children learning written Chinese must acquire the gender distinction between three different written forms of /t<sup>h</sup>a/ – 他 (masculine), 她 (feminine) and 它 (neuter). The Taiwanese variety of the Chinese writing system has five written forms for the same spoken pronoun: 他 for male humans, 她 for female humans, 牠 for animals, 它 for inanimate entities and 祂 for divine entities. In the same way, French children learn to mark the singular–plural distinction for the written form of nouns, verbs and adjectives, which has no correspondence in the spoken language: for instance, /pɔ̃m/ corresponds to <pomme> or <pommes> (‘apple/apples’), and /vɔ̃l/ to <vole> and <volent> (‘[it] flies; [they] fly’) (Fayol *et al.*, 1999). They take some time to acquire the distinctions that are not present in the French spoken language (Totereau *et al.*, 1997); experienced adult spellers make mistakes in writing from dictation if they are performing a concurrent task

(Fayol *et al.*, 1994). In the reverse direction, English children have to learn that /t/, /d/ and /ɪd/ all correspond to one written form, the morpheme <ed> (Beers & Beers, 1992). Bryant *et al.* (1997) found that eight-year-olds still get only 57% of regular past tenses correct; the same difficulty appears with plural and third-person <s>s, both written morphemes that represent different spoken sounds (Treiman, 1993).

Cross-orthographic comparisons of 'slips of the pen' also demonstrate systematic differences of spelling: Moser (1991) describes slips of the pen by Chinese writers that could never happen with English writers, such as substituting one hanzi for another with similar meaning but totally unrelated sound or inverting the two hanzi inside a lexical item. He also discusses how similar types of spelling mistake take different forms in the two writing systems. For example 'capture errors' in English involve replacing a part of an unusual word with a similar-sounding part from a more frequently used word, as in writing <enough> for <enought> because the sequence <ought> is more frequent ('thought', 'fought', etc); in Chinese this leads to writing 生 /ʃəŋ/ (be born) instead of 气 /tʃhi/ (anger) because the two hanzi share the same first three strokes but the former hanzi is more frequent (Moser, 1991).

The main alternative to the dual-route model has been the general connectionism model applied to writing. This sees the mind as a unified overall system (Brown & Loosemore, 1994) that cannot be divided into separate modules. Learning spelling means weighting connections between the input letters and the nodes of the system; the more often the reader sees <t> linked to /t/ the stronger the connection becomes. The main argument for a connectionist approach to spelling is provided by the computer simulation by Seidenberg and McClelland (1989), which 'learnt' English spelling from input in this manner, making only a small number of mistakes. An account of a connectionist model is given by Van Heuven in this volume.

### **Cross-writing-system differences in awareness**

In the context of reading and writing research, research on *metalinguistic awareness*, that is to say conscious awareness of language, has focussed on *phonological awareness*. In this context, phonological awareness refers to the awareness of those sound units of the spoken language that are represented in the writing system. Since writing systems differ in the units of phonology they represent, readers of different writing systems need to be aware of diverse linguistic units in order to learn and use their writing system. Given the English-oriented nature of much reading research, researchers have mainly been concerned with *phonemic awareness*, that is to say the conscious knowledge of the phoneme – the minimal segmental unit of phonology – represented by one or more letters in alphabetic writing systems. Only occasionally is phonological

awareness extended to the allophonic level, as done in the chapter by Lau and Rickard Liow (this volume) which tests allophonic variation of flapped plosives in English.

A preliminary issue is the chicken and egg problem about whether phonological awareness is necessary for reading or reading creates awareness. Nation and Hulme (1997) suggest ability to segment speech into phonemes is a strong predictor of early success at reading and writing. In this volume Koda states that metalinguistic awareness makes an 'irrefutable' contribution to reading (p.000). In a recent extensive review of studies, Castles and Coltheart (2004), however, found no evidence that phonological awareness precedes and influences reading acquisition. Some phonological categories are created by children when they learn to read, say final nasal consonants in English-speaking primary school children (Treiman *et al.*, 1995): Goswami and Bryant (1990: 19) claim 'explicit knowledge about syllables precedes reading while an awareness of phonemes follows it'.

Non-alphabetic writing systems require other forms of metalinguistic awareness. Learners and users of the Chinese morphemic writing system clearly need to be aware of morphemes rather than phonological units (Li *et al.*, 2002). In Chinese readers, *morphemic awareness* is the ability to match spoken syllables with the written representation of the correct morpheme. Since the same Chinese syllable corresponds to many hanzi with different meanings, children must be aware that the same spoken syllable corresponds to different units of meaning, each represented by a different hanzi. For instance, the spoken syllable /nan/ meaning 'male' is written 男. But there is also a spoken syllable /nan/ that means 'South' and is written 南; for instance, /nan faŋ/ meaning 'the bridegroom's side' is written 男方, /nan faŋ/ meaning 'Southern' is written 南方. A similar issue is seen in English with homophonic words, rather than morphemes, as in /weilz/ corresponding to three words with different spellings, 'Wales', 'whales' and 'wails'. This remains important beyond the beginning stage: if Japanese children are asked to match the definition of an unknown lexical item against lexical items written in kanji or kana, they perform much better with kanji: given the definition of 'leukaemia', they have more difficulty matching it with はっけつびょう /hakketsubjō:/ than with 白血病 ('white-blood-disease') (Hatano *et al.*, 1981 cited in Nagy & Anderson, 1999). Readers of meaning-based writing systems also need to be aware of semantic radicals at the sub-hanzi level: the ability to identify them correlates with reading ability.

Readers of a syllabic writing system need to be aware of syllables rather than phonemes or morphemes. For instance, Japanese kana represent morae (essentially consonant-vowel (CV) syllables with some exceptions), and so literate Japanese children are necessarily aware of morae (Akita & Hatano, 1999). Hebrew readers, with a consonantal

L1WS, are aware of CV phonological units rather than phonemes; when Hebrew adults were asked to delete 'the first sound' in a CVC Hebrew word, in 27% of cases they deleted the initial CV sequence (Ben-Dror *et al.*, 1995).

Language awareness is thus related to the specific units used in the user's writing system: whether you think of speech as phonemes or as morphemes depends on how you read and write. (And at another level undoubtedly affects the judgement of linguists who have to guard against the trap of seeing other languages through the lens of the phonological categories of their first language, as argued by Faber (1992) and Aronoff (1992).) Nobody needs to be aware of linguistic units that are not represented in their writing system: Brazilian illiterate adults are not aware of phonemes, so that they cannot perform initial consonant deletion tasks (Bertelson *et al.*, 1989), just as Portuguese illiterates cannot segment sentences into words (Morais *et al.*, 1986); English adults are not aware of syllables, so that they disagree with each other on where to place syllable boundaries in English sentences (Miller *et al.*, in preparation); Chinese readers are not aware of phonemes, so that they cannot segment words into phonemes (Perfetti & Zhang, 1991). Interestingly, Japanese children who are literate in syllabic kana can perform a phoneme deletion task with a high level of accuracy, albeit lower than children literate in English (Mann, 1986a); however the children's self-reports revealed that they were operating with morae rather than phonemes: when asked to delete the first consonant in a pseudoword, almost 75% of them either substituted the CV sequence (corresponding to one kana symbol) with a V (corresponding to one kana, i.e. replaced *ki-ru* with *i-ru*), or added a V (one kana) at the end of the syllable and then deleted the initial CV sequence (i.e. added *i* after *ki*, then deleted *ki*: *kiru* → *ki-i-ru* → *i-ru*). Speakers of the same language need to be aware of different linguistic units if they use another writing system with the language. For instance, there are differences in phonemic awareness between Chinese adults who had or had not learnt *pinyin* – a supplementary writing system used to represent hanzi with Roman alphabet letters (Read *et al.*, 1987): Chinese children showed an increase from 35% to 60% accuracy in a phoneme deletion task just 10 weeks after learning *zhuyinfuliao*, another supplementary writing system used in Taiwan (Huang & Hanley, 1997), and similar results were obtained with adults (Ko & Lee, 1997). Equally, Kannada-speaking children, who are literate in a semi-syllabary, perform some phoneme inversion and deletion tasks worse than blind Kannada-speaking children, whose *braille* is alphabetic (Prakash, 2000). The terms normally used to talk about units of language vary; Hebrew speakers only use the names for consonants and names of vowels are specialised knowledge (Tolchinsky & Teberosky, 1997); interestingly the games intended to promote language awareness

are writing-system-specific: both American and Japanese children play a game where they have to create a new word with the last sounds of the previous word, but the 'last sound' in the American game is the last phoneme, in the Japanese game the last mora (Akita & Hatano, 1999).

While users of different types of writing system (such as syllabic versus alphabetic) show different levels of awareness of different phonological units (for instance, higher syllabic versus phonemic awareness), within the same type of writing system, users of different orthographies also show different levels of phonemic awareness. For example, although both Italian and English are alphabetical writing systems, Italian children outperform US children on phonological segmentation (Cossu *et al.*, 1988). Furthermore, phonemic awareness is affected by instruction and is higher when symbol–sound correspondences are explicitly taught; Belgian children who were instructed in the phonics method performed phoneme segmentation tasks better than those instructed with the whole-word approach (Alegria *et al.*, 1982).

### **Other cross-writing-system differences**

The type and phonological transparency of writing systems affect other aspects of linguistic activities apart from reading, writing and awareness, for instance, the methods used to recall the written form of a partially unavailable lexical item or to communicate it to others. When English speakers are unsure about the spelling of a word, they can write the word down to see whether it 'looks right', i.e. use the visual form of the word to check it; this is not done by users of a phonologically transparent writing system like Italian. Also, if English speakers need to communicate the written form of a word to others (for instance when the interlocutor did not understand it), they will spell it letter by letter; Italian speakers do not use oral spelling unless there are communication problems, for instance with foreign words or on the telephone. When a Chinese or Japanese speaker cannot recall how to write a hanzi/kanji, they use 'finger-tracing', that is drawing the character in the air according to its stroke sequence and will also use it to communicate the written form of a word to others.

Apart from the linguistic units represented and the level of phonological transparency, other aspects of writing systems that affect reading and writing are orthographic conventions or physical properties, such as direction, letter formation, etc. For example, because of the left-to-right directionality of their script, English readers are better at identifying letters in horizontal rows than in vertical columns (Freeman, 1980). In addition the orthographic convention of using spacing to separate orthographic words in English text affects English readers' eye movements; their eyes tend to fixate the centre of the word, but due to the lack of

interword spacing in Chinese, Chinese readers' eye movements show no preference for word-central positions (Yang & McConkie, 1999); Japanese readers show another pattern of eye movements because their eye movements are guided by the alternation between kana and kanji (Kajii *et al.*, 2001). English readers also have a wide horizontal perceptual span suited to their horizontal writing system; Japanese readers have no differences in horizontal versus vertical perceptual span because they can also read vertically (Osaka & Oda, 1991).

Although this book concentrates on linguistic activities in the L2WS, it is important to note that different writing systems also have an impact on nonlinguistic aspects of cognition. For instance, there are effects of a morphemic writing system on visual memory: the importance of visual memory for using the Chinese and Japanese writing systems results in better memory for geometrical patterns in Japanese children than in English children (Mann, 1986b, but see Flaherty & Connolly, 1995, for counter-evidence). There are also cross-orthographic differences in how writers of different writing systems draw. For instance, when Chinese children draw geometric patterns comprising horizontal and vertical lines, they tend to start with the horizontal line, whereas English children start with the vertical line, in accordance with the writing principles for the graphemes in their writing systems (Wong & Kao, 1991). The directionality of the writing system also affects how people perceive movement: when shown small drawings that appear to rotate, English adults perceive the rotation as being right-to-left, but Japanese adults perceive it as being left-to-right (Morikawa & McBeath, 1992).

Directionality also affects the representation of temporal sequences. When asked to put images of events in order (such as having breakfast, going to school, going to bed), English children put images in a left-to-right order, while Hebrew and Arabic children, whose writing system is written right-to-left, choose the opposite direction (Tversky *et al.*, 1991). Also, when asked to name pictures of objects on a sheet of paper, Hebrew children name objects starting from the right and moving to the left and English children start from left and move to the right (Kugelman & Lieblich, 1979). To take a mundane example, before and after pictures in English advertisements go from left-to-right (for instance, a pile of dirty laundry on the left, then the detergent, then a pile of clean laundry on the right); in Hebrew such advertisements are read from right-to-left. Chinese temporal metaphors refer to 'before' as 'up' (as in 'the week above' meaning 'last week'), whereas English temporal metaphors refer to 'before' as 'left'; time's winged arrow probably goes from left-to-right in all classroom explanations of English tenses. This mirrors the directionality of the two writing systems, where what is written before is above (in Chinese) or on the left (in English). These metaphors in turn influence behaviours such as thinking of 'before' as up or left

(Gentner *et al.*, 2002). Linguists' representations in phrase structure trees clearly also express direction in a left-to-right direction.

### **Some Cross-writing-system Differences**

#### *Reading*

- the balance between the two routes (lexical/phonological)
- timing of phonological activation (before/after word recognition)
- correlates of reading acquisition (phonological/morphological awareness, etc.)
- size of unit used for decoding (grapheme, rime)
- size of neighbourhood effects
- use of analogy between words
- speed of learning to read

#### *Writing*

- reliance on the two routes (lexical/phonological)
- correlates of spelling acquisition, e.g. phonological/morphological awareness
- size of unit used for encoding (grapheme, rime, etc.)
- use of analogy between words
- time required for learning to spell
- speed of learning to spell
- types of spelling error

#### *Awareness*

- language units that people are aware of (phoneme/syllable/morpheme, etc.)
- levels of phonological awareness

#### *Other*

- methods for recalling partly unavailable written forms
- eye movements in reading, perceptual span, etc.
- preference for direction
- visual memory
- sequences in drawing
- mental representation of temporal sequences

## **Introduction to Second Language Writing System Research**

### **What is a second language writing system?**

The term 'Second Language Writing System' (L2WS) can be applied to any writing system other than the system that the person learnt to read

and write for their first language. For instance, the English writing system is a L2WS for a first language writing system (L1WS) reader of Chinese who learns English at school or in the UK; s/he is a L2WS learner. Many L2 speakers can read and write their second language and in this sense are L2WS users; a bilingual secretary in a Japanese company in the US uses Japanese as a L2WS, English as a L1WS (in the literature, L2WS users are often called 'biscrptals' or 'biliterates'). Like 'second language acquisition', Second Language Writing System serves as an umbrella term for a third language writing system, a fourth and so on (although this does not mean that learning or using a L3WS is the same as learning or using a L2WS).

There is therefore a crucial difference between a Second Language Writing System (L2WS) and a Second Writing System – any additional writing system for representing the same language. Children in China learn to read not only Chinese but also the Roman-alphabet-based *pinyin*, which acts as a supplementary second writing system, mostly for pedagogical purposes. On the other hand there are minority or immigrant children who are native speakers of a language, but learn to read in a second language, say Bengali-speaking children in Tower Hamlets in London acquiring literacy in L2 English. In this case they are learning neither a L2WS nor a L1WS, but a *first* writing system that happens to be in their second language. These children are users of *two* languages but *one* writing system. The concepts of language and writing system need to be kept logically separate, even if in most situations they overlap. Indeed there are also children acquiring two writing systems simultaneously, one for the L1WS and one for the L2WS, for example Arabic-speaking immigrant children in the UK learning the English writing system during school hours and the Arabic writing system after school. Some of the chapters to follow will demonstrate the sheer diversity of combinations of language and writing system in, say, children in Singapore (Rickard Liow) or in Switzerland (Schmid).

It is also necessary to make the obvious point that writing system research across languages (cross-writing-systems research) is not the same as L2WS research. Huang and Hanley (1995) compared the use of L1WS Chinese in Hong Kong and Taiwan with the use of L1WS English in England; this does not necessarily tell us anything about the acquisition of Chinese and English as L2WSs. In general, it is important to separate what is cross-linguistic and what is cross-orthographic, what is L1 transfer of aspects of the first *language* (phonology, syntax, morphology, etc.) and what is L1WS transfer of aspects of the first *writing system* (orthographic conventions, phonological transparency, written morphology, etc.).

**Terms**

*L1WS*: a writing system that represents the first language.

*L2WS*: a writing system that represents the second language.

*L2WS learners/users*: people who are learning/using a second language writing system.

*The first writing system*: the writing system that the person learns first, regardless of whether it is in their first or second language.

*The second writing system*: the writing system that the person learns second, regardless of whether it is in their first or second language.

**Issues and methods in Second Language Writing System research**

The concern of Second Language Writing System research is the reading, writing, learning and awareness of L2WSs by L1WS-literate children and adults, as well as any other consequences of using a L2WS for linguistic and nonlinguistic activities. Like children acquiring their first writing system, L2WS learners are affected by universal aspects of writing system use, by the characteristics of the specific writing systems they are learning and by the limited capacity for decoding and encoding initially available in a second writing system.

Some characteristics of the writing system being learnt may be consistent across L2WS learners as well as across L1WS learners. For instance, a highly transparent phonological writing system is learnt faster than a less transparent one by both L1 and L2 learners. Just as Italian children learn to read Italian faster than English-speaking children learn to read English (Cossu, 1999), so English/Hebrew bilingual children learning to read Hebrew decode L2WS Hebrew words faster than L1WS English words because Hebrew, when it is written with added diacritics to represent vowels, is more phonologically transparent than English (Geva, 1999). Another similarity between L1WS and L2WS learners is that neither are initially proficient in decoding and encoding the writing system. Huge differences in reading speed are normally found between L1WS and L2WS readers; Jackson *et al.* (1994) found that the English reading speed of Chinese students at American universities was more than four standard deviations below the American students' reading speed.

Beyond these shared features with L1WS acquisition, a L2WS learner may have to learn *inter alia*:

- at the most global, a new writing system that represents different linguistic units from his/her L1WS (for instance, consonantal versus phonemic, or syllabic versus morphemic);

- a new script for the same writing system (for instance, both writing systems are phonemic but one is written with the Roman alphabet and the other with the Cyrillic alphabet, say Spanish versus Russian);
- a new level of phonological transparency for the same script (for instance, more or less phonologically transparent orthographies both written with the Roman alphabet, such as Italian versus English, or both written with a morphemic script, such as Chinese and Japanese).

When the learners have essentially finished acquiring the L2WS, they still may read, write, and analyse the L2WS in different ways from the L1WS user of the same system. L2WS learners, however, differ from children acquiring their L1WS because they have already had experience of another writing system. On the one hand, L2WS learners are facilitated because they do not have to learn some basic facts about writing systems, for instance that there is a direction to the sequence of symbols and their orientation. On the other hand they are handicapped because what they already know does not necessarily apply to their new writing system. For instance, English L1WS learners learn that the length of the spoken word in phonemes roughly corresponds to the length of the written word in letters, but English learners of L2WS Japanese cannot apply this knowledge because spoken word length is not reflected in the number of kanji in writing: for instance /ko/ and /mizu:mi/ are both written as 湖.

### Main issues in current L2WS research

The bulk of L2WS research to date deals with the effects of the L1WS on the L2WS, particularly the transfer between the two major types of writing system, the sound-based and the meaning-based, and between the two routes for processing, the phonological and the lexical. Research into such effects on L2WS reading began in the early eighties (e.g. Adams, 1982; Barnitz, 1982), but only became widely known through the efforts of Keiko Koda in numerous publications (e.g. Koda, 1988, 1994, 1996, etc.). Within the field of Second Language Acquisition (SLA) research, the transfer of diverse aspects of language from the first to the second language (*language transfer*, see Odlin (1989), which also contains a short section on writing systems) was a major early preoccupation. Recently transfer has been seen as a process that also goes from the second language to the first (Cook, 2003). What makes second language acquisition distinctive is indeed the first language already present in the learner's mind. The major task of SLA research must be to map out the complex relationships between these two languages in the same mind – whether they stay separate, interact or merge.

Because of the distinction between language and writing system, it is not so much aspects of the language itself that may be carried over as the attributes of a particular writing system. It is not Chinese *per se* that is transferred by Chinese learners to the English writing so much as features of the Chinese morphemic writing system. A parallel in other areas of second language acquisition is intonation: speakers of 'tone' languages have a particular set of difficulties acquiring an 'intonation' language and vice versa (Ke, 1992); it is the move from one type of linguistic system to another that is important, not from one language to another. In principle language transfer, say carrying over specific features of English to Italian, should be separated from writing system transfer, say rather than the conventional directions. It is also important to separate *language transfer* from *writing system transfer*. A specific feature of the Italian language may be carried over to English, say writing <\*termometer> for <thermometer> because Italian lacks a phoneme /θ/; this is an example of cross-linguistic influence (asterisks indicate impossible spellings). Or a specific feature of Italian orthography may be transferred, say writing <\*ingiury> for <injury> because in Italian <gi> corresponds to /dʒ/ before <u>; this is cross-orthographic influence. Transfer shades over into the question of which route is used in processing (reading and spelling) (Hayes 1988).

### Research methods in L2WS research

The different research disciplines involved bring their own diverse methods to the study of L2WSs. Much research consists of quasi-experimental studies, comparing different groups of users of the same writing system (seen in this book for instance in the chapters by Lau & Rickard Liow and by Sasaki). Other quantitative approaches include observational research (seen here in the chapters by Van Berkel and by Somers) and simulations as in connectionist models (seen here in the chapter by Van Heuven). Finally, qualitative approaches can also be used (as in the chapter by Hickey). Tables 1.1 and 1.2 display some of the typical methods employed; Table 1.4 organises these in terms of the types of writing system. This section cites a representative sample of the important papers in this area so that readers can follow up particular approaches or writing systems they are interested in.

#### *Experimental methods*

In a sense fully experimental research is not possible when the variable is the L1WS as participants cannot be randomly assigned to groups, unless, say, an artificial writing system were used. Much L2WS research is thus quasi-experimental, involving groups selected by their L1WS and L2WS.

Figure 1.5 gives some of the standard research designs. Most studies employ the same task in the same writing system performed by one or

**Table 1.1** Some experimental tasks for researching reading and writing

<i>Task</i>	<i>Description</i>
Word naming (reading/recognition)	Reading aloud the target (word, pseudoword, etc.) as quickly as possible; accuracy or reaction times or both are measured (Akamatsu; Schmid; Scholfield & Chwo, this book).
Oral reading	Reading a text aloud (Jackson <i>et al.</i> , 1999).
Silent reading	Reading in silence; reading time is measured in words per minute, seconds per word, hanzi per minute, etc. (Nassaji & Geva, 1999).
Silent reading with comprehension measures	Reading in silence, followed by multiple-choice questions, recall, etc. (Koda, 1995).
Silent reading with eye-tracking	Participants' eye movements are recorded during silent reading, revealing what parts of the text they are reading and for how long (Bernhardt & Everson, 1988).
Item recall	A series of items (words, nonwords, pseudokanji, etc.) are presented, followed by a second series: the participant decides whether s/he has seen the item in the previous series (Sasaki, this book), or which item preceded or followed the one just seen in the previous series (Koda, 1988; Mori, 1998).
Lexical judgment/decision	Words and nonwords are presented, the participant decides whether each item is a genuine word or a nonword (Chikamatsu, 1996; Muljani <i>et al.</i> , 1998).
Similarity judgement	Participants decide whether two items (e.g. words, pseudowords) are the same or different. Items can be presented simultaneously or with Stimulus Onset Asynchrony (SOA) (Brown & Haynes, 1985; Haynes & Carr, 1990).
Auditory/visual word matching	Participants listen to a spoken item (word/nonword) and choose the one that matches it from a set of written items (Holm & Dodd, 1996).

(continued)

**Table 1.1** *Continued*

<i>Task</i>	<i>Description</i>
Visual search	Subjects check whether a previously presented symbol is present in a list of symbols. For instance, in 'letter cancellation' they have to find a letter in a series of words (Chitiri & Willows, 1997; Green & Meara, 1987).
Sentence acceptability judgment	Deciding whether a sentence is correct or incorrect; the sentence may contain phonological or visual foils, i.e. items (words, hanzi, etc.) that sound or look like the correct item, as in 'a pair is a fruit' (Hayes, 1988).
Spelling test	Timed or untimed test of spelling words from dictation (Brown, 1970; Okada, 2002; van Berkel, this book).

more groups of L2WS users and L1WS users of the target writing system; for instance, English learners of L2WS Japanese compared with Japanese L1WS readers (e.g. Chikamatsu, this book) or by two or more groups of users of the same L2WS with different L1WSs, say, Chinese and Malay learners of English as a L2WS (e.g. Randall, this book). The two designs are combined in studies comparing groups of L2WS users with different L1WSs compared with L1 users of the target writing system, say Japanese, Spanish and Arabic learners of L2WS English with English L1WS users (e.g. Brown & Haynes, 1985; Koda, 1988); the L1WS users can be adults or learners, i.e. children (e.g. Jackson *et al.*, 1999).

Differences in performance are then explained as the consequences of the participants' L1 writing systems, i.e. as transfer from the L1WS to the L2WS. For instance, L1WS readers of alphabetic and morphemic writing systems are compared in a task involving phonological recoding of materials in an alphabetic L2WS; differences are attributed to transfer of reading strategies from their alphabetic or logographic L1WS (e.g. Wang *et al.*, 2003). Comparing groups of learners of the same L2WS may be less likely to involve an implicit judgment in terms of deficiency than comparing learners with L1 users (as in one study which declares that the English readers 'set a standard' for word processing), and may be more likely to show the creative processes and strategies in the L2WS learners/users rather than their failure to conform to those of L1 users.

Other approaches that have been used include predictions about the performance of L2WS learners/users, based on a contrastive analysis

**Table 1.2** Some experimental methods for researching phonological awareness

<i>Task</i>	<i>Description</i>
Phoneme addition	Adding one phoneme, 'tool' → 'stool' (Leong, 1997).
Phoneme counting	Counting the 'sounds' in words (Holm & Dodd, 1996).
Phoneme deletion	Deleting one phoneme, 'smeck' → 'meck' (Wade-Woolley, 1999).
Phoneme odd-one-out	Finding the odd-one-out in a set of items (words, pseudowords) which all but one contain the same phoneme, e.g. 'fan' from 'fan/cat/hat/mat' (Prakash <i>et al.</i> , 1993).
Phoneme reversal	Transposing two phonemes, 'lip' → 'pil' (Holm & Dodd, 1996).
Phoneme segmentation	Separating the initial or final phoneme (Leong & Hsia, 1996) or each single phoneme
Rhyme judgment	Judging if pairs such as 'rang/sang' rhyme (Holm & Dodd, 1996).
Spoonerism	Inverting the initial phonemes of two words, 'big dog' → 'dig bog' (Holm & Dodd, 1996).

(see Lado, 1957, which contains a section on writing systems) of the L1WS and L2WS, which are tested against their actual performance (Schmid, this book). When the variable investigated is not the L1WS, other groups can be used: studies looking at the effects of L1WS instruction

**Table 1.3** Some types of normal language material

Collection of naturally occurring material	Student essays etc. (Somers, this book); dictations produced as part of normal homework (Luelsdorff, 1990).
Specially elicited full texts	Compositions, for instance games instructions. Used by James <i>et al.</i> (1993).
Collection of mistakes	Mistakes collected from sources, rather than treated as part of a text. Used by Terrebone (1973) and Cook (1997).

**Table 1.4** Summary of some L1 and L2 writing systems relationships that have been studied

<i>L1WS type</i>	<i>L2WS type</i>	<i>L1WS(s)</i>	<i>L2 WS</i>	<i>Source</i>
Morphemic	Alphabetic	Chinese	English	(R) Haynes & Carr (1990); (R) Leong & Hsia (1996); (R, A) Jackson <i>et al.</i> (1994); (A) Wang & Geva (2003); (O) Freeman (1980)
		Japanese	English	(W) Okada (2002)
Syllabic	Alphabetic	Kannada	English	(A) Prakash <i>et al.</i> (1993)
Consonantal	Alphabetic	Arabic	English	(R) Green & Meara (1987); (R) Ryan & Meara (1991); (R) Randall & Meara (1988); (W) Ibrahim (1978); (W) Haggan (1991); (O) Morikawa and McBeath (1992)
		Hebrew	English	(A) Ben-Dror <i>et al.</i> (1995); (O) Kugelmass & Lieblich (1979)
		Persian	English	(R) Nassaji & Geva (1999)
Morphemic vs. alphabetic	Alphabetic	Chinese, Vietnamese	English	(A) Holm & Dodd (1996)
		Japanese, Russian	English	(A) Wade-Woolley (1999)
		Chinese, Indonesian	English	(R) Muljani <i>et al.</i> (1998)
Morphemic vs. consonantal	Alphabetic	Japanese, Chinese, Persian	English	(R) Akamatsu (1999)
		Japanese, Arabic	English	(R) Fender (2003)

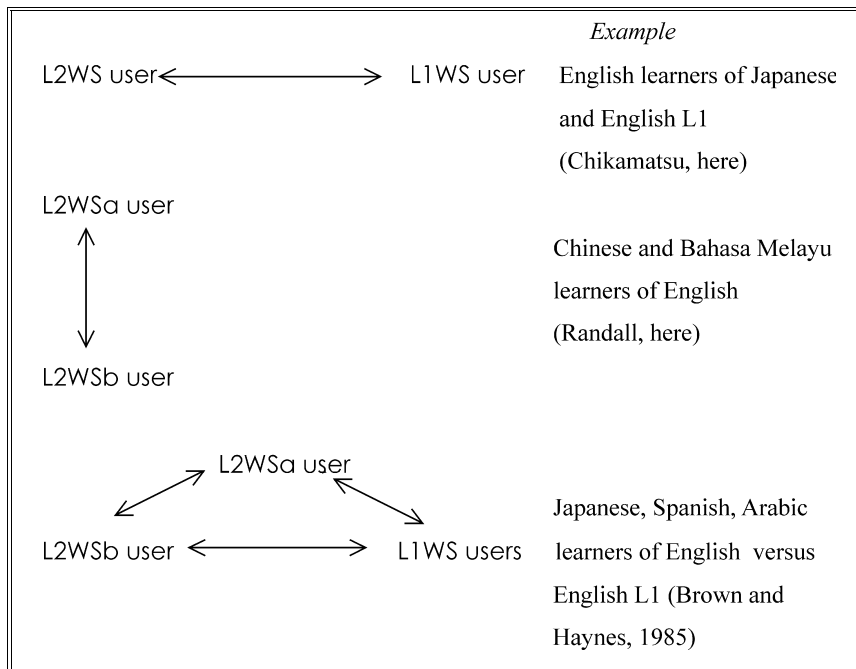
*(continued)*

Table 1.4 Continued

<i>L1WS type</i>	<i>L2WS type</i>	<i>L1WS(s)</i>	<i>L2 WS</i>	<i>Source</i>
Morphemic vs. consonantal vs. alphabetic	Alphabetic	Japanese, Arabic, Spanish	English	(R) Brown & Haynes (1985); (R) Koda (1988, 1995)
		Japanese, Greek, etc.	English	(W) Cook (1997)
		Chinese, Arabic, Spanish	English	(W) Oller & Ziahosseiny (1970)
Alphabetic	Morphemic	English	Chinese	(R) Hayes (1988); (R) Jackson <i>et al.</i> (1994); (R) Sun (1994)
	Consonantal	English	Hebrew	(A) Ben-Dror <i>et al.</i> (1995)
		English, Russian	Hebrew	(A) Wade-Woolley & Geva (1998)
	Alphabetic	Greek	English	(R) Chitiri & Willows (1997); (A) Loizou & Stuart (2003)
		German	English	(W) Luelsdorff (1986)
		Welsh	English	(W) James <i>et al.</i> (1993)
		Spanish	English	(W) Bebout (1985); (W) Terrebone (1973); Staczek and Aid (1981)
Alphabetic vs. morphemic	Morphemic	English, Chinese, Korean	Japanese kanji	(R) Mori (1998)
Alphabetic vs. syllabic	Syllabic	English, Chinese	Japanese kana	(R) Chikamatsu (1996); (R) Tamaoka and Menzel (1994)

R: reading; W: writing; A: awareness; O: other activities

or of L2WS proficiency on L2WS use compare groups with the same L1WS and L2WS (chapters by Akamatsu and Scholfield & Chwo, this book), sometimes with L1WS users as controls (Bernhardt & Everson, 1988). The most popular paradigm is participants with a morphemic L1WS combined with an alphabetic L2WS, say Chinese > English (e.g. Haynes & Carr, 1990; Leong & Hsia, 1996; Jackson *et al.*, 1994), but also



**Figure 1.5** Experimental designs

consonantal L1WSs and phonemic L2WSs (e.g. Randall & Meara, 1988) or alphabetic L1WS and morphemic L2WS (e.g. Hayes, 1988), etc. Some studies also use participants whose writing systems have the same script but with different degrees of phonological transparency, in particular combinations of alphabetic L1WS and L2WS (e.g. Chitiri & Willows, 1997; James *et al.*, 1993). Research mostly concerns the reading, writing and awareness of single orthographic units (mostly words, but also kanji or letters), sometimes presented in context (compounds, sentences, etc.) (e.g. Chikamatsu, this book; Randall, this book), sometimes following experimental manipulation, for instance degradation of the word's visual shape (Akamatsu, this book).

In all these methods, researchers measure the time taken to perform the task (response time, reading time, etc.) and the accuracy (number of correct answers), or only one of these two. Standard reading tests can be used (Nassaji & Geva, 1999; Wade-Woolley, 1999). Table 1.1 illustrates a range of the methods that have been employed, including all those represented in this book. This is intended as a nonexclusive list rather than a logical categorisation. (References in brackets are examples of studies that adopted the task.)

The methods used to test awareness of the linguistic units represented in writing systems include a variety of metalinguistic awareness tasks involving recognition or manipulation of linguistic units, some of which are displayed in Table 1.2. In these tasks, accuracy is measured, i.e. the number of correct answers.

These tasks can involve words or nonwords (as in 'poor teddy' → 'toor peddy'). They measure accuracy, but can be used in conjunction with measures of response times, as in the phoneme deletion task in Ben-Dror *et al.* (1995). They can be used for other linguistic units besides phonemes, for instance Bassetti's word segmentation task (this book). Awareness can also be investigated with the same methods used in spelling research, such as spelling (Holm & Dodd, 1996), dictation (Leong & Hsia, 1996), word or pseudoword naming (Holm & Dodd, 1996; Koda, 1989; Lau and Rickard Liow, this book). Orthographic awareness of the L2WS can also be measured: for instance, awareness of legal letter sequences in the L2WS can be tested with a decision task where two words are shown and the participant decides which one looks like a L2 word (Wade-Woolley, 1999).

#### *Descriptive methods*

Another broad approach is to collect and describe L2 learners' writing. As in other areas of SLA research, a starting point is the technique of Error Analysis (Corder, 1974), in which the learners' writings are scrutinised for mistakes, i.e. forms that are not correct in the target writing system (even if L1 writers may also make them), which are then analysed in terms of preset categories.

Errors can be collected from different sources, such as free compositions or dictations. As with experimental research, L1WS users or learners (children) can be compared with L2WS learners (Bebout, 1985; Brown, 1970) or groups of L2WS learners/users with different L1WS backgrounds (Cook, 1997), but most studies look at a single group of L2WS users, sometimes to test predictions deriving from contrastive analysis (Oller & Ziahosseiny, 1970). The same learners/users can be retested over time (as in Van Berkel, this book), providing longitudinal information by showing which errors are persistent and what is or is not a temporary compensatory strategy; it is indeed possible to collect all the misspellings produced by a single L2WS user (e.g. Luelsdorff, 1990).

After errors are collected, they are categorised. Cook (1997) used the simplistic categories taken from the L1 English studies conducted by the National Foundation for Educational Research (Brooks *et al.*, 1993): letter insertion, omission, substitution, transposition and grapheme substitution. Bebout (1985) analysed Spanish learners' errors with English using categories such as consonant doubling, other consonant errors, errors with schwa /ə/, errors with silent <e>, other vowel errors, letter

misordering and homophones. Errors can also be categorised according to the spelling processes or strategies they reflect: Luelsdorff (1990) used categories such as overgeneralisation (of L2 spelling rules) and transfer (including 'orthographic cognatisation'); James *et al.* (1993) began by performing a Contrastive Analysis of the similarities and differences between the English and Welsh writing systems and classified errors into categories such as mispronunciation (L1 phonological interference), misrepresentations (writing a L2 phoneme using a L1WS correspondence rule), lexical cognate misspelling, etc. Some studies also use miscue analysis (see Pumfrey, 1985) to analyse errors in reading aloud (e.g. Sergent, 1990).

The difficulty with many of the above error collection techniques is that only unusual forms may strike the analyst's eye (see Van Berkel, this book). A more balanced approach uses a large corpus of materials from which errors can be drawn and their frequency established against a larger mass of material (Table 1.3 provides examples of such materials). The possibilities of a computer-based corpus approach are described in the chapter by Okada in this book. At the moment these are limited by the lack, or limited availability, of corpora of L2 learners' writings that accurately reflect the spelling and other writing system properties of the original texts. The difficulties involved in creating such corpora are discussed by Somers (this book).

#### *Computer simulations*

Computer modelling of some aspects of the L2WS has often occurred in connectionist work on the first language writing system (Seidenberg & McClelland, 1989). Connectionist spelling networks 'learn' to transform a representation of spoken input into written spellings; they learn to produce correct or acceptable spellings for regular and irregular words, including previously unseen ones. Computer simulations have been mentioned occasionally in SLA research, e.g. Sokolik and Smith (1992) and Blackwell and Broeder (1992). The issues are:

- (1) Whether the simulations are based on the crucial SLA assumption that there is a pre-existing L1 system in the person's mind. That is a connectionist model of SLA has to demonstrate that there is already a functioning system to which a second system is added, rather than, say, make a cross-language comparison of two writing systems.
- (2) Whether they remain purely in the computer or connect to real-world evidence of writing system use.

The paper by van Heuven in this book shows some of the future possibilities of modelling that takes these points into account.

#### *Qualitative research*

While most research in second language writing systems is quantitative, L2WSs are also studied by means of qualitative research methods.

For instance, the think-aloud technique, whereby L2WS users perform a task while reporting the processes they are using, was used to study hanzi and word recognition strategies in US learners of Chinese (Everson & Ke, 1997). Interesting insights into low-level processes of L2WS reading and writing can also be found in narratives, such as the personal account of using Hebrew as a low-proficiency L2WS user by Andrew Cohen (2001). De Courcy (2002) used a variety of qualitative methods to investigate how a group of immersion students learn and use the Chinese writing system, including learner diaries, interviews, think-aloud protocols, etc.

#### *Examples of L2WS research*

Table 1.4 presents some of the studies that have been done. While this list is far from exhaustive, it can help the reader trace the L1WS and L2WS combinations they are interested in. Some of these studies are widely cited, others were included to show the variety of possible writing system combinations; the list is exemplificatory rather than comprehensive.

### **Main Findings of Second Language Writing System Research**

Research has consistently shown that L2WS users differ from L1WS users because of the other writing system they already know. Most research has concentrated on reading processes, especially word recognition, but it has also touched on writing and metalinguistic awareness. The characteristics of the L2WS and the L1WS experience interact in many different ways, as shown below.

#### **L2WS reading**

When the L1 and L2 writing systems encode the same linguistic units, L1 reading experience facilitates L2 reading. L2 readers are better equipped to read a L2WS that uses the same script or at least encodes the same linguistic units as their L1WS, and they read it faster than readers with a different L1WS background. For instance, L1 readers of Japanese (a partially morphemic writing system) are faster than L1 readers of an alphabetic writing system at word naming in Chinese, a morphemic L2 writing system (Yang, 2000). The same is true when both writing systems encode syllables: Chinese learners of Japanese as a L2WS read syllabic kana faster than romanised texts (Tamaoka & Menzel, 1994, reported in Kess & Miyamoto, 1999). It is also true when both writing systems represent phonemes: Spanish L2WS readers of English are facilitated compared with Chinese readers, even when matched for reading comprehension (Haynes & Carr, 1990). Thus, reading is facilitated when the L2WS represents the same linguistic units as the L1WS, even when the L2WS user has to learn a new script,

as in the case of Chinese learners of Japanese reading kana (Tamaoka & Menzel, 1994).

L1WS reading processes also affect L2WS reading when the two writing systems encode different linguistic units. While it might be supposed that L1WS reading processes would not be used when the two writing systems are different, the evidence suggests the opposite, mostly based on morphemic and consonantal L1WS readers reading L2WS English, but with some other writing system combinations. For example the effects of a morphemic L1WS (Chinese, Japanese) on the reading of an alphabetic L2WS have been repeatedly demonstrated. Comparisons of different readers of L2WS English revealed that morphemic L1WS readers rely more on sight-word knowledge in reading English in that they:

- (1) are less affected by the unpronounceability of English words than Spanish readers (Koda, 1987);
- (2) are less efficient at reading pseudowords than Spanish readers (Brown & Haynes, 1985; Haynes & Carr, 1990);
- (3) are more affected by word familiarity than Spanish readers (Brown & Haynes, 1985; Haynes & Carr, 1990);
- (4) are faster at recognising words than Arabic readers, who use the more time-consuming phonological recoding (Fender, 2003);
- (5) are more disrupted by alterations to word shape than Persian readers, whose L1WS is semi-alphabetic (Akamatsu, 1998).

This means that L1 readers of morphemic writing systems recognise English words in the same way as they recognise hanzi and kanji. In general, they use the visual route for reading *all* sound-based L2WSs, whether alphabetic or syllabic. For instance, Chinese learners of L2WS Japanese rely more on visual information for reading kana than do US learners of Japanese; when a Japanese word normally written in hiragana is presented in katakana (or vice versa), Chinese readers of L2WS Japanese are more disrupted (Chikamatsu, 1996).

There is also evidence of effects of a consonantal L1 writing system on an alphabetic L2WS. For instance, L1 readers of consonantal Arabic rely more on consonants than vowels in L2WS English word recognition. Arabic readers of English, when asked whether two English words were the same or not, tended to ignore differences in vowels; Arabic readers, who are used to reading by consonants only, when reading English are faced with 'what seems to be far too much information' (Ryan & Meara, 1991: 533). Effects of a phonemic L1WS on morphemic and syllabic L2WSs have also been found. For instance, US learners of Japanese recall a novel kanji more easily when it contains a pronounceable phonetic radical than when it cannot be pronounced (Mori, 1998), showing that they are searching for phonological clues in the morphemic characters. They also rely on phonological decoding to read kana words

more than Chinese learners (Chikamatsu, 1996), and are less disrupted than L1 readers when morphemic information is removed but phonological information remains, as in reading romanised Chinese (Bassetti, 2004) or Japanese texts solely written in kana with no kanji (study reported in Everson, 1993). The reliance on phonological information also affects their learning strategies, so that English learners of L2WS Chinese rely on phonetic radicals to learn hanzi more than Japanese ones (Shi & Wan, 1998).

Even when both writing systems represent the same linguistic units (or even use the same script), L2WS reading is affected by differences of phonological transparency in the two writing systems, as evidenced by several chapters in this book: Hickey and Ó Caimín's account of English L1 children learning Irish L2WS and Van Berkel's account of Dutch L1WS children learning English L2WS. L1 readers of a phonologically transparent L1WS use grapheme–phoneme recoding to read an opaque L2WS; in reverse, L1 readers of an opaque L1WS use a whole-word approach to read a phonologically transparent alphabetic L2WS. Over-reliance on phoneme–grapheme recoding frequently occurs in L1 readers of more phonologically transparent writing systems reading L2WS English (Birch, 2002). For example, Spanish L2WS English learners are slower at word recognition in English than Japanese learners, even though Spanish and English use the same script, since they are using grapheme–phoneme conversion via the phonological route, which is more time-consuming than the whole-word recognition used by Japanese learners (Akamatsu, 1999). On the other hand, readers of a less transparent system may fail to use the phonological route to read more transparent L2WS: English children reading French as a L2WS without instruction in French grapheme–phoneme conversion rules use a whole-word approach, although the French GPC rules are more reliable than the English ones and a phonological decoding approach would be more successful (Erler, 2003).

Experience of any previous writing system can affect L2WS use: Japanese ESL readers with better knowledge of *romaji*, the Japanese romanisation system, have better English word recognition skills (Yamada *et al.*, 1988, cited in Buck-Gengler *et al.*, 1998), and Chinese readers who know *pinyin* are better at reading English pseudowords (Holm & Dodd, 1996). In this case, knowing a second writing system helps the person to use a second language writing system (but it can also have negative effects – see Okada, this book).

Apart from the linguistic units represented and phonological transparency, other aspects of L2WS reading have also been studied, such as orthographic conventions. For instance, adding interword spacing affects eye movements in English readers of L2WS Chinese but not Chinese L1WS readers (Everson, 1986); marking the boundary between

prepositions and nouns in Hebrew facilitates English and Russian L2WS readers but not Hebrew L1 readers (Wade-Woolley & Geva, 1998).

There is also some neurolinguistic evidence from L2WS users. L2WS users with disabilities have different impairment in their two writing systems, showing the writing-system-specific nature of the impairment: Rickard Liow (1999) reports the case of a Chinese user of English who is dyslexic in English but not in Chinese; Wydell and Butterworth (1999) report the case of a Japanese user of English who is only dyslexic in English. While it is true that readers with some disabilities have difficulties in reading both languages, the nature of the difficulties is different in the two writing systems (Geva & Siegel, 2000).

To generalise, the main finding of L2WS research is that the greater the similarity between the L1WS and the L2WS (i.e. representing the same linguistic units, using the same script, having the same levels of phonological transparency or using similar correspondence rules or orthographic regularities), the more L2 reading is facilitated. But, even when the two writing systems differ, L2WS reading is still affected by L1WS reading processes.

### **L2WS writing**

The writing component of L2 writing systems has received rather less attention than reading. On the one hand, L2WS spelling, like reading, is affected by characteristics of the target writing system: in one study English learners of L2WS Hebrew were asked to write down previously learnt Hebrew words including diacritics for vowels; most of their spelling errors consisted of incorrect vowels, consistent with the fact that Hebrew only represents consonants (Cowan, 1992). And spelling is an area of second language acquisition where L2WS users reach fairly high levels of performance (Cook, 1997).

On the other hand, L2WS spellers do not necessarily behave in the same way as L1WS spellers or as L2WS spellers from other L1WS backgrounds. A fairly sparse scattering of research into spelling mistakes in L2WS English suggests effects of both the L1 phonological system and the L1 writing system. L2WS users with different L1s or writing systems have characteristic mistakes; for instance Japanese spellers of English show the Japanese /l~r/ confusion in the spelling of <recentry>, or the use of epenthetic vowels in <yesuterday>. The typical deviations of L2 spellers can depend on the L1 phonology and/or L1 writing system. L2WS spelling research has found effects of both the L1 writing system and phonology, with specific groups differing in their performance in ways that are consistent with their L1 writing system and phonology.

Turning to the effects of the L1WS, L2WS spelling accuracy is affected by the *type* of L1WS: Oller and Ziahosseiny (1970) found that L1WS

readers of various writing systems that use the Roman alphabet produced more spelling deviations than L1WS users of other writing systems (Chinese, Japanese, Arabic). Second, the L1WS affects L2WS spelling processes and strategies. Luelsdorff (1990) describes the spelling strategies of a German high-school learner of L2WS English. Some of these involve the use of the L1WS: for instance, using L1 letter names to spell L2 words, or L1 phoneme–grapheme correspondence rules in spelling <station> as <\*steschen>. James *et al.* (1993) also found effects of L1WS Welsh PGC correspondences on L2WS English spelling, for instance using <c> instead of <k> because the L1WS does not have <k>, or spelling <ship> as <sip> because in Welsh /f/ is spelled as <si>, or spelling <nephew> as <neffew> because in Welsh <ph> for /f/ is only used in word-initial position.

Differences between L1 and L2WS spellers were also found outside the phoneme–grapheme conversion rules, for instance in morphological spelling. Adopting the same method used by Bryant *et al.* (1997) for English children, Cook (2004b) found that L2WS learners of English are quicker to get the uniform morphological spelling for the written morpheme <ed> than L1WS children. The reasons for this might be various, including the difference in age and the effects of literacy in a L1WS, but are most probably the consequence of instruction, with L2 learners being specifically taught that the English past tense is spelled <ed>.

There are still limitations to L2WS spelling research. First, the sparse research available sometimes did not aim at finding effects of the L1 writing system; some researchers denied the possibility of there being any (e.g. Wyatt, 1973). Second, often the same L2WS spelling error can be explained as a consequence of either L1 phonology or L1 writing system. For instance, the confusion between <l> and <r> in Japanese ESL spellers is explained as a consequence of either L1 phonology (Cook, 1997) or the Japanese *romaji* transcription system (see Okada, this book) – indeed both probably play their part. Finally research looks at the product of spelling, i.e. the spelling errors, rather than at the process of spelling. The techniques developed in L1WS spelling research are rarely used in L2WS spelling research; for instance misspelling tasks where spellers are requested to spell a word incorrectly, or studies of spelling production time using keyboarded responses, etc.

There is even less L2WS research on the effects of orthographic conventions than on spelling. A bibliography of ESL writing (Tannacito, 1995) lists 19 papers about ‘spelling’, but only one for ‘punctuation’ and two for ‘orthography’. Although this bibliography is now quite old, the situation has not changed much in the interval.

### **L2WS awareness**

As seen above, using different writing systems requires awareness of different linguistic units (radicals and morphemes in Chinese, phonemes

and words in English and Italian, consonants in Arabic, etc.). Researchers working on language awareness in readers of a second language writing system have largely focussed on phonemic awareness, probably because English is the most studied L2WS. A common finding is that the metalinguistic awareness of the linguistic units represented in the L1WS affects phonemic awareness in L2WS English learners and users.

Firstly, users of a phonemic L1WS outperform users of a syllabic L1WS in phoneme awareness tasks with L2WS English: L1 readers of the alphabetic Russian writing system perform better than Japanese L1 readers at phoneme deletion in L2WS English even though matched in word recognition and pseudoword decoding (Wade-Woolley, 1999).

Secondly, readers with different L1WSs have different awareness of the phonological units represented by the L2WS. For instance, English users of L2WS Hebrew are faster than Hebrew L1 readers in deleting the first phoneme in Hebrew words and, unlike Hebrew readers, are unaffected by whether words are written with or without vowels (Ben-Dror *et al.*, 1995).

Apart from the differences in the linguistic units represented, there are also effects from the phonological transparency of the two writing systems. While both Greek and English are alphabetic, Greek-English bilingual children outperform English monolingual children in phoneme awareness tasks, probably because the Greek writing system is more phonologically transparent (Loizou & Stuart, 2003).

Other aspects of L2WS awareness have also been studied, such as orthographic awareness, i.e. knowledge of the possible combinations of symbols in the L2WS. Wade-Woolley (1999) found differences in the orthographic awareness of Japanese and Russian users of L2WS English: the Japanese learners were faster than the Russians in deciding whether a sequence of letters could be an English word. He explained this as a consequence of the Japanese learners relying more on orthographic information for reading English than the Russian learners, who rely more on phonology. Jackson *et al.* (1994) also found that Chinese readers had better orthographic awareness than phonological awareness of L2WS English. Regarding orthographic awareness of writing systems other than L2WS English, western learners of Chinese learn to use the phonetic radicals of hanzi in just six months, compared with two years in Chinese children (Chen & Wang, 2001).

### **Other aspects of L2WS use – linguistic and nonlinguistic processes**

Other aspects of writing systems, i.e. their physical properties, also affect L2WS use. Anecdotes are sometimes found in the literature: Ball (1986) reports that Arabic ESL learners turn to page 62 instead of page 26, reading the number in the wrong direction. But there is also experimental evidence, for example that L2WS reading is affected by L1WS

directionality: unlike English L1 readers, Chinese readers of L2WS English, whose L1WS may be written vertically, are not negatively affected in letter recognition when reading English letters vertically (Freeman, 1980). Arabic readers, whose L1WS is read from right-to-left, locate letters in English words faster when the letter is on the right-hand side of the word rather than on the left-hand side, whereas English L1WS readers are faster at locating letters on the left (Randall & Meara, 1988). Physical properties of the L1WS also affect L2WS writing: Sassoon (1995) reported that L2WS users are affected by their L1WS experience in terms of how they form letter shapes, how they join letters, how they hold the pen, etc. Anecdotal evidence is found in the literature, for instance that Chinese native speakers who learnt *pinyin* in school write Italian with all letters separated as in print writing, i.e. not joined up (Banfi, 2003). Other examples are presented in Cook (2001), for instance the fact that Chinese writers of L2WS English start writing the letter <t> with the horizontal line, following the order they use when writing hanzi.

L2WS users are also affected by both their writing systems when performing some nonlinguistic activities. For instance, after learning the English writing system, Hebrew children showed an increase in left-to-right directionality in the way they arrange pictures of temporal events (getting up, going to school, going to bed, etc.) (Tversky *et al.*, 1991); they also name objects from left-to-right rather than from right-to-left as they did when they were literate only in Hebrew (Kugelmass & Lieblich, 1979). When shown drawings that seem to be rotating, English readers perceive an illusory right-to-left rotation and Arabic readers an illusory left-to-right rotation, but Arabic L2WS English users perceive rotations as being equally left-to-right and right-to-left (Morikawa & McBeath, 1992). In other words the directionality of both writing systems affects nonlinguistic activities in L2WS users.

### **The Multi-competent L2WS User**

Most of the research findings reported above deal in one way or another with the issue of transfer from the L1WS to the L2WS. Indeed the term 'transfer' often figures in the titles of articles (e.g. Verhoeven, 1994), book chapters (Gesi Blanchard, 1998), conference papers (Durgunoglu & Öney, 2000) and books (Carlo & Royer, 1994). Even when it is not explicitly mentioned, transfer is still generally the framework for researchers working in this field, as in Koda (1995; this volume). The review of findings above shows that most research concentrated on transfer from the L1WS to the L2WS. In other areas of SLA research, the transfer of some aspect of the first language to the second is now so well-established that people have turned to other research

questions. Indeed if the first language had no effect on the second language in the learner's mind, there might not be a discipline of SLA research since L2 acquisition would be effectively covered by L1 acquisition research. While the new area of L2 writing system research initially needed to make this point about transfer, it is not clear that much mileage can be gained from continuing to make L1-to-L2 transfer a main theme of research: once transfer has been shown to apply in general, is it necessary to demonstrate it over and over for all possible pairs of writing systems in all possible ways? L2WS learning and use are more complex and involve many other factors apart from L1WS transfer. The findings reported above show that it is not simply a matter of transferring L1WS habits to the L2WS, but that there is an interaction between the characteristics of the two writing systems and the processes associated with them in the L2WS user's mind. In general, L2WS users use their writing systems differently from L1 users with one writing system. The L2WS user is not simply failing to use the L2WS in the same way as a L1 user, or trying to use a L2WS in the same way as his/her L1WS; L2WS users read, write, learn and analyse their L2WS *differently* from L1WS users, because they have more than one writing system in their minds.

We can therefore extend the notion of multi-competence, first proposed in Cook (1991), to writing systems. Multi-competence was defined as the knowledge of two or more grammars in one mind (Cook, 1991), expanded later to the 'integration continuum' which deals with the various relationships that may obtain between the two or more languages in one mind (Cook, 2002), in particular to the effects of the second language on the first, sometimes known as 'reverse transfer' (Cook, 2003). A multi-competent L2 user is not two monolinguals in one person, but has an integrated knowledge of the two languages, which interact and affect each other. Applied to L2WS research, this suggests that the multi-competent L2 reader, as well as knowing two or more languages, also knows two or more writing systems. This means that L2WS users:

- (1) have different uses for their L2WS, compared with L1WS users of their L2WS, and for their L1WS compared to L1WS users of their L1WS;
- (2) have different knowledge of their L2WS compared with L1WS users of their L2WS, and of their L1WS compared with L1WS users of their L1WS;
- (3) have an integrated system in which both writing systems coexist.

These points are explained in more detail below.

### **Uses of writing systems in multi-competent L2WS users**

The multi-competence theory predicts that L2 users use their L2WS in ways that differ from L1WS users with only a single writing system. For

instance, a L2WS reader can use the L1WS to represent the pronunciation of L2 written words, as in the case of Japanese learners of L2WS English who use *furigana* – raised kana symbols used to show the pronunciation of difficult or infrequent kanji – to note down the pronunciation of English written words (Okada, this book). The L1WS can also be used to develop L2-reader-specific reading and writing strategies for the L2WS, as when a L2 reader sounds out unknown L2 words using L1WS rules, to encode them in working memory and to keep reading, or a L2WS writer uses L1WS orthographic patterns to spell unknown L2 words, as in Italian-German children acquiring literacy in Italian, who borrow graphemes from German to represent Italian phonemes (Schmid, this book).

The L2WS user is not just a monocompetent user reading and writing another writing system as if it were their first one but with lesser proficiency, but is a new type of reader-writer who, consciously or unconsciously, adapts the processes and strategies developed for using one writing system to the particular cognitive needs of using another. A L2 user can use his/her specific strategies to perform tasks more efficiently than monocompetent L1WS readers. For instance:

- (1) Japanese readers of L2WS English are less disrupted by the presence of unpronounceable symbols in English texts than English L1WS readers (Koda, 1995);
- (2) L2WS readers of English are better at detecting word-final silent <e>s in text than English L1WS readers (Cook, 2004a);
- (3) Italian readers of L2WS English are less affected by phonological foils than English L1WS readers in English word recognition tasks (Sasaki, this book);
- (4) English readers of L2WS Chinese and Japanese read faster than L1WS readers when only phonological information is available, without morphemic information, as in reading romanised Chinese (Bassetti, 2004) or Japanese written in kana without kanji (study reported in Everson, 1993).

L2WS users also perform differently in their L1WS from monocompetent users of the same L1WS. They develop specific reading and writing strategies for the L1 writing system, which differ from the strategies of monocompetent users. For a start, L2WS users can perform better than monocompetent L1 users of the same L1WS: children who are skilled English readers and are also literate in the more transparent Italian L2 writing system perform English word recognition and spelling better than children who are skilled English readers but are only literate in English (D'Angiulli *et al.*, 2001). Secondly, even when performance is apparently the same, processes and strategies may still be different from those of monocompetent users of their L1WS. For instance, letter

search patterns of Greek users of L2WS English in their L1WS Greek differ from those of monocompetent Greek WS users, showing different effects of stress patterns, word length and content/function word distinction (Chitiri & Willows, 1997). L2WS users' reading and writing practices become a mix of the reading/writing practices of their two writing systems, as in Arabic readers of L2WS English, whose L2WS letter search patterns differ from those of both English and Arabic L1 readers (Randall & Meara, 1988). L2WS users can invent new meanings for L2WS symbols, as the Chinese writer of L2WS Italian who uses full-stops to separate 'information units' within the sentence (Banfi, 2003). L2 readers can also use codeswitching in writing, take notes in one writing system while reading another, and in general take advantage of all the writing systems they know.

### **Knowledge of writing systems in multi-competent L2WS users**

The multi-competence theory applied to L2 writing systems predicts that the L2WS user has a knowledge of his/her two writing systems that differs from the knowledge of L1WS readers of either writing system. The research reviewed above suggests that the L1WS affects phonological awareness in L2WS users: English users of L2WS Hebrew are better than Hebrew monocompetent readers in phoneme deletion (Ben-Dror *et al.*, 1995); Greek child users of L2WS English outperform English monocompetent children in phoneme awareness (Loizou & Stuart, 2003). But researchers also found effects of a L2WS on awareness of L1 phonological units that are not represented in the L1 writing system. For instance, Kannada-speaking adults, who are literate in a syllabic writing system, perform phonemic awareness tasks in their L1 better if they learned L2WS English: on a phoneme deletion task performed in Kannada, Kannada-English biliterates obtained 99% accuracy, but Kannada monoliterates only achieved 46% accuracy (Prakash *et al.*, 1993). This confirms the multi-competence hypothesis: a L2WS user has different knowledge of their L2WS from L1WS users of that writing system and different knowledge of the L1WS from monocompetent L1WS users.

### **Co-existence of writing systems in the multi-competent L2WS user's mind**

Finally, when L2WS users are using one of their two writing systems, both WSs are simultaneously activated in their minds at some level: readers are slower at recognising L2 words whose orthographic patterns are legal in both their writing systems than those that are legal in only one of their writing systems (Altenberg & Cairns, 1983; Beauvillain & Segui, 1992). This may happen because, when a word's orthographic pattern is legal in both writing systems, bilingual readers have to check more

entries in the orthographic lexicon(s). L2WS users are also faster at recognising L2 words whose orthographic patterns are legal in their L1WS than those that are illegal, showing that the effects of the legality of a word in one writing system carry over to the other (Muljani *et al.*, 1998). When L2WS users read, both the meanings of interlingual homographs (word spelled in the same way but having different meanings and pronunciations in the two WSs) become activated (Van Heuven, this book). For example, in English <pain> /peɪn/ means 'suffering'; in French <pain> /pɛ̃/ means 'bread': French users of L2WS English are facilitated by <pain> more for the French <beurre> 'butter' than the English <ache>. In English <four> /fɔː/ means '4', in French <four> /fʊr/ means 'oven': French users of L2WS English have the <five> facilitated (Beauvillain & Grainger, 1987). In both cases, the most frequent lexical item is activated, regardless of the language being read. So the orthographic lexicon of the writing system that is off-line is always available, resulting in activation of lexical items in the other language. On the other hand, the amount of activation of words from the other writing system may depend on which of the two writing systems has been previously activated (Chitiri & Willows, 1994; Jared & Kroll, 2001). When people write in their L2WS, orthographic conventions are also activated from their L1WS. This includes using L1 punctuation marks when writing in the L2WS, as in Arabic writers of L2WS English who use spacing before full stops or treat quotation marks as brackets (Somers, this book); and using L2 orthographic conventions when writing in the L1WS, such as Italian users of L2WS English who write the names of the days of the week in capitals when writing in Italian, where it is not necessary.

In conclusion, the presence of a L2WS in the mind affects the use and knowledge of the L1WS and all the writing systems of the L2 user are present and interact during reading and writing. An approach based on unidirectional transfer from L1WS to L2WS cannot handle such evidence.

If this argument is correct, it also raises a question about the methodology of L2WS research. Research that compares monolingual L1WS users with L2WS users often takes the results for monolinguals as being those shown by the subjects in their L1 rather than those shown by 'pure' monolinguals (e.g. Chitiri and Willows, 1994). Even when (rarely) a supposedly monolingual group is used for comparison, the subjects often turn out on closer inspection to be people who are living in a country where the other writing system is used, especially when the L2WS under investigation is not English and native controls are drawn from the English-speaking country where the research is performed (e.g. in a study comparing Chinese natives and English L2 readers of Chinese, the Chinese controls were students in US universities (Hayes, 1988)). The same applies to research comparing L2WS learners or users

with different L1WS backgrounds, who often turn out to be all studying the L2WS in the US (and therefore to be literate in L2WS English): for instance, comparisons of American, Chinese and Korean learners of Japanese all studying at a US university (Mori, 1998). The problem is that all these learners and users are in a sense 'contaminated' in that their use and knowledge of their L1 writing system may have been affected in some way by the L2WS they have acquired. While such effects may only arise at advanced levels of L2 reading and writing, this would need to be established: D'Angiulli *et al.* (2001) showed benefits in the L1WS (English) for English-Italian children with just some exposure to the Italian writing system. This methodological point is not of course peculiar to L2WS research but affects any research that tries to establish native performance; Kato (in progress) showed that the Voice Onset Times established for plosive consonants for monolingual Japanese in their L1 had been distorted by the fact that the subjects measured had been living in the United States. In syntax too, if linguistics insists on accepting the monolingual native speaker as the gold standard, those who know another language may be suspect in the first language: Cook (2002) warned 'The judgements about English of Bloomfield, Halliday or Chomsky are not trustworthy, except where they are supported by evidence from 'pure' monolinguals' (p. 23). In L2WS research as well it is important to control the whole linguistic and orthographic background of participants.

## Research Questions in L2WS Research

The most common research questions in research into L2 writing systems has undoubtedly been the effects of the L1WS on a L2WS which represents different linguistic units and/or has different levels of phonological transparency, as we have seen. We should nevertheless point out that the ability of people to use a L2WS raises a number of other interesting questions for SLA research and psychology.

Even with transfer from L1 to L2 writing system, there are unanswered questions such as:

- *ultimate attainment*: do L2WS learners from different L1WS backgrounds differ in their ultimate attainment in terms of speed and accuracy in reading and writing the target WS?
- *rate of development*: do learners from different L1WSs develop L2WSs at different rates compared to each other or compared with native learners?
- *learning strategies*: are L2WS learning strategies affected by L1WS learning strategies (say rote repetition of written symbols as in Japanese children)?

- *orthographic conventions*: are L2WS users affected by differences in orthographic conventions, such as the absence or presence of capital letters, or the use of spacing to represent pauses rather than word boundaries?
- *physical properties*: are L2WS users affected by L1WS directionality, ways of producing actual written symbols, etc.?

But a number of research questions go beyond the question of transfer from L1WS to L2WS. Some of the questions that can be asked are:

- *reverse transfer*: does learning a L2WS affect how people read, write and analyse their L1WS (for instance, does learning a more phonologically transparent L2WS affect reading and spelling processes used for the L1WS)?
- *awareness of other units not utilised in speech*: are L2WS facilitated for instance in learning that -ed is one written morpheme?
- *L1WS attrition*: do L2WS users lose L1WS writing automaticity, say Chinese students using L2WS English?
- *integration of the L1WS and the L2WS*: to what extent are the two writing systems distinct in the mind of the L2 user or do they form a merged system?
- *multiple language writing systems*: how does each subsequently learnt writing system (including supplementary writing systems such as romanisation) affect the others, say second on third and so on?
- *effects of teaching*: what are the effects of teaching method on L2WS acquisition, say the differences between phonics and whole-word methods? What are appropriate L2WS teaching methods?
- *learning setting*: are there differences, say, between the English spelling of an Italian waiter and a student in a language school in London?
- *individual differences*: are there effects of age of L2WS onset, number of L2WSs known, motivation, cognitive style, working memory, visual and phonological skills, etc.?
- *sociolinguistic factors*: how do sociocultural practices in the two societies, and particularly the status and attitudes towards the writing system, affect L2WS reading and writing?
- *neurolinguistic research*: which parts of the brain are activated when reading or writing a L2 writing system, compared with native readers of both the L1 and the L2 writing systems?
- *nonlinguistic consequences of learning a L2WS*: does learning a new WS's directionality affect how people represent temporality, arrange images, etc.?
- *the effects of new technologies*: how does L2WS interface with computer-mediated communication such as e-mail in learning and using L2WS?

## **Organisation of the Book**

This book contains 16 chapters, organised roughly into four sections on the reading, writing, awareness and teaching of a Second Language Writing System.

### **Writing a Second Language Writing System**

The chapters in this section look at two aspects of writing a Second Language Writing System: spelling and handwriting.

Nobuko Chikamatsu looks at whether kanji are stored and accessed by English-speaking learners of L2WS Japanese as units or decomposed into radicals (semantic or phonetic components of kanji), through an experiment with the 'tip-of-the-pen' technique. When participants were in 'tip-of-the-pen' state, i.e. remembered some information about the missing kanji but not the complete kanji, they had to indicate the likely internal structure and likely number of strokes of the unknown kanji. The results show how the Japanese mental lexicon of L2 learners is organised and how an alphabetic L1 writing system affects the writing of a morphemic L2 writing system through the role of phonological, morphological and orthographic information for character recall. Apart from the results themselves, the most striking part of this chapter is perhaps the innovative use of the 'tip-of-the-pen' research technique.

Ans van Berkel investigates how Dutch high school students learn to spell English, aiming to find out whether they rely on L1 spelling strategies, which are mainly phonological given the transparent L1WS, or orthographic strategies (i.e. discovering rules). An error analysis of data from dictation of familiar words concentrated on two types of error: L1 errors (due to transfer of L1 phonological knowledge) and L2 errors (due to inadequate L2 spelling knowledge). An analysis of correct answers looked at the role of phonological and orthographic strategies. Dutch learners of English clearly rely on phonological strategies in the early stages of learning English as a L2WS but start using orthographic strategies at later stages. The strengths of this paper are its clear contrastive descriptions of the spelling system in two languages and the use of large amounts of elicited spelling data.

Mick Randall looks at the effects of a meaning-based L1WS (Chinese) and a phonologically transparent alphabetic L1WS (Bahasa Malayu, or BM) on L2WS English, with a view to disentangling the relative contributions of the L1 phonology and of the L1WS to L2WS word knowledge, using experiments that compare first English L2WS learners with different first languages (Chinese and BM) and same first writing system, and then learners with different L1s and L1WSs. The patterns of spelling errors reveal that the L1 phonology plays an important role in determining L2WS spelling errors, speakers of different languages showing the

same spelling errors for consonant clusters that do not exist in their first languages. The main difference between the Chinese and BM groups was the treatment of the inflectional morpheme <ed>, which could not be explained in terms of orthographic distance. The chapter provides a new insight into the complex relationships of meaning-based and phonologically based writing systems.

The chapter by Harold Somers looks at the creation of learner corpora, i.e. computerised collections of language produced by L2 learners, and argues that the handwriting of L2 learners of English contains features that should be represented in corpora. The author discusses the features that should be made available for researchers and teachers and how they can be marked up with reference to spelling, punctuation, letter shape etc., using examples taken from a small corpus of hand-written texts produced by Arabic ESL learners. The chapter is valuable in providing a background in corpus linguistics for L2WS research and for discussion of the implications of corpora for writing system research.

The chapter by Takeshi Okada investigates the role of a previously learnt supplementary writing system, Japanese *romaji*, on the mental representation of written words in English as L2WS. This results in spelling errors that are specific to Japanese EFL writers, never occurring in native English writers. Okada compares two corpora of elicited spelling errors produced by Japanese and English spellers of English, explaining a range of error types and relating the data to a description of the spelling and word learning processes of Japanese learners of English. The chapter provides further insight into the complex Japanese writing system situation, reminding us of the importance of the roman alphabet *romaji* as well as the more studied kana and kanji scripts.

Stephan Schmid looks at how the L1 phonology and the L1WS affect the L2WS spelling and reading, taking the situation of Italian-German bilingual children learning Italian as a second writing system in Switzerland, based on a contrastive analysis of the Italian and German phonologies and orthographies. He describes the effects of the L1 phonology (both the standard and the regional variety) and the L1WS orthography in qualitative and quantitative terms based on classroom experiments. The chapter is important on the one hand because of its use of rigorous phonetic analysis, on the other because it shows the complexity of the real world situation once one goes beyond the stereotype of a standard speaker of a language.

### **Reading a Second Language Writing System**

The next four chapters look mostly at L2WS reading, mainly using experimental approaches to investigate word recognition.

Phil Scholfield and Gloria Shu-Mei Chwo look at the effects of different L1 and L2 reading instruction methods on word recognition in English as

a L2WS for Chinese primary school students in Hong Kong, where they had learnt to read both the L1 and L2 writing systems with the whole-word approach, and in Taiwan, where they had learnt by means of phonological recoding. A similarity judgment task was used, involving a decision whether two words presented simultaneously had the same meaning or not; the pair were either phonologically similar, visually similar or neither. The significant differences between the two groups in response times and accuracy confirmed that reading instruction methods result in different L2 word recognition processes even in readers with the same L1WS. The interest of the chapter is its insistence that initial teaching method as well as writing system may be crucial.

The chapter by Nobuhiko Akamatsu investigates whether increased L2 reading proficiency reduces the effects of the L1 writing systems on L2 word recognition, looking at how the ability of Japanese learners of L2WS English to read via the lexical route can hinder their reading via the phonological route. The task involves English words in their normal word shape or with alternating case (alternating lower and upper case within the word), a manipulation that forces readers to use the phonological route as it disrupts the word shape. The results showed that increased levels of proficiency in Japanese readers of L2WS English do not change the preferred reading route. This chapter is interesting in reminding us of the role of proficiency in research on the effects of the L1WS on L2WS reading.

Walter Van Heuven describes the BIA+ (Bilingual Interactive Activation) model, a recent model of bilingual visual word recognition. He argues that previous evidence from experiments into visual recognition of cognates and 'interlingual homographs' can only be explained by language nonselective access to an integrated lexicon. The BIA+ model implements such nonselective access and simulates the visual word recognition processes of a (balanced or nonbalanced) bilingual. An implementation of the BIA+ model is the SOPHIA (Semantic, Orthographic and PHonological Interactive Activation) model which can replicate bilingual readers' performance with interlingual homographs and pseudohomophones and account for some experimental findings not covered by the previous model. Van Heuven's chapter is a good example of the integration of careful experimentation and a computer-based psycholinguistic approach in L2WS research.

Miho Sasaki looks at the effects of a phonologically transparent alphabetic L1WS (Italian) and a morphemic L1WS (Japanese) on reading a less phonologically transparent alphabetic L2WS (English). She compared Italian and Japanese users of L2WS English as well as English native readers using an item-recognition paradigm. The results revealed differences among the Japanese, English and Italian groups in accuracy (number of errors) and speed (response time). This chapter

broadens the database of research into the effects of L1WS transparency on L2WSs.

### **Awareness of Language and Second Language Writing System**

The three chapters in this section look at L2WS users' awareness of the linguistic units represented in their L2 writing system.

Keiko Koda presents the Transfer Facilitation Model, which describes how metalinguistic awareness developed for the first language is transferred and facilitates second language reading. Taking a functionalist approach, the model predicts that: (1) aspects of metalinguistic awareness that apply to both L1 and L2 writing systems facilitate L2 reading at the initial stages; (2) awareness of how language elements are represented in the L1WS affects the rate of development of such L2WS awareness; (3) the orthographic distance between the L1WS and L2WS determines differential rates of L2 reading development; and (4) L2WS decoding skills vary systematically across readers with different L1WS backgrounds. Tested against a range of empirical studies, the Transfer Facilitation Model provides a useful framework for future research. This chapter is useful in adding to the few general models that are available for L2WSs and showing the latest progression in Koda's thinking.

Benedetta Bassetti looks at how awareness of the L1 linguistic units represented in the L1WS interacts with characteristics of the L2WS in affecting awareness of the linguistic units of the second language, by looking at word awareness in English-speaking learners of L2WS Chinese and Chinese L1WS users. Results from two word segmentation tasks, comparing the L1 and L2 groups' mean word lengths, levels of agreement on segmentation and word segmentation strategies, showed differences between the concepts of Chinese word in Chinese and English users of Chinese. These results are explained within the multi-competence framework in terms of the interaction between the L2 learners' first language word awareness and characteristics of their L2 writing system. This chapter contributes to the academic discussion of second language awareness extended to units larger than phonemes.

The chapter by Lily Lau and Susan Rickard Liow looks at the reliance on phonological awareness in spelling English as a L2WS by kindergarten children with different L1 and L1WS backgrounds (English, Chinese and BM) by means of a Flaps Spelling Test which shows processing skills in spelling words that are spelled with <t> but pronounced with a flapped voiced /d/. BM-speaking children showed poorer performance in the spelling of t-flaps, i.e. more reliance on phonological coding, than English children. Both exposure to the first language and exposure to the L1WS affect phonological processing in the L2WS. This chapter is interesting because

of the complexity of the situation it deals with and because of its neat use of the flaps technique.

### **Teaching a Second Language Writing System**

The last section of the book examines the L2WS in educational contexts.

Therese Dufresne and Diana Masny propose that, from a post-structuralist perspective, learning a new writing system involves destabilisation of the system and a quest to seek and maintain stability of that system. They use two case studies: one concerns how an English-speaking child interacts with a new concept through learning French, the other how a Gujarati-English child, literate in English, interacts with the Gujarati writing system. The post-structuralist approach can provide an alternative based on the acquisitional processes rather than products, and on the restructuring of previous knowledge to accommodate new. The paradigms of teaching and learning (constructivism) that have replaced the traditional ones, both in the context of the teaching of language and writing in Canadian immersion programmes and worldwide, affects language and writing research as well. This is related to Dufresne's theory of the Telling Maps and Masny's Multiple Literacies Theory. This chapter takes the discussion of L2WSs to a different plane by reminding us of their status within general contemporary theories.

Tina Hickey looks at the difficulties of children learning to read Irish as a L2WS in Ireland, and report the results of a successful experimentation with Taped Book Flooding. English L1WS children learning Irish as a L2WS have a number of difficulties – poor decoding skills, interference from English orthography, lack of motivation and lack of reading resources. The problem of preparing Irish reading materials for these readers is illustrated with an Irish-language storybook translated from English. The authors then describe their own successful trials of 'Taped Book Flooding' as a means of encouraging extensive L2 reading. The interest of the paper comes from its highly contextualised focus on one situation of contact between two alphabetic writing systems and its practical discussion of actual reading texts and new teaching techniques.

Vivian Cook looks broadly at how L2 writing is taught in foreign language teaching by analysing how various coursebooks present the written target language. The author first discusses the neglected role of written language in language teaching and lists what learners have to know to use a L2WS. An analysis of written language in coursebooks for English, Italian and French shows that their use of written language is not representative of actual written texts or actual activities. The same level of neglect of writing system is also present in modern language curricula, both in England and in the rest of Europe. This contribution

tries to situate L2WSs in the broader educational context of foreign language teaching.

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