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INDIVIDUAL DIFFERENCES IN CHINESE READERS OF ENGLISH: ORTHOGRAPHY AND READING

By

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ABSTRACT

INDIVIDUAL DIFFERENCES IN CHINESE READERS OF ENGLISH: ORTHOGRAPHY AND READING

By

Margaret Elizabeth Haynes

Few studies have considered reading difficulties of learners whose first language writing system differs from that of English. Do adult Chinese literates who use English for academic study (L2 readers) process English orthography as efficiently as American college students (L1 readers)? Is greater sensitivity to English "orthographic regularity" (systematic sequencing of letters) significantly associated with reading success when Chinese literates read in English?

To examine these questions, orthographic processing was measured by same-different visual matching tasks with words, orthographically regular "pseudowords", and letter strings. Analysis of covariance (with number matching as covariate to control for general perceptual speed) indicated the L1 group benefited more from systematic sequencing of letters in pseudoword matching than did the L2 readers (significant group-stimulus interaction). This is consistent with development of orthographic sensitivity in L1 children learning to read in English.

A second analysis examined the association between perceptual processing of English orthography and types of reading success: reading speed, comprehension, and learning

of new words from reading. The two <u>speed</u> outcomes derived from (1)reading paragraphs and (2)reading a technical text with headings and illustrations. The <u>comprehension</u> outcome, corresponding to the former speed measure, required accurate answering of multiple choice questions without referring back to the paragraph. <u>Word-learning</u> was measured (in relation to a vocabulary knowledge pretest) by definitions written first after reading the technical text for general comprehension (<u>incidental</u> word learning) and later after a guided rereading with follow-up questions (<u>attended</u> word learning). This last measure characterizes L2 readers' ability to develop both lexical and conceptual knowledge through strategic rereading.

The impact of individual differences in orthographic processing was evaluated using multiple regression (including additional variables of Chinese reading comprehension, number matching, and English grammar, listening, vocabulary range, and lexical access efficiency). Orthographic sensitivity (1)correlated with comprehension, not speed, (2)was significantly associated with incidental and attended word learning, even when other variables were accounted for, and (3)explained approximately the same amount of variance as did Chinese reading comprehension. Thus writing system mastery is both harder and more important to L2 reading success than existing theory and research would suggest.

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I have been particularly fortunate in the mixture of committee members who participated in the planning and writing of this work. Paul Munsell, chairperson, has questioned inferences, demanded clarity, and helped me to understand the place of this study in the gradual evolution of science--all while giving wholehearted support. Julia Falk has challenged me to develop greater consistency, objectivity, and precision in both thought and language. Lynn Paine has deepened my perception of the cultural contexts of language education and educational research. Pat Barrett spent many hours sharing his test resources and knowledge while I was developing grammar, vocabulary, and reading instruments.

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While my committee members and I were shaping this contribution to our understanding of language development, my parents, husband, mother-in-law, and children gave support and sacrificed irreplaceable segments of their lives. I thank you.

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CHAPTER I: INTRODUCTION

A. BACKGROUND

English is the primary medium for communicating scientific and technical knowledge in the world today (Michel, 1982; Kaplan, 1983; Swales 1985; Grabe 1987). Most of this information is created, stored, transmitted, and retrieved--not in spoken language--but in written text. Thus, for development of science and technology in the modern world, rapid comprehension of written English has become essential.

To help second language (L2)[1] readers learn to comprehend English text quickly and accurately, language teachers need a good understanding of where reading difficulties are apt to occur and what can be done in the short and long run to help students overcome these difficulties. In other words, we need to have a clear picture of L2 reading development.

A central issue for understanding L2 reading development is the effect that incomplete and unstable

[1]No distinction between foreign language and second language is implied by the use of "second language". "L2" will be used for convenience throughout to refer to use of a non-native language in either spoken or written form. Specific distinctions between L2 learners will be stipulated only when necessary.

language proficiency might have on reading processes. All too often the impact of limited language proficiency has been underestimated (Eskey, 1988). Similarities between L2 and L1 reading are stressed without sufficient critical examination of the differences. In articles and books written about L2 reading over the past two decades, one finds a pervasive assumption that L2 readers can and should read in the same way that proficient L1 readers do. The analogy between L1 and L2 reading is most openly argued in recommendations for second language reading instruction (e.g., Twaddell, 1973; Chastain, 1976; Rigg, 1977; Cates and Swaffar, 1979; Hosenfeld et.al., 1981; Schultz, 1983; Mahon, 1986). Pedagogical recommendations center on developing better reading strategies, especially encouraging students to read more quickly, build more tolerance for uncertainty, and assimilate the meanings of new words from the contexts in which they appear, just as L1 readers seem to do.

Such recommendations appear to lack firm grounding in basic research on the development of L2 reading skills. Despite an increase in L2 reading research over the last decade, we do not know how L2 reading at various stages of proficiency might differ from L1 reading. In reviewing research on the dual impact of L2 proficiency and L1 literacy on L2 reading, Alderson (1984) found very little empirical clarity on the issues. He was able to argue only that low L2 proficiency interferes with the use of L1 literacy skills in L2 reading at early stages of language learning. He admitted: "We have little or no evidence, however, about the role of foreign language competence at higher levels of [reading] proficiency."(p.20) In other words, beyond the beginning level, very little is known about similarities and differences between L1 and L2 readers.

Discussions of language proficiency and reading often adopt a narrow definition of language proficiency, one which centers on knowledge of the spoken linguistic system. L2 reading researchers have tended to overlook a key aspect of a reader's L2 competence: ability to handle the visual representation of the new language, that is, its <u>writing system</u>.

If their native language is not written in the Roman alphabet, L2 readers of English may need to learn not only the new symbols that are used in writing and reading, but also the graphotactics (systematic ordering) of those symbols when they are combined into strings corresponding to speech. Developing L2 literacy in an unfamiliar writing system may also involve understanding the visible mapping (analysis) of the spoken language into units such as words, syllables, morphemes, or phonemes. Being told about the writing system may not be sufficient: extensive practice using the new system may be necessary to achieve both speed and accuracy in recognizing symbols and their combinations (LaBerge and Samuels, 1974; Gibson and Levin, 1975; Perfetti, 1985).

Thus it seems urgent for researchers to consider more carefully the development of L2 literacy for the L2 reader from a different writing system background (this subclass of L2 learners will henceforth be designated as WS2 learners). The nature and extent of WS2 readers' difficulties with the written code need to be examined. Slow or inaccurate perceptual processing may impede L2 reading, certainly at first, but possibly far beyond elementary levels of language proficiency.

The present study examines this possibility, that writing system difficulties have a significant influence on the reading success of WS2 learners well beyond the initial stages of language learning. Before operationalizing this hypothesis, however, it is necessary to justify the research project in relation to current L2 reading theory and pedagogy. This introduction must respond to two potential criticisms. Some may already assume that writing system differences are important in L2 reading and are adequately considered in research and teaching. Their response to the above hypothesis is likely to be that such difficulties are too obvious to need empirical study. Conversely, others may argue that visual processing skills play an insignificant role in fluent L1 reading, so writing system difficulties could have little to do with successful comprehension in L2 reading. How such contradictory positions could be taken on this issue may be explained by the following overview of the background of L2 reading theory.

1.The status of writing system differences in current L2 reading theory

Over the last decade researchers have begun to explore differences among writing systems and the differences in the cognitive skills which develop in conjunction with the use of these various writing systems (Gibson and Levin, 1975; Gleitman and Rozin, Rozin and Gleitman, 1977; Kavanagh and Venezky, 1980; Scribner and Cole, 1981; Taylor and Taylor, 1983; Carr, 1986). Many differences have been documented, though their significance remains controversial. For example, while most languages are read horizontally from left to right, others are read right to left, and a few vertically, from top to bottom. Gray (1956) concluded that direction of reading has no influence on fluent reading, as long as it is the reader's habitual direction. In an extensive review of psychological research comparing literacy in various writing systems, Hung and Tzeng (1981) found that writing system differences do have an impact on L1 readers, but at elementary processing levels . Some of these differences include:

1)right cerebral hemisphere processing of Chinese or Japanese logographs under some task conditions, in contrast to left hemisphere processing of alphabetic and syllabic stimuli (Paradis, et.al., 1985, reviews the work with Japanese in depth);

2)greater Stroop interference between conflicting written and pictured stimuli for logographic readers than for readers of phonologically-coded systems (that is, processing of logographs seems closer to the processing of non-verbal visual stimuli than is the processing of words in writing systems such as syllabaries or alphabets);

3)two routes to word recognition--visual or phonological--that are somewhat optional and strategically controllable for readers of English (a morphophonemic or "deep" orthography); in contrast, one route--a more pervasive and automatic phonological coding--for readers of "shallow" orthographies such as Serbo-Croatian, in which there is nearly a one-to-one correspondence between graphemes and phonemes.

Despite these differences, Hung and Tzeng concluded that comprehension processes of fluent L1 reading are the same across writing systems: "...differences due to orthographic variation in the visual processing of print occur only before but not after word recognition." (p.408); "At the level of words, script and speech converge on the amodal linguistic entity."(p.404) Like Gray, these authors concluded that elementary processing differences have little effect on universals of comprehension in reading.

The implications of this conclusion for WS2 learners are not straightforward, however. Writing system differences which have little impact on fluent reading in L1 may have a major impact on WS2 reading development. During the process of language and reading acquisition, it may be the case that WS2 learners are handicapped by such elementary differences as symbol shape, coding of linguistic units (morphemic, syllabic, phonemic, or combinations of these), directionality, and graphotactics. Their lack of fluency with the written code may result in less efficient word identification and limit their ability to apply knowledge and strategies they rely on in L1 reading to the slow and more awkward task of WS2 reading (Meara, 1984; Brown and Haynes, 1985). This would roughly correspond to difficulties experienced by children beginning to read in their native language, struggling to coordinate what they know about the spoken language with clumsy processing of an unfamiliar written code (Biemiller, 1970; Chall, 1983). For beginning L1 readers, as for WS2 readers, even well-developed language strategies for comprehension and inference from context may fail during reading if the visually obtained data on which the strategies operate is faulty or unstable (Evans and Carr, 1985).

Nevertheless, the prevailing opinion of those who study language learning and pedagogy seems to be that orthographic differences matter little (the few exceptions are reviewed in Chapter 2). One looks in vain for references to the literate language learner in volumes written about the basic principles of language acquisition (e.g. Robinett and Schachter, 1983; Klein, 1986). In fact, the majority of works on L2 reading mention neither the problem of orthographic differences nor the effects a new symbol system might have on L2 reading (e.g. Clarke and Silberstein, 1977; Coady, 1977; Ulijn, 1980; Alderson, 1984; Swaffar, 1988).

Those who do mention the difficulty of adapting to a new writing system tend to treat it as a short-term difficulty, seemingly insignificant in comparison to the problems

of mastering the linguistic system: "...learning a new script is not usually a lengthy process."(Rivers, 1978: 206). One recent L2 pedagogy text suggests that careful and systematic instruction will be required, but only for a limited period of time:

> A moderately well-educated teenager or adult, even one whose first language uses a writing system graphically different from that of English, may be able to master the mechanics, with efficient instruction and appropriate materials, in a minimum of fifty lessons, or approximately four months of well-taught classes with primary emphasis on the mechanics of reading. (Bowen, Madsen and Hilferty, 1985:219-220)

These authors provide no empirical evidence at all for their assertion, though, to their credit, the assertion is cautiously qualified. In sum, there seems to be a widespread consensus that whatever difficulties WS2 learners experience have little significance for our understanding of L2 reading.

One reason that teachers and researchers in the United States might discount writing system differences is their frequent lack of direct experience with non-western writing systems. The type of language learning with which Americans tend to be most familiar involves European languages which, like English, are written in the Roman alphabet. French, German, Latin, and Spanish are almost the only languages offered even in the best U.S. high schools. (Sims and Hammond, 1981, for example, cite only one school with Hebrew and only a few with Russian, though there are Americans who are exposed to Hebrew through temples or to Chinese or

Japanese through private instruction outside of public schools.) The College Board does not offer language proficiency exams for highschoolers in Chinese or Japanese, and in fact has discontinued its Russian test due to a lack of applicants for it (Personal communication from Russel Webster, Executive Director of TOEFL at ETS, May, 1988). In sum, most Americans have only experienced languages written in a familiar alphabetic system.

Furthermore, when English literates do study Arabic, Japanese, Chinese, or other non-Roman WS2's, the language texts often provide a recoding of the WS2 into a romanized form representing the sound system of the language. This allows readers of the Roman alphabet, when analyzing or memorizing spoken forms in the new language, to rely on the symbols they already know. Without this romanization, the foreign visual representation (Chinese characters, Arabic letters, etc.) would present an extra hurdle, a second system that had to be learned along with the new spoken code. Thus in the language learning experience of many Americans the Roman alphabet has remained a tool for learning to speak (but not read) WS2 languages.

Despite Americans' lack of direct experience with WS2 learning, one might expect L2 reading researchers and teachers in this country to express greater concern about the effects of learners' writing system knowledge. After all, U.S. higher education has seen a large influx of Chinese and Japanese literates, as well as Iranian and

Middle Eastern readers of Arabic, over the last two decades (Sirowy and Inkeles 1985). Many of these have studied in university intensive English centers where faculty conduct research and graduate students in TESL receive their teacher training. Yet, as mentioned above, writing system differences are rarely mentioned in research articles or methods texts. The notable lack of interest in this issue may be due in part to the disciplinary and theoretical allegiance of L2 reading theorists. L2 reading pedagogy and research have been closely tied to the discipline of linguistics; furthermore, so-called "psycholinguistic" theories have dominated research and publication about L2 reading (Bernhardt, 1986), spreading an awareness of reading universals but perhaps underestimating the role of visual processes in reading.

2.Linguistics and psycholinguistic models of reading

This century has seen the discipline of linguistics defined as the study of spoken language. Saussure, as well as the American structuralists who dealt with unwritten languages, proposed a field of modern linguistics in which speech occupied a priviledged position as the primary linguistic form (Saussure, 1916/1959; Newmeyer, 1986). Structural linguistics held that, "Writing is not language, but merely a way of recording language by means of visible marks." (Bloomfield, 1933/1984). This position was argued

with reference to the universality of spoken language (in contrast to the limited spread of literacy) and the chronological primacy of speech in both individual and cultural history (Falk, 1978). However, this exclusive focus on spoken language also appears to have been motivated by linguistics' need to justify itself as an academic field distinct from departments of classics and humanities whose disciplines were more closely tied to written and literary traditions of language use (Newmeyer, 1986).

The deliberate and systematic excision of the written representation of language from much of contemporary linguistics may now have yielded to a more balanced viewpoint, according to Falk: "...speech and writing can be viewed as simply two different ways of representing language" (1978: 152). Samson's (1985) volume covering historical, linguistic, and psychological aspects of writing systems is indicative of this change. Nevertheless, one heritage of the close connection between linguistics and language teaching (Newmeyer, 1986) has been that spoken language still occupies a position of privilege in the language classroom. Granted, the disenchantment with audiolingualism and the exploration of cognitive theories of language development which followed the challenge to behaviorism in the late 1950's have brought back reading and writing to L2 instruction. Yet teaching and research of L2 reading in this country still seem to reflect the historical bias of linguistics toward spoken language. Linguistics is

one of the core disciplines of TESOL programs in the United States, but these programs include no discipline with a corresponding emphasis on written language processes (Frank-McNeil and Byrne, 1986). The continuing close tie between L2 research and pedagogy and the discipline of linguistics may in part explain why a majority of L2 reading studies ignores writing system differences.

The recent historical connection between linguistics and L2 pedagogy seems to have led many L2 researchers to rely on L1 reading theories which highlight the similarities between written and oral language processing. Over the last decade, L2 reading research and pedagogy have been dominated by so-called "psycholinguistic" models of reading (Bernhardt, 1986; Bernhardt and Lange, 1985). These models downplay visual aspects of reading while emphasizing the role of the reader's linguistic and world knowledge.

Psycholinguistic approaches to reading, associated in particular with the work of Frank Smith (1971/1982; 1978; 1983) and the Goodmans (1977; K.Goodman, 1970; 1973), have greatly influenced views of L1 reading by demonstrating that native speakers actively apply their knowledge of spoken language in the process of comprehending written materials[2].

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[2]The influences of psycholinguistic reading research extend much further than the space and focus of this document allow. These include revolutionizing the field of reading by proposing that visual identification may be a consequence, not a cause, of comprehension. The current interest of reading educators in reading strategies may be attributed in part to the psycholinguistic argument that readers must learn to compromise between desire for accuracy and need for speed by reading more selectively (predicting, sampling, confirming).

Unfortunately, there are two major difficulties with the application of psycholinguistic theories to L2 reading. The first is that they are essentially models of fluent reading which may have little to do with reading development, particularly in L2. Furthermore, by de-emphasizing visual perception, psycholinguistic theories have led to misconceptions about what happens during fluent reading.

Proponents of psycholinguistic views of reading describe how fluent reading could be possible despite the seeming paradox between the detail of the stimuli and the need for rapid comprehension. They stress that the knowledge of readers enables them to capitalize on the redundancy of language. They argue that mature readers take shortcuts in perceptual processing by relying on their own prior knowledge of what to expect.

One problem is that psycholinguistic theorists extend this analysis to all stages of reading development (Smith, 1978). As Chall (1983) points out in evaluating the psycholinguistic approach to reading, despite surface similarities between early and fluent reading, care must be taken in drawing analogies between different developmental stages of reading:

> In one sense, beginning and very mature readers seem to behave in a similar manner toward print: they do not stick too cl they do not stick too instead on the meaning. Yet mature readers can stick to the print if they want to or need to. Going beyond it is a conscious choice for them, one based on knowledge. Young children at the prereading stage, and at the beginning of Stage 1, have no choice. They must supply their own words because they do not know enough about how to get

> the author's words from the printed page. To advance, to build up the skill for making choices, beginners have to let go of pseudo-reading. They have to engage, at least temporarily, in what appears to be less mature reading behavior--becoming glued to the print--in order to achieve real maturity later. They have to know enough about the print in order to leave the print. (1983:pp.17-18)

Just as psycholinguistic descriptions of fluent reading have led to shaky analogies between mature and novice L1 readers, so have they led many L2 reading researchers to questionable analogies between L1 and L2 readers (e.g., Clarke and Silberstein, 1977; Rigg, 1977; Devine, 1980; Schultz, 1983; Carrell, 1983). There is a tendency for some L2 reading researchers to base their work on a psycholinguistic view of reading without sufficient attention to the impoverished linguistic knowledge base of L2 readers (Eskey, 1988). Since L2 learners know much less about the spoken system than native speakers, anticipation and guessing during reading may therefore be difficult, even impossible. Further, WS2 learners of English start with a lack of knowledge about the English writing system. Without knowledge of what to anticipate--linguistically or orthographically--they may be forced to rely even more on perceptual processes during reading than either L1 beginning readers or L2 readers who are already literate in a Roman alphabetic system.

Inappropriate application of psycholinguistic models of the fluent L1 reader is not the only problem with current L2 reading theory, however. More difficult for the progress of

scientific inquiry is a narrow conception of fluent L1 reading. While emphasizing the reader's reliance on nonvisual information (such as linguistic or world knowledge), some psycholinguistic approaches have underestimated the role of visual information in L1 reading. One example is the position that individual letters are not an important unit in reading.[3] In relation to letter processing, Smith (1982) asserts that "It is only when words cannot be identified immediately that the prior identification of letters becomes relevant at all..."(p.150), implying that normal word identification takes place without analytical processing of component letters.

In contrast to Smith's statement, cognitive psychologists, especially eye movement researchers, have provided a good deal of evidence that letter identification plays a major role in L1 reading. L1 readers often identify the first three letters of upcoming words, perhaps to help them with the rapid decisions which they must make about saccade length during fluent reading (Rayner, 1983). Readers are particularly sensitive to the identity of the first and last letters of words to the right of those that

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[3]Due to lack of space, only one such misconception is presented here. Others include underemphasizing the importance of individual differences in fixation duration (Smith, 1982: 35) and overemphasizing the importance of skipping over words, suggesting that a reader who engages in visual processing at the word level will find it difficult to comprehend ongoing text and that such interference is to be circumvented by looking at as few words as possible (Smith, 1978: 118-124).

are directly fixated (Carr, 1986:29-35). Other evidence which suggests that visual processing of letters has a central impact on reading is that, as words increase in letter length, they seem to take longer to encode (Just and Carpenter, 1987). Furthermore, the visual span (the range of print to which a fluent L1 reader is visually sensitive, about 15 letter spaces to the right of the fixation point for readers of English), is more consistently predicted when defined in letter units than when words are adopted as the unit of measure (Rayner, 1983). This suggests that it is letters, not words, which determine the visual span. Other evidence from eye-movement studies of reading for comprehension indicate that minor misspellings disrupt reading even when the misspelled word is still easily identified and highly predictable from context (Zola, 1982). All of these findings suggest that letter identification is much more than just a cumbersome method that readers resort to on rare occasions when they cannot identify a word from its overall shape. Indeed, it appears that efficiency of letter perception is closely tied to developmental changes. For example, Fisher and Lefton (1976) found that recognition of letters, especially those presented to the parafovea, increased in speed from 2nd grade to adulthood.

Sensitivity to letter units thus appears to play a larger role in reading than Smith suggests. This is only one example of how psycholinguistic models, by de-emphasizing perceptual processes, may create false impressions of the importance of visual intake during reading. The issue is one of degree, however. Neither Smith nor Goodman claim that visual perception is unnecessary in reading, only that it is uneconomical and that good readers appear to attend elsewhere, bypassing visual perception as much as possible. The central issue, then, is to what degree accurate visual perception is necessary in the development of L2 reading.

It is clear that both the visual stimulus and linguistic and world knowledge in the reader's head are involved in fluent reading. The visual stimulus requires some degree of data-driven or perceptually-based processing, while at some point in comprehension its interpretation requires inferential or knowledge-based processing. Models of reading which highlight the mutual contributions of knowledge and perceptual intake during reading have been termed "interactive models" (Rumelhart, 1977). In an absolute sense, the psycholinguistic models are also interactive, for they acknowledge both inferential and perceptual processing; however, their focus on the knowledge-based predictive activity of the reader (Smith, 1978; 1983, chapt.3) contrasts directly with the importance accorded to perceptual processing in another interactive model, the interactive-compensatory model of Stanovich (1980; 1981).

3.Psycholinguistic and interactive-compensatory models of reading: anticipation vs. automaticity

It is crucial to distinguish between psycholinguistic viewpoints and other more data-sensitive interactive models when evaluating the impact of psycholinguistic views on the the study of L2 reading. Both involve facilitation from prior knowledge during reading. However, for the interactive-compensatory (I-C) model, perceptual data-gathering processes play a central role at all stages of reading development.

In contrast, for psycholinguistic models of reading, the more fluent a reader becomes, the less necessary visual processing is thought to be (Smith, 1971/1982). K. Goodman has set up an opposition between perceptual processes and comprehension, between precision and selective attention to print:

> Effective and efficient readers are those who get to meaning by using the least amount of perceptual input necessary. Readers' language competence enables them to create a grammatical and semantic prediction in which they need only sample from the print to reach meaning. (1976, p. 59)
>
> Skill in reading involves not greater precision, but more accurate first guesses based on better sampling techniques, greater control over language structure, broadened experiences and increased conceptual development." (1970: 504).

For psycholinguistic theorists, the good reader avoids precision, being skilled at selecting which cues to process. Readers' selectivity has been traced through the analysis of miscues (systematic errors) observed during oral reading.

> Many miscues reflect readers' abilities to liberate themselves from detailed attention to print as they leap toward meaning. Consequently, they reverse, substitute, insert, omit, rearrange, paraphrase, and transform. They do this not just with letters and single words, but with two-word sequences, phrases and sentences. (Goodman and Goodman 1977:324)

This emphasis on the reader's reconstruction of the text by sampling and predicting contrasts with interactive models (such as I-C) which give a larger role to precise perceptual processes. Instead of ignoring what there is not enough time to see, the good reader of interactive models achieves efficiency through automaticity of perceptual processing (Bryan and Harter, 1897; LaBerge and Samuels, 1974):

> The concept of automaticity ... refers to the gradual emergence, with practice at a task, of performance that seems effortless, fluent, and relatively free of concentration and conscious attention. It connotes the liberation of attention during performance, enabling one to concentrate on other aspects of the task at hand or to attend to something else at the same time. It implies as well that some form of change has occurred in how the task is handled; that some type of learning mechanism has come into play which fuels the transition from performance that requires effort and concentration to something that seems easy, unconscious, and sometimes unintentional. (Brown, 1985: 1)

Automaticity in reading means that units of print can be recognized not only with great speed but also without requiring conscious attention or volition from the reader (Singer, 1982). Through practice readers become increasingly familiar with various units, such as letter features, letters, letter sequences, and words--that is to say, readers come to know the possible written alternatives and their combinations. Their familiarity with visual stimuli gradually leads to automatic categorization of perceived shapes on the page (Rumelhart, 1977; McClelland and Rumelhart, 1981; Singer, 1982). Thus, good readers' advantage comes, not from strategic sampling or ignoring segments of text, but from precisely identifying visual stimuli more quickly and with less effort; in consequence, the skilled reader can conserve attentional resources for higher level comprehension (McConkie and Zola, 1981; Perfetti, 1985; Stanovich, 1980; Stanovich and West, 1981).

According to the interactive-compensatory model, before learners achieve automaticity they compensate for its absence by relying on conscious knowledge-based prediction to lighten their load of visual processing (Stanovich, 1980; Stanovich and West, 1981). Psycholinguistic models consider such prediction to be a useful strategy not only for early readers but for advanced readers as well, so they can avoid extensive visual processing. In the I-C model, however, good readers would instead rely heavily on automatic visual processing, recognizing units in a precise, yet rapid and effortless manner while keeping conscious attention focused on comprehension.

In both models, as readers gain experience, they begin to read more rapidly, thus seeming to devote much less attention to perceptual recognition. For psycholinguistic theorists, this means that less visual processing is required; for interactive theorists, it means that the visual processing is taking place more efficiently, demanding less attention or cognitive resources.

One result of these differences is that interactive-compensatory and psycholinguistic approaches to reading present contrasting views of the effect of <u>anticipation</u> during reading. While for psycholinguistic theorists any anticipation of the upcoming text would be beneficial, in the I-C model such anticipation involves costs for the weaker perceptual processor, who expends more attentional resources in recognizing visual forms and thus is slower (Posner and Snyder, 1975) to recover when an incorrect prediction does not match the form of the word on the page. Indeed, experiments comparing good and poor readers' word recognition for contextually predictable word completions as opposed to surprising (incongruous) word completions indicate that weaker readers take more time (show greater "inhibition") with incongruous words, that is, they take more time to recover from an incorrect prediction than readers with more automatic identification skills (Becker, 1982; Carr, 1981; Stanovich and West, 1979; Perfetti and Roth, 1981). Since weaker readers make more incorrect predictions to begin with (Perfetti, Goldman, and Hogaboam, 1979), reliance on anticipation from context could be quite detrimental until word identification skills reach some threshold of efficiency (Carr, 1981; Evans and Carr, 1985). For strong readers, on the other hand, prediction from con text can be reasonably good--but might not be necessary, since perceptual skills have become so effective (Stanovich, 1980).

The preceding comparison carries crucial implications for the development of L2 reading. According to psycholinguistic theorists, inferential anticipation of upcoming text is the key skill to develop--readers should be able to save visual processing time by guessing a lot. In the I-C model, however, perceptual automaticity is crucial--readers can save processing time through automatic recognition of written stimuli.

Given these differences, it is not surprising that the dominance of psycholinguistic theories in L2 reading research and pedagogy has led to an interest in universal reading strategies at the level of comprehension processes, and a lack of interest in specific writing system differences at the level of perceptual processes. Much recent work with L2 readers has focused on prior knowledge and strategy use (e.g., Hudson, 1982; Carrell and Eisterhold, 1983; Alderson and Urquhart, 1984;) Though such higher-level processes figure importantly in both interactive and psycholinguistic models, they tend to be more closely associated with psycholinguistic models in L2 reading research. These models emphasize the universality of comprehension strategies, particularly the conscious use of prior knowledge, sèlectivity, prediction, and monitoring of comprehension.

This emphasis on comprehension strategies might seem to receive some support from current L1 reading research, where there has been a surge of publications concerning L1 reading stragegies (Baker and Brown, 1984: 376). From an interactionist perspective, however, strategic control during reading requires processing resources (attention) that may not be available if the reader's perceptual recognition of letters and words lacks automaticity, thus requiring extra time and attention (Frederiksen, 1981; Perfetti, 1985).

In fact, one of the most successful experiments in training weak L1 readers to use reading strategies (Palincsar and Brown, 1984) included only those weak comprehenders whose decoding skills had already reached a threshold of fluency:

> To meet the criteria of adequate decoding, the students were required to read grade-appropriate texts at a rate of at least 80 wpm with two or fewer errors. This criterion was established...as the minimum acceptable decoding fluency for instructional purposes. (p.124)

In other words, the researchers considered that instruction in comprehension monitoring would probably not be effective if readers had not already attained a certain fluency in recognizing printed words. This is actually more consistent with a model emphasizing automaticity, in which fluency in perceptual processes would seem a prerequisite to developing conscious use of reading strategies.

Furthermore, a study of first graders' L1 reading acquisition found that in a curriculum that stressed data-driven perceptual recognition skills, spoken language competence was positively correlated with reading achievement--but in a curriculum that de-emphasized perceptual skills in favor of an immediate focus on higher-level linguistic and conceptual abilities, spoken language competence actually correlated negatively with reading achievement (Evans and Carr, 1985). Again, lending support to the interactive-compensatory model, this finding suggests strongly that gaining fluency in the perceptual processing of written stimuli is a necessary stage of reading development which cannot be bypassed.

Predictions about L2 reading development based on psycholinguistic models would be quite different from those of the I-C model. The former appear to imply a strong relationship between L1 and L2 reading skills, with the good guesser being a good reader in both languages.

In contrast, the I-C model might predict that that writing system background would have a large effect on L2 readers' development. WS2 readers, who could not apply the automatic symbol-specific processing skills they had attained in their native script to the task of rapid visual recognition in L2, would have difficulty becoming good L2 readers. More of their attentional resources would be focused on visual identification while they were becoming familiar with the new writing system, resulting in poorer reading performance.

Despite growing evidence for L1 interactive models which accord a central role to visual perception in reading

(McClelland and Rumelhart, 1981; Lesgold and Perfetti, 1981; Perfetti, 1985; Just and Carpenter, 1987), interest in the perceptual components of interactive models is only beginning to be expressed by a few L2 reading theorists (Haynes, 1984; Brown and Haynes, 1985; Eskey, 1986; Grabe, 1986; Eskey and Grabe, 1988; Grabe, 1988). The implications of interactive models for WS2 learners have yet to be examined systematically, tested empirically, and applied pedagogically[4].

B. A STUDY OF WS2 READING

1. Justification for this study

The impetus for this study, as reviewed above, thus is the issue of the degree to which a new writing system causes problems for WS2 readers. From a psycholinguistic reading perspective, the WS2 reader might be expected to encounter difficulties initially, but very soon be able to adjust using prior knowledge and strategies learned from L1 reading; consequently, writing system differences would have a trivial effect on L2 reading development. In contrast, from an interactive-compensatory perspective, such visual processing differences might be expected to cause intense

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[4]Stoller (1986) has tried to draw pedagogical implications for WS2 learners from interactive models and WS2 readers' slow rate of reading. This effort is well-intended but perhaps--considering how little is known about efficiency of visual "identification" processes among these readers and its interaction with higher level "interpretive" processes (Eskey, 1986)--somewhat premature.

difficulties as WS2 readers struggle with lower level perceptual problems, having few attentional resources left over for integrating discrete units into a comprehensible message.

A study that investigated the role of visual processing not only would yield information about L2 reading development, but also might shed light on the validity of each of these theoretical positions. Evidence that visual recognition processes have little or no effect on the reading of intermediate WS2 learners might strengthen the psycholinguistic approach's assumption that non-perceptual processes are more significant for these readers. In contrast, evidence that visual recognition continues to improve at intermediate levels of language proficiency and that individual differences in visual recognition are related to reading success would support an I-C model of L2 reading which accords a more central role to perceptual processing.

2. Approach of this study

The general approach of this study is to measure and compare the efficiency (speed and accuracy) of visual processing and reading performance in WS2 learners who have progressed beyond the beginning level in reading English.

This study compares two groups who are native speakers of Chinese, literate in their L1, and experienced with English reading and writing. The first group of freshmen college students have completed six years of English in secondary school, but this did not require extensive reading in English. The second group of seniors have all majored in fields requiring the use of English textbooks, thus having more exposure to reading in English.

This study compares the perceptual processing efficiency of these two groups to each other and to that of American college students to test several hypotheses. It begins by asking whether: 1) visual processing efficiency in English, for Chinese WS2 learners, continues to improve beyond the beginner level; and 2) even after considerable experience with the new writing system, these WS2 learners' visual processing efficiency with English orthography is still significantly different from that of American college students of comparable age.

In order to more directly evaluate and compare the two models of the WS2 reader (the psycholinguistic and the interactive-compensatory models) these readers' differences in perceptual processing efficiency are also studied in relation to reading outcomes of comprehension, speed, and ability to learn the meaning of new words from reading. The third major question is whether there is a significant correlation between visual processing efficiency and measures of speed, comprehension, and new word learning.

To find such a correlation, however, one must take into account the correlations between other facets of linguistic proficiency and English reading outcomes in order to weigh more accurately the relative impact of visual processing effi

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efficiency. Thus a fourth major question is whether the association between individual differences in visual processing efficiency and English reading outcomes will be significant even when other individual differences are separately accounted for--differences in L1 reading proficiency and in L2 vocabulary, grammar, and listening skills. In other words, it is predicted that the impact of visual processing differences is significant and independent of variability in L1 reading or higher-order L2 language skills.

By asking these four questions, this study addresses the significant issue of the degree to which non-beginner WS2 learners may be significantly affected by difficulties with the writing system of the language they are reading.

Chapter II: LITERATURE REVIEW

The empirical work that has been carried out on writing system acquisition has not been integrated into the mainstream of L2 reading theory. This review gathers together pertinent research from psychology, linguistics, English, and education concerning development of visual encoding in both L2 and English L1. The two goals of this review are to present evidence on the difficulties of writing system acquisition and to explain a set of methodological principles, based on the strengths and weaknesses of other research, which have guided the present study. At the end of this review, specific guidelines for this study will be presented.

A. STUDIES OF LEARNING NEW WRITTEN SYMBOLS

1. Alphabetic readers learning new symbols

One of the basic tasks for the WS2 learner is developing fast and accurate (efficient) recognition of the shape of symbols in the new writing system. Crothers, Suppes, and Weir (1964) have shown that this can be surprisingly difficult, even when there are only a few new symbols to be learned. These researchers studied American readers transferring from the English to the Cyrillic (Russian) alphabet. The adult subjects practiced choosing from four CVC (consonant-vowel-consonant) sequences written in Cyrillic the one sequence which matched an aurally presented Russian syllable. They were given immediate feedback after each item, enabling them in four days of practice (with about 200 items per day) to perform as accurately on Cyrillic stimuli as they could in English. Despite this accuracy, the subjects' speed in choosing their answer improved less readily. Practice continued for fifteen days, but latencies (the time taken to answer) for items which contained visually confusable letters remained over twice as long as latencies for English words.

A particularly interesting comparison within the Russian stimuli in this study involved the differential mastery of two types of symbols: 1) novel Cyrillic letters which are visually similar to one another and 2) familiar Roman letters which in the Russian system represent different phonemes than they do in English. The correspondence between familiar letters and new sounds (2) was mastered more quickly and led to greater fluency than the correspondence between unfamiliar, visually confusable symbols and their sounds (1): "The subjects apparently could free themselves more readily from a highly over-learned sound-symbol relationship than they could learn the distinctive graphemic features of a new system." (Crothers, et.al., p. 216).

Overall, this study suggests that fluent visual recognition of unfamiliar symbols develops gradually rather than rapidly. The implications for learners of completely unfamiliar writing systems are serious. They may have much greater difficulty in discriminating between visually similar symbols than the subjects in this experiment, since, instead of a few new Cyrillic symbols mixed in with familiar letters, they are faced with a complete set of unfamiliar symbols, as are L2 readers of English from Chinese, Japanese, or Arabic writing systems.

One methodological implication of this study (as in much research on skill development: Lachman, Lachman and Butterfield, 1979; Carr, Brown and Vavrus, 1985) is that measurement of WS2 learning needs to include not only accuracy, but speed as well. In this study of Cyrillic, native-like accuracy was reached much sooner than native-like speed, so it is likely that for other WS2 learners speed will be a sensitive index of the mastery of the new symbol system.

A second group of laboratory experiments, this time involving an invented symbol system, also demonstrated the difficulty of mastering a new visual code. Brooks (1977), reporting on learning curves in a task requiring subjects to pronounce English words when presented with their visually unfamiliar code forms (limited "alphabets" of between six and eleven symbols), remarks on the difficulty that subjects had in achieving fluency when matching these sequences of relatively new symbols to familiar English words, even after they had become quite practiced in making the association between individual symbols and letters:

> As they [the subjects] tell the story, they often would have all the letters translated well before they could put together a full word...Despite reasonable fluency in the alphabet, subjects took approximaely 50% longer to name five-letter words and twice as long to name six-letter words than to translate each of the letters in matched five- and six-letter strings. In the course of producing these effects, a number of these adult subjects also showed the type of blocking that is often reported with children who are just beginning to read. On some occasions, people could correctly translate all the letters and not be able to come up with a correct pronunciation for an incredible period, the record being 5 1/2 minutes. (pp. 167-168)

In other words, even when one is quite familiar with the oral forms of words and the alphabetic structure to be expected, it is difficult to gain fluency in recognizing sequences of unfamiliar symbols.

2. Potential problems of generalizability

A weakness of the two studies described above is that the tasks are not entirely analogous to that faced by WS2 learners of English.

a. Symbols without meaningful context

First, in these experiments, the stimuli either meant nothing to the learners (Crothers, et.al., 1964) or they were single English words whose sound, not meaningfulness, was the central focus of the task. One might hypothesize that, if the experiments had involved meaningful language, as does WS2 reading, there might have been better retention of the stimuli. Thus these experiments do not on their own constitute valid tests of the development of fluency with new symbol systems. They could overestimate the difficulty learners face in second language learning.

On the other hand, early work on the struggles of telegraphers to learn a new code--in meaningful contexts--indicate that the observations with Cyrillic syllables and imaginary alphabets for English words are probably valid for communicative language contexts as well. Bryan and Harter (1899) found that apprentice telegraphers made rapid initial progress in recoding individual symbols into Morse code, but then hit two separate plateaus during which their speed did not increase very much. The first seemed to involve mastery of sequences of letters in specific word units. For a considerable time learners could only attend to the word level, despite the fact that the incoming messages were coded in larger linguistic units of phrases, clauses, sentences, and discourse. Later, learners experienced a sudden rate increase in which they became able to process clusters of words together. This was followed by a second plateau without much increase in speed, a plateau which represented the end point of progress for most telegraphers. According to testimony collected by Bryan and Harter from Morse code operators, only a few of them gained the ability to think about the meaning of incoming messages: the rest "...are all, in some degree, tied to the mechanism of the language. They cannot copy far behind. The mind must not wander far from the incoming stream of words..." (p. 358).

This pattern of skill development is interpreted by modern cognitive psychologists as a demonstration of the gradual achievement of automaticity as learners master a new code (Singer, 1982). At the early stages of learning, a receiver (reader or telegrapher) does not benefit greatly from the larger lingusitic context because most attention must be focused on smaller units. Only with practice does the receiver begin to handle the smaller units more mechanically, allowing attentional focus to shift to larger language units. However, it takes a great deal of practice for the performance to become completely automatic.

In comparison to the study of telegraphers' skill acquisition, Crothers, et.al.'s (1964) and Brooks's (1977) experiments with symbol learning represent much lower levels of skill development. At this beginning level, with visual identification demanding a great deal of attention, it is likely learners would not have been able to attend to larger context even if it had been present. Thus, despite the lack of a meaningful linguistic context, the findings concerning the slow progress of new symbol learning may be considered valid, at least for early stages of acquisition.

b. The need to study the learning of non-parallel orthographies

A second, potentially more serious difficulty in applying the Cyrillic and invented alphabet studies to WS2 learning is that, unlike Japanese or Chinese students of English, the learners in both studies were already literate in an alphabet. Indeed, in the Brooks studies, the symbols of the new code stood in direct one-to-one correspondence with the English alphabet in which the adult subjects were fluent. Thus the participants were only learning to recode a familiar system. As a result, these studies may have underestimated the difficulty of acquiring fluency in a new writing system. For many WS2 learners, learning the novel symbols of the code is only part of the problem: they must also adapt to different rules of directionality, graphotactic sequencing and/or mapping of symbols onto the spoken language.

For example, Arabic is read from right to left, just the opposite of English. Studies of Hebrew readers, who also read from right to left, have shown that the asymmetry of the visual span is the reverse of that observed for English speakers: Hebrew readers show a larger visual span to the left of eye fixation, while English readers perceive more letters to the right of the fixation point (Pollatsek, et.al., 1981). Thus directionality of reading would be a potential source of confusion for some WS2 learners. In fact, Hebrew-English biliterates have been found to have asymmetry to the left when they read Hebrew, but asymmetry to the right for English (Pollatsek, et.al., 1981). What remains yet unexplored is the learning curve for directionality, that is, how quickly readers adjust their visual attention to meet the demands of directionality of a writing system.

Another relatively unexplored area is the transfer from one mapping and graphotactic system to another. For example, Arabic, though similar to the English alphabet in its consonantal system, does not fully represent the vowels of the language. Children are given diacritic symbols above or below consonants to represent short vowel sounds, but texts written for adults do not normally provide these symbols. Consequently, Arabic readers must infer short vowel sounds and syllable boundaries between consonants in order to distinguish between similar words (Barr, 1976). Haynes (1981) suggested from evidence in the oral misreadings of Arabic students that they tend to ignore vowel cues in some English words, misrecognizing words such as "riding" to be "reading", and that they tend to insert extra syllables into consonant clusters such as the final three letters in "prompt". This pattern of difficulty is consistent with the discrepancies between the English and Arabic coding of phonology in writing and typical juxtaposition of symbols in the writing system. Unfortunately, one problem with this observational study is that the source of difficulty could not be ascribed uniquely to the writing system. Differences in Arabic and English phonology, such as lack of final consonant clusters in Arabic, could also explain many misreadings. This problem of how to distinguish between visual and linguistic sources of error, is one that research into WS2 acquisition must be careful to deal with.

This closer look at the case of Arabic demonstrates why it is necessary to search beyond experiments with English alphabet users who are learning a parallel alphabetic system. The problems with fluency of visual recognition found by Crothers, et.al., (1964) and Brooks (1977) for English readers learning new symbols are likely to be multiplied when learners are dealing with changes in directionality, graphotactics, and mapping onto the stream of speech.

c. Difficulties in defining populations of literates

It is not such as simple matter, however, to define parallel or non-parallel systems. This difficulty is clearly demonstrated by a study by Oller and Ziahosseini (1972), who claimed to have shown that greater differences between writing system may actually favor the development of literacy in a new language's code. Their evidence came from a study of dictation spelling accuracy in which subjects were grouped into "Roman" and "Non-Roman" readers. After finding a significantly higher proportion of errors in the "Roman" group, they proposed that "subtle distinctions" (p. 186) between writing systems, such as those between English and Spanish, caused more interference than larger ones such as between English and Arabic.

This study, however, is open to criticism on at least two fronts. First is relevance of the task to the conclusions. Their dictation task is quite unlike reading. It requires recoding aural sentences into appropriate written symbols. This accuracy task contrasts with reading, which instead of production of visual symbols requires recognition of them with sufficient accuracy to evoke meaning but also with sufficient speed to integrate components (letters, words, phrases) into meaningful propositions. Spelling and reading are quite different tasks. The former may be easier than the latter for WS2 learners, particularly since the accuracy component of efficiency appears to develop more readily for WS2 learners than does speed.

A second problem, one shared by many studies of L2 reading, is the problem of subject grouping. Oller and Ziahosseini (1972) mention the general grouping of "Roman" and "Non-Roman", but they do not report how many of their "Non-Roman" group were Chinese, Japanese, or Arabic readers, whether any other non-Roman writing systems were represented, or exactly which "Roman" languages were included. Equally problematic is their neglect of cultural or educational background variables. For example, if their "Roman" readers tended not to value literacy or not to have achieved a very high educational level in their own language, while their "Non-Roman" group came from strict educational disciplines which insisted on accuracy in writing, the discrepancy in English spelling accuracy which they found would be related, not to writing system factors, but to their subjects' practice of literacy in their own languages and their cultural attitudes toward literacy use.

As Scribner and Cole (1981) have demonstrated in their detailed study of coexisting Vai, Arabic, and English literacy, the skills which literates acquire seem to be related to more than the writing system itself: they are a reflection of the practices within specific cultures where acquisition and use of literacy takes place.

This methodological difficulty of subject definition has already been discussed in relation to the field of L2 reading as a whole (see Chapter I). What is surprising is its pervasiveness, even in studies which attempt to specify subject background. A prime example is Henderson's (1983) dissertation on Arabic-speaking students. Henderson began by comparing L2 readers of English--college-age native speakers of Arabic or Spanish--with American college students. Interestingly, he found the Arabic group to read only half as fast as the Spanish group, with poorer comprehension, while the Spanish group also read significantly slower than the American readers. However, when Henderson went on to study an Arabic group in more detail, he neglected to specify the background of his readers. Algerian, Lebanese, or Tunisian readers might exhibit quite different English reading than students from Arabic countries where French is not one of the languages of education. Haynes (1984), for example, found that Tunisian readers, despite less instructional time in English, were significantly faster English readers than other Arabic readers untutored in French.

In spite of unclear subject definition, Henderson's attempt to analyze processing differences between better and poorer Arabic-speaking L2 readers of English might have succeeded had he avoided other pitfalls. With twenty subjects, he grouped the top ten into the "good reader" group and the bottom ten into the "poor reader" group. As a result, not only were his groups not sufficiently distinct in L2 reading proficiency, but also their size was small. Thus it is not surprising that he failed to find significant patterns of group differences in accuracy or latency any of the component processes he studied.

3. Summary of findings and methodological guidelines

Even for learners of an analogous alphabet, fluency in recognizing new symbols develops only gradually. At first, the presence of meaningful context will not make the learning any easier, since the learner must focus attention on the processing of individual novel symbols. In addition to new symbols, an unfamiliar writing system may present difficulties with directionality, graphotactics, and mapping onto the stream of speech. Some research shows that such differences between writing systems may have an impact on language learners, but it is unknown whether difficulties are of short duration or of long-term developmental consequence.

A sensitive measure of WS2 learning should include both accuracy and speed. It should also be chosen so as to avoid confounding writing system differences with phonological differences between English and the L2 to be studied. Furthermore, the task should be pertinent to reading. Finally, the subject sample should be well defined in relation to writing system knowledge and literacy practice; study of heterogeneous groupings of literates with widely varying reading experiences will not yield interpretable findings that clarify the role of writing system knowledge in learning to read a second language.

B. STUDIES OF NON-ALPHABETIC READING

1. How Japanese and Chinese orthographies differ from English orthography

In contrast to alphabetic readers of English or Arabic, Japanese and Chinese readers have not learned a writing system which maps onto individual phonemes of their language. Japanese literates use a combined system in which some words are represented by a _syllabary_ mapping with consistency onto specific syllables of speech, with no tie to meaning, while other words are represented logographically by _Kanji_ characters. Originally borrowed from the Chinese, these represent units of meaning which may vary in the number of syllables they contain (Martin, 1972). This non-systematic association between speech sound unit and symbol, as well as the representation of units of meaning, are the basic characteristics of a _logography_, which may be defined as "word-writing" (Gelb, 1952). In a logographic system, language is mapped at the level of the word, with written units constraining pronunciation only through association with a word-unit in the spoken language (Carr, 1986).

Like Japanese Kanji, the Chinese writing system has been classified as a logography (Gelb, 1952; Carr, 1986), since characters also represent units of meaning. However, virtually all Chinese characters are also monosyllabic (Kratochvil, 1968). Since most of these monosyllabic signs also represent morphemes, most of which can be combined into words, Chinese can more specifically be classified as a "morpho-syllabic" language (de Francis, 1984). Though this label does not fit all phenomena in the Chinese writing system, "The term morphosyllabic syggested for Chinese simply accounts for more of the facts than any other name, and that is the best that can be expected in a situation where no label is 100 percent satisfactory." (de Francis, p.126).

Most characters in the language, between 80% (Gibson and Levin, 1975) and 90% (Martin, 1972), are composed of a semantic and phonetic element which may in some cases provide a clue to meaning and pronunciation. Neither set of clues allows for systematic translation from writing to speech or meaning. Due to the historical evolution of pronunciation in Chinese and nonsystematic changes made by scribes, the phonetic component in most written symbols has become inaccurate (Karlgren, 1923/1974). Semantic components, as well, are of limited usefulness. At best they suggest association with a general semantic category, though even then they are sometimes inaccurate (Taylor and Taylor, 1983). They may serve as mnemonic clues for readers who have already encountered them in specific characters, but are often too vague to be of much use to readers puzzling over a character for the first time. This phenomenon may be made clear by considering the changes in character shape and meaning over time. As Just and Carpenter (1987) explain, the loss of correspondence between symbol and referent evolved both through changes in writing implements, which reduced the pictoral quality of symbols, and also through changes as semantic components were extended by analogy to more abstract concepts: "For example, a character that originally meant 'accuracy in hitting a physical target' was generalized to mean 'to succeed.' " (Just and Carpenter, p. 309).

Why would one expect non-alphabetic readers, such as Japanese readers of a combined syllabary and logography or Chinese readers of a "morpho-syllabic" writing system, to show any special differences or difficulties learning or reading English as a second writing system (WS2)? The central reason is that the English alphabet is based on a more analytical level of sound representation than the written codes of Chinese or Japanese.

Alphabets code language at the level of the phoneme. It is no trivial matter, however, for speakers to become aware of the phonemic segmentability of their native language. As A.M.Liberman, et.al. (1967) have demonstrated, phonemes of language are not acoustically distinct, but overlap; furthermore, the acoustical shape of consonants varies, depending on the vowel environment in which they occur. Thus the phoneme is an abstraction which, as shown by series of studies on language awareness and reading development (Gleitman and Rozin, 1977; Stanovich, 1986; Merrill Palmer Quarterly, 1987), is not an obvious unit of language to all speakers. In fact, there is some evidence that nonliterates have significantly less phonemic awareness in their native language than comparable individuals who have become readers of an alphabet (Morais, et.al., 1979).

Read, et.al. (1986) compared literate Chinese who had been taught pin-yin, the romanization of Chinese which began to be used by primary schools in Mainland China in 1958, with literates who had graduated from primary school before the teaching of pin-yin became national policy. Chinese of both groups were asked to either add or delete a phoneme from a syllable. The alphabetic-trained group performed above 80% with both words and nonwords, while the non-alphabetic group averaged significantly lower accuracy (37% with words and 21% with nonwords). Thus one difference between Chinese readers and alphabetic readers may be the extent to which they are able to segment spoken language into abstract phonemic units. This difference might come into play during the learning of a second alphabetic language, influencing the ability of learners to relate speech to writing as well as the ease with which they learn systematic patternings of letters in the new alphabet.

A second major difference between English and the non-alphabetic systems of Japanese Kanji or Chinese characters is that the pronunciation of written English words can be guessed with a fair degree of accuracy from the sequence of letter symbols, while in the latter two systems there is no reliable ways to predict pronunciation from the stimulus shape. Faced with a longer, low-frequency English word, practiced alphabetic readers can use pronunciation strategies to break it down into chunks to assist visual discrimination and memory. The characters of Chinese, however, can only be broken down into visual components suggesting semantic and/or syllabic category, and these usually provide only vague clues to meaning or pronunciation. The unreliability of these clues means that the learner/reader of Chinese or Japanese must learn to associate characters directly with whole-morpheme or whole-syllable units without the intermediate spelling-to-sound structure available to readers of an alphabet.

Furthermore, instead of the 26 letter symbols of the Roman alphabet, the learner of Chinese must discriminate between a large number of separate symbols:

> When each character represents a morpheme, there must be as many characters as there are morphemes in a language...The typical typesetting tray of a printing press contains 2500-3500 different characters. (Taylor and Taylor, 1983, p.35)
>
> ...For typing and typesetting, characters are cumbersome mainly because of their great

> variety...A Chinese 'typewriter' found in business offices is actually a sort of a printer's sypesetting machine, having a few thousand common characters plus a reserve of a few more thousand uncommon ones. A typist must first search for a required character and then punch it.(Taylor and Taylor, 1983, p. 51)

Thus the reader (or typist) of Chinese must learn how to manage in memory a cumbersome number of visual symbols. That Chinese literates are not overwhelmed by a completely unmanageable number of characters is due to the fact that morphemes can combine with one another to make up a geometrically larger set of words (Taylor and Taylor, 1983).

Still, in order for such a large number of symbols to be discriminable, great variety of intricate shapes is required. The average number of strokes in Chinese characters is 16,[5] making them visually more complex than the letters of the English alphabet:

> If several thousand characters are to be visually discriminable, many of them must be complex. To print alphabetic letters as configurations of dots on a display screen, a 7 x 11 dot matrix is often used, but to print Chinese characters, a 50 x 40 dot matrix is common. (Taylor and Taylor, 1983, p.35)

Given the visual complexity of Chinese symbols, the sheer number which have to be learned, and relatively poor segmentability of characters in comparison to an alphabetic system, one might predict that readers who learn and use these symbols, whether Chinese or Japanese, develop

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[5]In Mainland China characters have been simplified so that the average stroke number for the common characters is around 10 (Taylor and Taylor, 1983, 36).

different capabilities than do alphabetic literates.

An important question to consider, then, is whether the reading processes of nonalphabetic literates are indeed different from those of alphabetic literates.

2. Non-alphabetic reading

One source of evidence for differences in cognitive processing of alphabetic and non-alphabetic literates is the study of non-alphabetic literates performing reading tasks in their own writing systems. Performance of those readers has been contrasted with performance of fluent readers of alphabetic systems.

Readers of Chinese may rely less on speech recoding than do readers of alphabets, according to a number of researchers. Treiman, Baron & Luk (1981) asked subjects to read L1 sentences silently in order to make meaning judgments of truth or falsehood. The researchers compared Chinese and American readers' latency and accuracy on sentences with true nouns, homophones of true nouns, and non-homophones with similar visual appearance. They found that the readers of English made more errors and took more time when homophones were present, while the readers of Chinese were faster and more accurate on homophone sentences. These results suggest that L1 readers of Chinese use less speech recoding when reading in L1. This is consistent with a number of studies using tasks involving the processing of individual characters. These studies provide evidence that, taken in isolation, Chinese symbols involve more holistic visual encoding, with greater right-hemisphere involvement, than has been observed with alphabetic literates (Biederman and Tsao, 1979; Fang, Tzeng, & Alva, 1981; Hung & Tzeng, 1981).[6]

This tendency to favor visual encoding may well derive from more than the writing system itself. Chinese does consist of a large number of visually distinguishable characters, many of which contain some semantic clue, so that visual accuracy without reference to speech codes might seem to be a logical outcome of the symbols themselves. But in addition, the morpho-syllabic structure of spoken Chinese may favor reliance on visual codes, since the spoken language, with a relatively simple syllable structure, contains a large number of homophones (Leong, 1973; Taylor and Taylor, 1983). As a result, speech recoding might increase the ambiguity of the linguistic input, while visual encoding would reduce ambiguity.

This balance between the visual elaboration of the writing system and the simplicity of the sound system has been cited by Chen and Juola (1982) in explaining the reliance on visual coding and storage with Chinese readers. These researchers found that when subjects were asked to

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[6]Converging evidence for differences between alphabetic readers and non-alphabetic readers of Chinese and Japanese also comes from studies of hemispheric differences, as mentioned in Chapter 1. Due to the complexity of the methodology, difficulties in determining validity and generalizability of the findings, and their indirect bearing on the issues and methodology adopted in the study reported here, it was decided not to describe this area of research in detail here.

identify which word of a pair matched a word from a previously studied (remembered) list on either graphemic, phonemic, or semantic dimensions, Chinese literates more easily recognized graphemic similarities. In contrast, English literates did not seem to rely more heavily on any single coding dimension, performing about the same regardless of whether similarities were graphemic, phonemic or semantic. Chen and Juola reason that, for Chinese readers,

> ...the phonemic representations of logographs are probably less distinctive than their visual representations. Furthermore, the visual aspects of each character are particularly important, not only in terms of helping to differentiate and identify a character among others, but also in providing information about the general meaning of the character. This is probably why the results suggest that logographic characters heavily activate 'visual' encoding strategies, resulting in emphasis on visual codes in memory, whereas phonological recognition and memory processes based on phonological codes are deemphasized... (p.223)

Similar reliance on visual coding by Chinese literates has been reported by Tzeng and Wang (1983). After exploring a variety of experimental paradigms with alphabetic and non-alphabetic readers, including the Stroop interference task which pits color stimuli against contradictory written word names of colors, an adaptation of Stroop using numbers in conflict with the written name for numbers, and a list-presentation and recall task, these researchers concluded that non-alphabetic readers employ different processing strategies from those of alphabetic readers, that "...visual processing is more critical in the task of recognizing logographs..." and leads to stronger visual memory traces as a result (p.241).

3. Comparison with reading in English

Complementary to these indications that Chinese readers more easily activate visual codes are studies showing that readers of consistent alphabetic orthographies("shallow" orthographies), such as Hebrew or Serbo-Croatian, automatically activate phonological codes in some task conditions (Shimron & Navon, 1982; Lukatela, et.al., 1978).

These writing systems differ somewhat from English, which does not map the phonemic level alone (this is one attribute of a "deep" orthography, Hung and Tzeng, 1981). Its orthographic system combines spelling-sound correspondences at the phonemic level with mapping of larger units of sound and meaning. Thus it is more properly termed a morphophonemic system rather than a pure alphabet (Venezky, 1970; C.Chomsky, 1970; Gleitman and Rozin, 1977), in some ways resembling the Chinese writing system (Carroll, 1972).

In spite of these "logographic" (Carr, 1986) or meaning-based representational tendencies of English, its readers seem to activate speech codes more readily than do readers of Chinese (Treiman, Baron, and Luk, 1981). An enormous amount of research has been invested in demonstrating the pervasiveness of pronounceability effects on fluent readers of English orthography (Gough, 1984). It has been established that English literates name words faster than pictures, make affirmative judgments of lexicality more quickly when stimuli are pronounceable, and rely more heavily on speech recoding when experimental techniques such as visual masking are used to cut short encoding through the visual system (Carr, 1986). On the other hand, unlike readers of shallow orthographies who show automatic use of speech recoding even when it hinders their task performance, readers of English seem to have some strategic control over the use of speech codes, switching to semantic codes when speech codes are less appropriate to a given task (Kleiman, 1975; Carr, 1986). Furthermore, it is possible that spelling patterns in English constitute a visual code which is automatically activated in certain task situations. Seidenberg and Tannenhaus (1979) found chronometric evidence for the intrusion of visual coding during a seemingly non-visual task of rhyming judgments.

Thus one of the problems in this area of research is the unexpected flexibility of readers, who seem able, whether automatically or strategically, to switch their relative reliance on speech codes in response to even slight variations in experimental design. This is true both for English readers (Crowder, 1978) and for non-alphabetic literates. Though there is a good deal of evidence of the more ready availability of visual codes for readers of Chinese and Japanese, this does not mean they do not engage in speech recoding (see Besner, 1987). In general, when tasks require individuals to remember lists or read groups of characters, such as phrases or sentences, researchers have found that users of non-alphabetic systems, like readers of alphabetic ones, resort to speech recoding and left hemisphere processing, presumably to gain the support of speech codes in working memory. This finding has held for studies of Japanese Kanji (Erickson, Mattingly, & Turvey, 1977) as well as with Chinese characters (Tzeng, et.al., 1977; Tzeng, et.al., 1979).

4. Summary of findings and methodological guidelines:

Despite the variability of task performance in both Chinese and English reading, recent research suggests a clear pattern in which alphabetic readers tend to recode visual symbols into sound-based representations. Conversely, Chinese and Japanese readers of characters seem more able to disregard correspondences with speech, relying somewhat more readily on a visual coding option.

One crucial lesson in caution from this area of research is that it is often difficult to be sure of the causal factors underlying a set of experimental results. English is not a shallow alphabet in which spelling to sound recoding is automatic for readers, but a deep orthography allowing for strategic options for shape, sound, and meaning recoding. Similarly, Chinese and Japanese are not pure logographies. Japanese mixes sound-based syllabaries with a meaning-based logography, while Chinese encases units of meaning in characters which also represent uniformly-sized syllabic units of sound. Orthographic mapping of speech is relevant to the structure of both systems. Thus findings that readers operating in the non-alphabetic systems have a stronger tendency to code visual cues cannot be attributed simply to a lack of experience with analytical speech recoding. In fact, other factors such as the simplicity or complexity of the syllable structure in the spoken language may also play a role in determining which codes are more useful for the processes of reading in a given writing system and language. Furthermore, subtle changes in task requirements have also been shown, with English as with other mixed orthographies, to elicit different types of processing, with English readers having options of shape or meaning coding, while non-alphabetic readers engage in speech recoding with certain tasks.

Nevertheless, one area of comparative potential that calls for further exploration involves the lack of an "alphabetic principle" (Carr, 1986) in Chinese and Japanese. Research has shown the phonemic level of linguistic structure is less obvious to children, non-literates, and non-alphabetic literates, in contrast to readers of alphabetic systems. The lack of orthographic representation of individual phonemes in Chinese and Japanese may cause these readers, when learning to read in an alphabet-based WS2 such as English, to underuse the systematic aspects of the orthography in comparison native speakers of the language.

C. STUDIES OF NON-ALPHABETIC READERS LEARNING ENGLISH ORTHOGRAPHY

Several years ago, John Barnitz (1982) reviewed research concerning orthographic effects on learning to read in a second language. He contrasted French immersion programs for English speaking children in Canada, in which L2 literacy facilitated later learning of L1 literacy, with English immersion programs for Farsi-speaking children in Iran. Unlike the Canadian children, the children in the Iranian programs did not learn to read in either language as well as children in monolingual programs. Orthography was hypothesized to be one factor impeding literacy transfer (see also Cowan and Sarmad, 1976). Barnitz admitted that a host of other factors could also have brought about this result and lamented the lack of research on the learning of WS2 orthographies: "...few experimental studies directly examine the role of orthographies in the transfer of literacy. Much of the available evidence is indirect and involves only alphabetic systems." (p. 560) This statement remains valid today. The little that we do know about WS2 learning of English is discussed below.

1. Questions about visual coding in English WS2

The evidence that nonalphabetic readers can show greater reliance on some type of visual code when reading their own writing system has provided a point of departure for examining whether they also favor non-speech coding in English.

a. A memory code study

Chu-Chang and Loritz (1978) studied the memory of Chinese and Spanish literates for written English words (L2) and compared this with performance by the Chinese in their first writing system. Subjects were shown a set of words (drawn from pairs of phonologically, semantically, or visually similar words), then given a recognition list on which they were to circle words they thought were identical to the ones in the original set. (Chinese stimuli were characters rather than words). The researchers were surprised by the pattern of mistaken recognitions which they found: Chinese subjects reading in their own writing system--one which in other experiments appears to foster stronger visual coding--made significantly more phonological misrecognitions than visual ones. In contrast, in English, they made more visual misrecognitions. Spanish readers also tended to make more visual misrecognitions, though this tendency was not significant.

These authors interpreted their first finding to mean that there was a preference for phonological recoding of visual stimuli in reading Chinese. This seems to be a mistake. The task (memory for a set of items) would seem to favor the conversion of stimuli to speech codes for retention in working memory (Conrad, 1972), so on this task such phonological confusions would not be particularly surprising. The lower error rate for visually confusable items would also seem to indicate the opposite interpretation from that given by the researchers, who suggested these Chinese readers were not relying much on visual codes for carrying out the task. Conversely, the subjects may have been simply more accurate in their use of visual encoding as a result of greater reliance on visual processing in reading of Chinese. That is, the low error rate with visual stimuli could be interpreted as an indication that Chinese readers more accurately retained the visual configuration of characters in memory and thus did not mistakenly circle visually similar items.

The second finding, that Chinese literates produce a higher percentage of visual misrecognitions when reading English, is similarly open to various interpretations. Does it mean that they prefer visual coding for L2 reading? If so, does it reflect transfer from reading of native writing systems or lack of oral proficiency in English L2? Or does it mean that, being slower in reading their L2, subjects in both groups just lacked the time necessary to translate the stimuli to a speech code (K.Bock, personal communication)? Further, there is the possibility that the degree of similarity between confusable pairs was not equal. A look at phonologically confusable stimuli shows lack of complete homonymity in half of the phonologically similar pairs (vice/fights or use/youths), so one interpretation of the results could be that the visual pairs were much more similar than the phonological ones. Also, there were extreme differences in word length for some of the English phonological pairs (I/eye or no/know), while the visually confusable items had identical word length (tile/lite or ail/all). Since readers must perceive stimuli visually to some extent before phonological recoding takes place (Posner and Mitchell, 1967), the phonological words' visual distinctiveness from their distractors might explain why readers didn't appear to rely more on phonological codes in the English task.

Finally, there is the interpretation given by the Chu-Chang and Loritz themselves, that there may be a universal developmental shift from visual to speech-based codes in memory. In a daring and clearly questionable analogy between children's cognitive development and L2 learners' reading development, they venture that writing system differences have less impact on learners than do developmental stages of reading that parallel cognitive development.

This research deserves attention as an early attempt to understand distinctions in the orthographic knowledge of L2 learners. Nevertheless, it also illustrates several pitfalls to avoid in studying WS2 learning. First, the processing required by the task was not well defined, so the same set of results could be interpreted in various ways. Second, the differences between stimuli types were not related to stages of information processing or to the fact that at least some form of visual perception precedes phonological recoding. Connecting predicted performance on tasks to what is known about cognitive processing would seem essential if any sense is to be made of experimental findings. Third, differences between stimuli categories were not controlled so that confusability was equated across sets of words. Finally, in discussion of results, vague and inappropriate analogies were drawn between L1 research findings on child development and the results of a single L2 study.

b. A timed reading efficiency study

Koda (1987a; 1987b) advanced more modest claims about strategic options of non-alphabetic readers in English. Adopting a task from Cunningham and Cunningham (1978), she asked Japanese readers to read an English text in which names of fish had been changed to nonwords which had to be identified at the end of the reading. In one text the nonwords were pronounceable according to grapheme-phoneme conversion principles (doffit, mintex), while in the other they were not (dfofti, mnitxe). In the 1978 study, readers of English had proved significantly slower in reading the text with unpronounceable words, but Koda (1987a) found the Japanese to be faster readers of English with the non-pronounceable names, while maintaining a similar level of comprehension on the posttest.

One of the strengths of Koda's study was a follow-up interview in which she asked individuals about strategies they had used for remembering the nonwords. Most readers in the pronounceable word group had used either the first syllable or the whole word--that is, pronounceable units derived from the original spelling. In so doing, they demonstrated application of the alphabetic principle of spelling to sound recoding, though it appears to have slowed their reading. Conversely, all subjects in the other group reported either associating the stimulus with a different familiar word or using one or two letters to form a visual mnemonic association (such as _ff_ to suggest stripes on a particular fish). For the group of readers dealing with unpronounceable stimuli, freedom from a phonemic recoding strategy seemed to pay off in shorter reading times.

Koda (1987b) adopted the same task for a follow-up study comparing Japanese, Arabic, Spanish, and English L1 readers. (A listening and cloze pretest were used to ascertain that the L2 readers of English were at comparable proficiency levels in the English language.) In this study, two English texts were read by each reader, one containing pronounceable nonwords, the other unfamiliar symbols from Sanskrit. Results showed that the "phonographic readers" (the latter three groups, all accustomed to alphabetic reading) were significantly slowed by texts with Sanskrit symbols, while the Japanese were not (as in the earlier study, there were no significant differences in comprehension on the posttest). Despite the unfamiliarity of the Sanskrit symbols, 13 out of 21 Japanese subjects spent less time reading the Sanskrit passage than the pronounceable pseudoword passage. Koda suggests that

"...the reading effectiveness of the three phonographic groups was seriously impaired by phonological inaccessibility" of the Sanskrit symbols (p.31), while the "morphographic" Japanese readers apparently were able to adapt strategically, applying non-acoustic visual encoding.

The converging results of these two studies, showing that Japanese readers have the option to rely on purely visual strategies, while "phonographic" readers do not, make sense when one considers the readers' experience with reading Kanji. Not only are these logographic symbols keyed to meaning, not sound, but single logographs also frequently have varying pronunciations in different contexts (Hadamitzky and Spahn, 1981). This situation would make it doubly uneconomical for readers to search for pronunciations when reading kanji, fostering instead a direct association between shape and meaning. Thus the strategic flexibility of Japanese readers in Koda's study has a logical connection to what they have learned from their native writing system, not only the arbitrary association between symbol and sound characteristic of logographies, but also the many-to-one sound-symbol mapping of Kanji. Koda does not explore how this strategic flexibility may be applied in learning to read English. This issue will be addressed near the end of this chapter.

The finding of longer reading speeds when texts contain pronounceable nonwords calls for further comment than provided by Koda. Does this mean that the alphabetic principle is inefficient for readers? Can this somewhat counterintuitive finding be believed? Brooks and his colleagues (1977) have supplied some longitudinal studies of the learning of invented writing systems which may be seen to bolster Koda's finding. Brooks reports one comparison of adult alphabetic readers learning new symbol sequences that were either alphabetically related to the phonemes in the word they represented or arbitrarily associated with the word's pronunciation, as in a logography. The subjects' slowness in identifying and blending new symbols together has already been discussed in the first section of this review. In comparison, responding to new symbols by paired-associate learning was faster for the first 100 or so trials (each presenting the same six "words" in varied order). It was only after 180 trials that the alphabetic principle proved beneficial for response times, with alphabetic stimuli identified in shorter latencies than were logographic ones.

If it takes longer at first to identify new written stimuli by grapheme-to-speech recoding, then Koda's pattern of results for Japanese readers appears quite sensible. Bypassing this more time-consuming process, they are able to build direct associations between symbols and meaning, just as Brooks's subjects did when learning direct associations between invented symbols and sound. But then several questions arise from Koda's and Brooks's findings: Do Japanese readers actually use this same short-cut to meaning in their learning of English as a second language? If they do, what effect does this have on their reading and learning of vocabulary over a long period of time? Immediate benefit of non-alphabetic approaches might give way to slower reading in the long run, in comparison with readers who apply the alphabetic principle. Furthermore, avoidance of grapheme-to-speech recoding might impede the learning of vocabulary, for as more visual configurations are encountered the potential for confusion between them becomes greater. On the other hand, it must be remembered that Brooks's subjects were already alphabetic literates, so it is also possible that their long-term benefit from alphabetic structure in the invented stimuli merely reflects a predilection growing out of their literacy experience rather than a universal of learning written language. Clearly, Koda's research, amplified by Brooks's findings, indicate an area of research in which much more needs to be learned about WS2 reading acquisition.

c. A visual matching study

Further converging evidence on the abilities of Japanese readers in English has been provided in a comparative study by Brown and Haynes (1985). They hypothesized that writing system differences should put Japanese and Arabic L2 readers of English at a disadvantage in comparison to Spanish readers familiar with the Roman alphabet.

Brown and Haynes began by measuring individuals' speed on same-different visual matching of pairs of English words or letter patterns, a paradigm which appears to tap the "visual code formation" stage of reading (Carr, 1986, 29-29). This same-different matching task requires that subjects make a forced-choice decision between "same" or "different" when they see a pair of letter sequences. They are to choose "same" if they perceive any non-matching letters in the two stimuli. It is important to note that the stimuli were presented one right above the other, since there is some indication that other formats, such as side-by-side, may lead readers to engage in some type of speech recoding, thus confounding visual code with speech code and making the results much more difficult to interpret (Carr, Pollatsek, & Posner, 1981).

Predicting that same-different visual matching performance would show the Spanish readers to be faster than Arabic and Japanese readers with English alphabetic stimuli, Brown and Haynes were surprised to find the Japanese group to be the fastest, with the Spanish group faster only in comparison to the Arabic literaters. The Japanese speed advantage was maintained when matching complex figures (non-linguistic shapes), though the Spanish group no longer showed an advantage over the Arabic group. Evidently the Japanese readers were more efficient <u>in general</u> at visual processing tasks, while the Spanish readers' speed with English words and letters was a specific result of their

Spanish writing system knowledge and thus did not transfer to non-alphabetic shapes.

i. Why visual coding may not suffice

Up to this point, a strong case can be made that Japanese readers of English, though lacking experience with alphabetic literacy in their native language, are able to read more efficiently and flexibly in English than some other L2 students as a result of the practice with precise visual coding which their native writing system necessitates. Nevertheless, studies of reading development and individual differences with L1 speakers of English indicate that such visual coding might not be sufficient for developing fluent word recognition in an alphabetic system. This area of research will be briefly reviewed before further discussion of the performance of Japanese readers in Brown and Haynes (1985).

Preschool children sometimes learn to read on their own before receiving formal instruction in reading. While some of these readers can use decoding ("transformation of a string of letters into a phonetic code" Perfetti, 1985, p.90), a subgroup has been found who cannot; they seem to rely on a visual word-recognition strategy similar to paired-associate learning (Backman, 1983). This would not seem to augur well for their future development as readers. It is incorrect to conclude, simply because skilled readers can bypass speech recoding during word recognition (Kolers, 1966; Doctor and Coltheart, 1980), that learning to read an alphabetic system does not benefit from learning of decoding skill. As Stanovich (1986) and others have pointed out, there is a reciprocal relationship between vocabulary development and reading skill which depends critically on readers' ability to pick up new vocabulary through reading. Logically, decoding must be part of that process. By decoding one can recognize in print words that one has heard but never before seen in print. For words that have not been heard before, decoding offers a second memory cue through pronunciation to enhance memory for visual shape when one tries to remember the form of vocabulary whose meaning has been inferred from context.

Though speech recoding is not necessary for skilled reading, it may be crucial as native speakers of English learn to read: there is considerable evidence that efficiency in reading the English alphabetic system does not develop without decoding skill. Longitudinal studies of beginning readers have shown that direct teaching of the spelling-to-speech code benefits children's progress in reading comprehension, sometimes allowing those who are behind in linguistic development or reading experience to pull ahead of others who, though more advanced to begin with, did not receive this type of training in the orthographic system (Evans and Carr, 1985; Perfetti, et.al., 1987). Studies comparing good and poor readers consistently find that speed in decoding low frequency or unfamiliar words distinguishes the two groups (Perfetti and Hogaboam, 1975; Frederiksen, 1981; see Stanovich, 1986 and Perfetti, 1985, for reviews). Though spelling-to-speech recoding is cumbersome at first (Biemiller, 1970), it does appear to lead to faster word recognition in the long run for alphabetic readers (Brooks, 1977).

ii. The question of orthographic regularity

Given the importance of decoding ability in the development of reading for L1 learners, it was logical for Brown and Haynes (1985) to further explore the limits on their Japanese subjects' apparent speed advantage in processing visual stimuli. In a second same-different visual matching experiment with longer stimuli the Japanese readers not only maintained their advantage over the alphabetic readers in the study, but showed that the increase in word length took less extra time for them than for the Spanish and Arabic readers. One might guess from this that the alphabetic readers could have been slowed by a tendency toward automatic speech recoding (see Meara, 1984, concerning Spanish readers). Though these results cannot indicate the mechanism which led to the speed differences observed, the Japanese were clearly more efficient at this visual matching task.

One interesting pattern in the same-different matching performance of these three types of literates concerns their development of sensitivity to orthographic regularity. But before discussing these results in more detail, it is necessary to take another detour to consider the meaning of orthographic regularity. It can be best explicated with reference to the concept of pseudoword. According to Carr (1986),

> A pseudoword is a string of letters that obeys the constraints on letter sequencing of the English language and can be pronounced in a systematic way, such as MARD, BRIP, TENGISH... pseudowords are like words in visual structure and pronounceability, but have no meanings and are unfamiliar. (29-9)

This definition of pseudoword makes intuitive sense, but the components of orthographic regulary are difficult to pin down precisely (Mason, 1975; Massaro and Taylor, 1980). For instance, consider the "pseudoword" TENGISH above. In what way is it like other English words in visual structure? How common is the syllable -GISH in our language? How frequently do the bigrams gi, is, and sh co-occur in English? How often does each letter appear in first, second, third, etc., position (see Mayzner and Tresselt, 1965, for tabulation of such frequencies in English.) Furthermore, by what systematic means is it to be pronounced--by analogy with the word "English" or by analysis into "ten" and "gish"? These approaches yield different pronunciations with this and other "pseudowords". In fact, Carr (1986) acknowledges that the graphotactic and spelling-to-sound translation rules developed by linguistic scholars such as Venezky (1970) do not constitute an airtight system for all cases, leaving room for probabilistic "best guesses" and exception words (Carr, 1986, pp. 29-21, 29-22). Thus the notion of orthographic regularity, the principle by which pseudowords are to be constructed, remains problematic.

Before throwing out the notion of orthographic regularity, however, one must consider how useful this theoretical construct has been for understanding the development of alphabetic reading. It appears to capture an essential characteristic of alphabetic literacy, that readers become sensitive to the systematicity of English letter sequences (possibly their pronounceability, but see Gibson, et.al, 1970; Mason, 1975; Singer, 1982). Pseudowords are recognized (Baron & Thurston, 1973) and remembered (Gibson, et.al., 1962) more accurately than random strings of letters, even though readers could not have encountered them previously. There is a great deal of theoretical controversy over the precise cognitive mechanisms which contribute to this sensitivity (Carr and Pollatsek, 1985), but for the present purpose it is sufficient to note that one can trace an increase in sensitivity to orthographic structure of English in readers' responses to pseudowords.

Chall (1983), in reviewing developmental changes as readers gain skill, reports that by grade 5 children can match meaningless CVC or CVCC sequences as fast as they can match individual letters. By grade 10 syllable matching is as fast as word matching. Thus, while beginning readers benefit from simplicity of stimuli (single letter) and more advanced readers still benefit from familiarity of stimuli (words), as they become even better readers they benefit increasingly from the systematicity of the English orthographic system. This developmental pattern has been observed using a variety of experimental paradigms, including judgments of word-likeness (Massaro & Hestand, 1983; Zivian & Samuels, 1986), letter-search time (Mason, 1975), pronunciation latency (Perfeti and Hogaboam, 1975), and judgment of whether a target letter was present in a briefly presented letter string (Massaro & Taylor, 1980). Sensitivity to orthographic regularity does not appear to develop automatically with age, reading experience or sight vocabulary (Zivian & Samuels, 1986). It is the good readers who are sensitive to the regular structure of pseudowords, while the poor readers tend to treat them more like arbitrary strings of letters (Frederiksen, 1981; Perfetti and Roth, 1981; Perfetti, 1985). Thus an interesting question to examine is whether or not this benefit from orthographic regularity develops for non-alphabetic learners of English reading.

The findings of Brown and Haynes (1985) suggest that sensitivity to orthographic regularity does increase with language proficiency. First combining data from all three literacy backgrounds, they divided the sample into high and low proficiency groups (based on test scores at the language center where they were studying). They found that the more proficient group was faster on the pseudowords, relative to the letter strings, than was the less proficient group.

This indicated that students of all three orthographic systems--Spanish, Arabic, and Japanese--showed orthographic learning similar to that documented for L1 readers of English. In addition, when they divided the Japanese readers into high and low language proficiency subgroups, they found the same pattern, with the more advanced language learners better able to profit from systematic sequencing of English letters. Interestingly, the Japanese group as a whole showed smaller benefit from pseudowords (relative to letter strings) than did the two groups of alphabetic literates. This hints that, despite their visual speed advantage, the adjustment to orthographic patterns in English may have been more difficult for these non-alphabetic readers than for readers whose own writing system follows more similar patterns.

iii. The question of pronunciation

Brown and Haynes (1985) carried this analysis of L2 readers one step further by comparing their pronunciation latency (and accuracy) when reading English words and pseudowords aloud. They found that the Japanese advantage, so clear in a purely visual task, evaporated. When reading long words or pseudowords, the Japanese were much slower than the other two groups. This did not appear to be general slowness of speech in English, since they were just as fast as the other groups in pronouncing short words and pseudowords. Still, it appears that these readers' rapid visual encoding may have had its costs as well as benefits.

Like Koda's Japanese readers, these subjects could outperform alphabetic readers when use of a non-speech code was appropriate. But when translation to speech was called for by the task, and when stimuli were neither short nor familiar, they began to look more like Brooks's learners of new alphabetic symbols, taking a long time to identify and blend together parts of the written stimulus.

In fact, Japanese readers tended to segment the longer stimuli into syllabic chunks, often retreating to the beginning of the word after they had pronounced the first one or two syllables, repeating the whole in a manner similar to the "recycling" that Vai syllabary readers used (Scribner and Cole, 1981, p. 165), as if they had trouble assembling the whole word or pseudoword into one spoken unit. Whether their difficulty was related to lack of experience with the detailed sequence of letters in an analytical phonemic mapping of an alphabet, to oral reading patterns learned in conjunction with their first orthography, a syllabary, or to speech problems related to the dissimilar syllable and stress structure of English and Japanese--or some combination of these factors--cannot be determined from this data. What is clear, however, is the dissociation between visual efficiency and the inefficiency of the students' symbol-to-speech recoding with longer stimuli.

iv. Limitations

This study charts useful new territory in distinguishing some of the peculiarities of WS2 learners' English reading. Nevertheless, it also demonstrates some problematic areas for research of this type. First, the authors do not report on correlations between visual matching or word pronunciation latencies and reading comprehension. Thus it is not clear what larger significance these peculiar differences between alphabetic and non-alphabetic readers might have. Furthermore, there are two central difficulties with using vocalization data in the study of second language reading. First is the difficulty of knowing when a word has been read accurately. It is not easy to distinguish between systematic pronunciation deviations from standard English, which should not count as reading errors, and ones which indicate misperception of the written stimulus. Brown and Haynes (1985) used trained raters to estimate the accuracy of the oral readings, with fairly high inter-rater reliability on scoring of lists of ten words, yet there was considerable deviation in scoring on individual items. A second problem involves interpretation. As has been mentioned above, whenever L2 learners are asked to answer orally, it becomes more difficult to know whether the patterns that are found result from reading difficulties or lack of proficiency with the spoken language.

<u>2. The need to study component processes</u>

Given the difficulties of researching component processes of L2 reading and the lack of evidence, in the studies reviewed above, that these lower level processes have anything to do with fluent reading, one might question the usefulness of pursuing this direction of reading research.

In fact, as discussed in Chapter I, psycholinguistic models have led theoreticians of L2 reading to question the significance of differences in lower level processing and to argue that development in reading requires a shift of attention away from letters and words. For example, Field (1985) has suggested that comprehension difficulties of Chinese readers of English result from paying too much attention to lower level units such as morphemes and words. This proposal, based on informal observations during Field's teaching in China, is presented as part of a model of Chinese readers which Field developed from Coady's (1979) "Psycholinguistic model of the ESL reader." Though this report of word-level focus may be accurate, it needs to be confirmed through more systematic ethnographic study. More important, the underlying causes of this word-level focus need to be uncovered. Certainly Field's review of cultural and educational factors provides an important foundation for further research. But instructing learners to shift attention away from the word level may not be the appropriate solution if processing difficulties with the writing system are the main cause of this word-level focus. Before drawing instructional implications, observational study needs to be supplemented by experimental approaches, particularly since lower-level influences may not be amenable to observational detection.

In a spirited attack on the preponderance of research on high level L2 reading processes, Meara (1984) criticizes the (often implicit) assumption that "Word recognition, however it occurs, is going to proceed in much the same fashion no matter what is being read and so, for practical purposes, it can probably be safely ignored." (p. 98) He points out that the variation among L2 learners in lower level processes are apt to render nonsignificant any real but small differences that may exist in higher level processes.

From here, Meara attempts to demonstrate the potential variability in word recognition process by uncovering basic processing differences among readers of English from various orthographic backgrounds. He reports (for two groups, "Chinese speakers" and "other non-Roman speakers") that accuracy for word recognition in English decreases much more in conjunction with increasing word length than it does for L1 readers of English (1984). This result does not seem consistent with the Brown and Haynes (1985) evidence that Japanese readers are unaffected by word length in visual matching, but it may have a closer relation to their finding that Japanese turned out to be slower on long words when oral reading was required. Meara (1984) also reports that Chinese readers are more accurate than L1 readers when deleting a letter, such as 'e,' within a passage of English (1984). This type of performance had earlier been claimed as evidence for a general tendency toward more detailed visual coding in a mixed group of L2 readers, since they cancelled out more letters than L1 readers did (Hatch, et.al, 1974). Meara appears to be the first to find this result with one specific group of literates, Chinese readers. He concludes not that they are more visual readers but that they do not have as strong a tendency as native speakers to perceive words in terms of their morphemic components. Also, Green and Meara report that Chinese literates, unlike American and Spanish alphabetic readers, do not produce an M-shaped letter-search function on English words, but rather the same U-shaped function (for English words as for Chinese characters) that has been observed when Americans search strings of shapes rather than strings of letters (Green and Meara, 1987).

From such findings Meara argues that researchers must not ignore lower level processes and indeed should, for the present, focus on word recognition:

> The implication of this work is that experimental studies on word recognition (and other aspects of word handling) might in the long run be more fruitful than work on higher order processes, simply because until we understand these basic processes more fully, it is going to be very difficult to provide convincing interpretations of the way non-native speakers perform on more complex tasks. (1984, p. 105)

Though Meara's evidence is pertinent to his point, his research is still at a preliminary stage. The patterns observed with Chinese readers are suggestive, but need to be connected in some way with more reading-like processing, with developmental changes, and with measures of L2 reading success. Though these different processing patterns are likely to have an impact on either speed or comprehension with English texts, at this point one can only speculate on how differences in isolated performance relate to learning to read in a different orthography.

3. Summary of findings and methodological guidelines

This review of studies of non-alphabetic literates learning to read in English leaves many unanswered questions. Evidence has been found that Japanese literates have available some visual mode of processing which gives them a speed advantage over other learners of English on certain tasks. This appears to be a processing short cut, perhaps under strategic control, which does not depend on having previously learned to pronounce stimuli according to the alphabetic principle. In fact, Japanese readers seem to have considerable difficulty when asked to translate into spoken form longer words or pseudowords written in English orthography. What is unclear is whether either this pronunciation difficulty or the visual short cut affects Japanese literates as they learn to read in English.

A particularly promising direction for study is the increasing sensitivity to orthographic regularity

demonstrated by students of English from various writing system backgrounds, including Arabic and Spanish as well as Japanese. The pattern of more efficient processing of graphotactically regular pseudowords by more proficient language learners is consistent with findings from L1 studies of reading development in English. Furthermore, this area of orthographic knowledge can be studied in the visual task of same-different matching, avoiding ambiguities of speech recoding and the problems inherent in rating L2 speakers' oral readings of English.

This review of research concerning non-alphabetic WS2 readers of English shows that the transition by readers of Chinese to the English writing system has been studied very little. Researchers have advanced a few suggestions about Chinese literates' visual coding of English, based on preliminary experiments comparing them with alphabetic readers. However, for both the Chinese and Japanese, it is as yet unclear whether this visual mode of processing is optional and under strategic control only in appropriate tasks or whether instead it might be a limiting influence on their progress in English reading. There has been a singular lack of studies relating the lower-level processing components of non-alphabetic readers to complex reading tasks in English.

Despite the paucity of research studies in this area, there are already a number of methodological applications that can be derived from them. The first is the need to refer to a foundation of knowledge in cognitive science when designing tasks to answer specific questions about stages of processing, such as visual and speech coding, which have been found theoretically, experimentally, and clinically separable (Carr, 1986). For example, if one wishes to study the process of visual code formation, one should avoid tasks which bias subjects toward phonological recoding. An effort should be undertaken to isolate subprocesses experimentally, testing hypotheses that are clearly falsifiable by the pattern of results.

At the same time, the impact of these isolatable components of the reading process should be examined in relation to individuals' performance when reading for comprehension is the goal. Discovering a variety of subtle variations in processing has little use or meaning in isolation; what we need to know is whether these variations make a difference for the L2 reader's learning from written text. For example, speed measures appear to be sensitive to small variations in processing, but the patterns they yield must be interpreted within the larger framework of reading speed and comprehension of comparative groups of readers.

CHAPTER III: RATIONALE AND APPROACH OF THE STUDY

The choices made in designing this research project were guided in part by problems perceived in previous approaches to WS2 reading development, as discussed in the first two chapters. An attempt was made to design a study which would yield fairly unambiguous information about one component of reading, the orthographic knowledge of a specific group of WS2 learners, Chinese students of English. To evaluate the significance of this factor in WS2 reading, an individual differences approach with multiple regression was adopted. The rationale for each part of the study is presented below, while specific methods, results, and conclusions are described in later chapters.

A. SUBJECTS

This project targets a specific group of WS2 learners with relatively homogeneous L1 reading experience and skill. If a heterogeneous mix of students were studied (such as is found in intensive ESL centers in the US, where classes may include such readers as Japanese, Arabic, Farsi, Korean, and Chinese, as well as those experienced with the Roman-alphabet, such as Indonesian, Malaysian, or Spanish literates), systematic development of English writing system mastery could easily be obscured by uncontrolled background differences among the individuals under study.

In this study, Chinese university students in Taiwan, the Republic of China, were chosen as subjects. As speakers of Mandarin and literates of the Chinese non-alphabetic writing system, they represent a large group whose WS2 acquisition has received little attention. Also, their educational background, including literacy and English, is fairly homogeneous, increasing the probability of finding significant patterns of literacy transfer is such patterns exist. Several other important reasons for this selection include the researcher's knowledge of the language and educational context of these students, as well as established relations with individuals and institutions enabling access to a sample of students.

Two groups were sampled: college freshmen whose six years of secondary English instruction had followed a grammar-translation approach and college seniors whose additional three years of experience in studying subject matter from English textbooks in their major field was expected to have given them more experience with more fluent reading of English text. This selection of two samples at different stages in their college careers was designed to maximize the likelihood of finding evidence of developmental differences in perceptual processes, if development of automaticity in these processes is not a trivial stage of initial learning, but continues beyond the elementary level of language learning.

A second important step was taken by comparing this Chinese sample to a small group of American college students. This comparison is undertaken with full awareness of considerable differences between American and Chinese students, both in the type of academic discipline to which their previous schooling has exposed them and in the degree of academic achievement necessary to attain university admission. The students in Taiwan were likely to be a more select group (see D.C.Smith, 1986). Still, the degree of facility demonstrated by these American undergraduates on the same tests that were given to the Chinese participants should indicate how much farther these WS2/L2 learners must progress before they are comparable to L1 literates and in what ways their orthographic knowledge differs from skilled readers of English. This American group thus provides a reference point.

B. MEASURING AND COMPARING ORTHOGRAPHIC KNOWLEDGE

The first step of this study was to compare visual processing efficiency of English alphabetic stimuli by Chinese readers at two English proficiency levels and that of competent L1 readers of English. The visual matching task and stimuli of Brown and Haynes (1985) were adopted because they could yield data showing the extent to which these WS2 readers differed from L1 readers in visual efficiency with symbols (letter strings), orthographically regular sequences of symbols (pseudowords), and meaningful sequences of symbols (words). This approach enabled measurement of a theoretically, experimentally, and clinically distinct (Carr, 1986) component of reading, visual perception of orthography .

There is a danger, however, that individuals' ability to perform efficiently on any speeded task will invalidate the comparison of Chinese and American readers' efficiency (speed and accuracy) in matching as an index of fluency with English orthographic stimuli. Therefore a measure of speeded processing with familiar but non-alphabetic stimuli was included in this study. Since Taiwan students learn and use Arabic numerals in mathematics studies, these were used for an additional same-different visual matching task. Number matching performance could then be entered as a covariate in an analysis of covariance to isolate differences between these groups' visual efficiency with English orthography.

C. COMPONENT PROCESSES AND INDIVIDUAL DIFFERENCES APPROACHES

A third decision was made to adopt a component process approach to L2 reading. Though reading clearly involves interaction between various perceptual and higher level processes, one can only begin to understand its development by considering the relative contributions of different processes. This necessitates a working assumption that there are different sources of effects on reading (such as efficiency of visual shape recognition vs. lexical meaning recognition, or vocabulary vs. grammatical knowledge). This assumption, that there are different sources of effects on reading, is one that psycholinguistic researchers also adopt in evaluating the relative contribution of graphophonemic, syntactic, and semantic cues in reading (Goodman and Goodman, 1977). These sources of effects will be called components or component processes. It should be kept in mind that they are theoretical constructs, heuristics adopted to better perceive meaningful patterns in performance. This approach does not imply that they do not interact during reading, but that their separate contributions may be evaluated despite the interactions between them during fluent reading. (Brown and Haynes, 1985; Carr and McDonald, 1984; Frederiksen, 1981; Graesser, Hoffman, and Clark, 1980; Baddeley, Logie, and Nimmo-Smith, 1985; Palmer, MadLeod, Hunt, and Davidson, 1985; Perfetti, 1985; Carr and Levy, in preparation).

The individual differences approach of this study is similar to that of Singer and Crouse (1981). It combines the measurement of component skills which are theorized to be related to reading with a correlational approach in which these skills are evaluated in relation to a criterion variable. In this study there are several criterion variables, which are henceforth termed reading outcomes. A combination of the several correlations of individual variability in performance on component tasks with variability in performance on reading outcomes is called multiple regression. In standard multiple regression, each variable's association with the outcome is evaluated in relation to all of the other component variables entered into the equation. In hierarchical multiple regression, the researcher, on theoretical grounds, specifies the order in which the variables are to be entered into the equation. Both types of multiple regression have the advantage of taking into account the continuous range of individual variation in the data (Singer and Crouse, 1981, p. 126). Also, spurious correlations can be avoided by carefully choosing components so that they represent potential confounding variables--sources of variability which might logically precede the variable of interest and correlate both with that variable and the reading outcomes.

Brown and Haynes (1985) found that sensitivity to orthographic regularity (the efficiency of readers in matching pseudowords minus their efficiency in matching letter strings) increased for more proficient L2 learners of English. Furthermore, for L1 speakers, differential performance on tasks with pseudowords as stimuli reliably (across many studies) distinguishes between good and poor readers. Therefore with Chinese WS2 readers of English one might also predict orthographic regularity to be related to reading outcomes. Conversely, one might predict that lexical familiarity (the difference between efficiency with pseudoword matching and efficiency with real word matching) might be a stronger component of reading success if the learning of orthographic pattern is less important for these learners' L2 reading than is recognition of familiar words.

Thus interesting questions include whether visual matching is aided by knowledge of orthographic regularity or by knowledge of specific lexical items and whether the orthography or lexicality effect correlates more strongly with reading outcomes.

D.READING OUTCOMES

An essential part of this study evaluated components in relation to several measures of reading success. In theory, it would be possible for learners to differ in efficiency of lower level visual processing without those differences significantly affecting reading speed or comprehension.

The first of three types of reading outcomes in this study was reading comprehension. It is possible that individual differences in Chinese readers' L2 orthographic knowledge would correlate with comprehension, but not speed. This would occur if readers did not adjust speed in order to gain greater accuracy. For those less sensitive to orthographic regularity, maintenance of speed might involve a less analytical encoding of words, perhaps similar to the fast visual coding observed in Japanese readers by Koda (1987a; 1987b) and Brown and Haynes (1985).

In contrast, one might predict that Chinese readers' L2 orthographic knowledge would be more closely associated with reading speed if individuals with weaker writing system knowledge slow down to deal with perceptual recognition difficulties, choosing accuracy over rapid encoding. Given the fact that Palmer, et.al. (1985) found visual encoding at the word level to be more highly associated with reading speed than with comprehension, even for fluent adult L1 readers, it would not be surprising to find encoding efficiency differences at the letter or word level to be specifically associated with speed within a group of Chinese readers who are less practiced in English reading.

A third possibility is that variation in orthographic knowledge would show up as differential performance in both speed and comprehension. This prediction follows logically from the capacity limitation assumption of interactive views of reading (Lesgold & Perfetti, 1981; Singer, 1982; Perfetti, 1985; Brown and Haynes, 1985), that one consequence of slow or inefficient word level encoding is its drain on attentional resources, leaving less cognitive resources for interpreting text at higher levels. Thus Chinese readers with inefficient visual intake would experience delays in word recognition; this in turn would interfere with rapid integration of propositional meaning, slowing comprehension and placing a further load on working memory. As processing resources were exhausted, interpretation of the text would falter and remain relatively inaccurate. The final result would be slow and inaccurate comprehension, exacerbated by the fact that fewer cognitive resources would be available for capacity-demanding inferential processing (Perfetti, 1985).

Finally, and perhaps most interestingly, the impact of poorer orthographic knowledge on speed and comprehension should become particularly obvious when Chinese readers are required to connect various textual clues in figuring out the meaning of new words. This is because all of the factors discussed with respect to comprehension and speed are important in comprehending the parts of the text composed of already-known words, and an additional burden arises from trying to figure out the meaning of the unknown word and associating that meaning to the new orthographic and phonological word forms in an accurate manner. The complexity of this inferencing process even for L1 readers (Werner and Kaplan, 1952; Sternberg, 1987) is likely to place heavy capacity demands on readers' attentional resources. An additional difficulty involves the recognition of words providing contextual clues; if an L2 reader is handicapped by slower and less accurate recognition of clue words which are relatively familiar, it will be more difficult to integrate these contextual clues into a meaningful representation of the unknown word-concept, even if that meaning is presented rather explicitly in the text (Haynes, 1987). Furthermore, learning a new word requires not only inferring its meaning from the context but also retaining an association between the word-form (graphemic and/or phonemic) and its meaning (Pressley, Levin, & McDaniel, 1987). Accurate perception, retention, and recall of this word-form is probably much more difficult for readers who have weaker knowledge of the English writing system. Therefore it seems plausible that the combination of reduced attentional resources, necessity of integrating multiple clues, and less accurate visual perception of word-form might cause those with weak writing system knowledge to perform particularly poorly in learning new word meanings from reading.

A further reason for including word-learning from context as a measure of reading sucess is that it is important in characterizing readers' potential for developing new linguistic and conceptual knowledge through reading. Writers on L2 reading pedagogy contend that learning vocabulary from reading must be the primary means of vocabulary development beyond the beginning level (Twadell, 1973; Clarke and Nation, 1980; Liu Na and Nation, 1984; Mahon, 1986). Since broader vocabulary knowledge is strongly associated with better reading comprehension in both L1 and L2 (Anderson & Freebody, 1981; Saville-Troike, 1984; Cooper, 1984; Nation and Coady, 1988), it is likely that L2 learners who are better able to pick up new vocabulary from reading will make faster long-term progress in L2 reading. Thus, this study added a third reading success measure to comprehension and speed outcome measures.

Here the question arose of how to set up reading task from which readers are to learn new words. Readers may gain understanding of new words and concepts incidentally when their attention is focused on the overall meaning of a passage. Such understanding seems closer to natural comprehension processes. In contrast, by focusing a reader's attention on the task of learning new words and concepts, a teacher or experimenter may increase the reader's potential word learning from context. This redirection of the reader's attention may enhance the reader's strategic power and facilitate learning from text. This approach to measuring vocabulary learning from reading is particularly attractive in light of growing interest in the role of attention in language learning (Schmidt, in press). Furthermore, in educational testing there has been recent interest in "dynamic assessment" (Feuerstein, 1979; Lipson and Wixson, 1986), in designing tests which measure the "zone of proximal development" (Vygotsky, 1978), in attempting to estimate an individual's ability to profit from some instruction while performing a task. The realization is growing that in many cases it may be more useful to know an individual's teachability than to know a static level of proficiency.

Fortunately, these approaches to testing vocabulary learning from context are not mutually exclusive. One may first set up the reading task so that the reader will strive for general comprehension. After this, one can measure "incidental word learning". Then one may ask the reader to make a second pass through the text, this time focusing on problematic words and trying to derive their meaning from the context. Finally, one can test the reader's "attended word learning."

This approach has supplemented the initial two reading outcome measures of speed and comprehension with three others. "Incidental" and "attended" word learning constitute more analytical measures of comprehension. Finally, the time taken for the subject to complete the first reading of the words-in-context passage provides a second reading speed outcome.

In sum, this study weighs the influence of lower-level processes on outcome measures of "incidental word comprehension" and "attended word learning", as well as reading speed and general comprehension, before conclusions are drawn about the role of writing system transfer in L2 reading.

E. OTHER COMPONENTS

Reading is a complex process depending on much more than visual recognition of orthographic forms. There is therefore a real danger that simple correlations between orthographic knowledge and each of the five outcomes will overestimate the role of orthographic knowledge in reading. To get a more precise estimate of the significance of orthographic mastery, other components of reading must be included in the estimate of component-outcome association. Multiple regression makes this possible. Therefore, the participants in this study were given a number of other tests: 1) speed of access to lexical meaning in English; 2) range of vocabulary knowledge; 3) English listening proficiency; 4) English grammar proficiency; and 5) L1 reading comprehension.

The first two tests were designed to measure two aspects of vocabulary knowledge that might be of importance in L2 reading. The first test was a speeded one presented in the same format as the same-different visual matching tests. The only difference was that readers were to make "same" and "different" judgments according to the words' meaning, not their visual form. The second, third, and fourth tests were more standard multiple choice tests similar to those used by intensive English centers in the United States to estimate students' language proficiency. All three presented learners with linguistic contexts, sentence contexts for the grammar and vocabulary tests and a combination of sentence and conversational contexts for the listening test. As more complex types of language processing that the other tasks based on word stimuli, these may be expected to correlate significantly with another complex linguistic task, reading. In fact, there is a good deal of evidence that, for L1 readers, at least, listening and vocabulary tests tap two major correlates of reading skill (Anderson & Freebody, 1981; Sticht & James, 1984). Along with grammatical knowledge, they constitute important likely components of L2 language proficiency.

The last test, a multiple choice test translated into Chinese, represents the component of L1 literacy: proficiency in gaining information from written texts in one's first language and written code. For L2 reading theorists who assert that reading performance is largely dependent on an individual's own definition of reading (Devine, 1984) or willingness to make inferences during reading (Hosenfeld, 1984), L1 reading performance would be expected to associate strongly with L2 reading outcomes.

F. HYPOTHESES

This study tests several hypotheses about Chinese WS2 readers' efficiency in visual processing of English orthographic units:

1. That efficiency at visual matching improves as Chinese college students gain experience in reading English (tested through a comparison of entering freshmen with seniors who have had more experience learning from English texts).

2. That Chinese WS2 learners' efficiency at visual matching differs significantly from the performance of skilled American readers.

3. That Chinese WS2 learners' sensitivity to English orthographic regularity is significantly less than that of skilled American readers.

4. That individual differences in efficiency of visual matching correlate significantly with success in reading for comprehension in English. Reading speed, comprehension, and ability to learn new vocabulary from reading English should show a statistical association with measures of visual processing efficiency.

5. That the statistical association established in (4) above still holds even when L1 reading proficiency is accounted for (entered into the multiple regression equation):

6. That the statistical association established in (5) above still remains significant, even when other important influences on L2 reading are also accounted for: speed of lexical access in English, range of vocabulary recognition, listening, and English grammatical knowledge.

Since individual Chinese readers' efficiency with English orthography may also vary as a result of general efficiency differences in processing visual stimuli, a covariate will be included in testing the hypotheses above: efficiency in matching non-letter stimuli with which the Chinese have some familiarity, Arabic numberals. This may reduce the power of the study in that it will reduce the variability remaining among the Chinese students. However, since the variability of interest is that related to acquisition of the English writing system, specifically, rather than variability in speeded task performance in general, it seems best to take the conservative step of first removing this variability which is unrelated to the key hypotheses concerning acquisition of a second writing system.

CHAPTER IV: VISUAL PROCESSING EFFICIENCY: METHODS, RESULTS, AND DISCUSSION

A. METHODS

1. Overview

Freshmen and senior Chinese college students in Taiwan and American college students in the U.S. were individually administered a series of same-different matching tests with stimuli consisting of numbers, words, pseudowords, and nonsense strings of letters. The number matching performance was used as a covariate to control for individual differences in matching performance that were unrelated to writing system knowledge. Analysis of covariance was applied to determine whether there were significant differences in the performance of the three groups. The null hypothesis was that there would be no group differences or group-stimuli interactions. If supported, this would indicate that these intermediate Chinese readers had mastered visual processing of the English writing system to a level comparable with that of L1 readers.

2. Subjects

Two of the three groups studied consisted of skilled readers of Chinese. They were among the top 10% of high school graduates who had taken a competitive college entrance exam which in Taiwan (The Republic of China) determines which school and department, if any, the students will attend. These students had qualified for admission into one of five demanding departments at one of the best private universities in Taiwan: English, Computer Science, Chemistry, Electrical Engineering, and Industrial Engineering.

The two Chinese groups were seniors and freshmen college students. Both groups had begun their English instruction with six years of secondary school English. This did not mean they had achieved a high level of English proficiency, however. According to Yu (1983), the standard teaching method in Taiwan is grammar-translation, geared primarily toward preparing students for the English parts of the college entrance exam: written composition, Chinese-to-English translation, reading comprehension, and grammar. Since listening and speaking were not tested on the entrance exam, most students before entering college had had little exposure to these aspects of English (Yu, 1983). Once admitted, all university students were required to take a year of freshman English, which at this university was taught in English by either native speakers or non-native speakers who had earned graduate degrees in English-speaking countries and were fluent in spoken English.

It was expected that the freshman group would have lower English proficiency than the seniors. At the time this study began, the freshman students had had at most only three weeks of this daily English class. The seniors had not only completed a year of this class, but had also been assigned English textbooks in a majority of the classes in their major subject. Thus the seniors had had broader experience in using the English language both for listening-speaking and for learning new information from reading.

Because they had been using English textbooks for their coursework during the past three years, it was predicted that their writing system knowledge--in addition to their linguistic and reading proficiency--would be significantly better than that of the freshman group.

However, interviews with faculty and students conducted at the time of the study indicated that use of English textbooks by students was selective. Some students reported that only a small percentage of their classmates actually read the difficult textbooks, while the remainder relied on lecture notes. Many admitted that they only read their textbooks after hearing the lecture on a given topic. Students also indicated that it was usually possible to survive on exams without having read the text. Inspection of a freshman textbook in physics showed almost no annotations in Chinese, though there was a great deal of translation into Chinese written above some of the exercises that had been assigned from the textbook. Furthermore, this textbook was quite difficult, not only conceptually, but also linguistically, since it had been intended for college students who were native speakers of English. Some faculty members in the departments from which students volunteered for this study lamented the fact that students would not read at all, or at best only after they had heard a lecture on a given topic. Apparently there was considerable discrepancy between the expectations of the faculty who selected the textbooks and the students' ability to handle college-level reading in English. In this situation it was difficult for an amateur ethnographer to distinguish fact from wishful thinking, but one can at least infer that the distinction in reading experience between freshmen and seniors may not have been as great as had been expected when the original design for the study was developed.

Although the Chinese students were not yet studying in an English language environment, where they would have daily access to spoken English outside of the classroom, many of them did plan to come to English-speaking countries for graduate study. Thus the seniors in particular could be considered similar to international students with whom a great deal of L2 reading research has been conducted at intensive language centers in the United States.

The third group of participants consisted of American undergraduates. These were presumed to be relatively skilled readers, fluent with the English language and writing system. As a group, they represent the end point against which Chinese readers' orthographic and linguistic knowledge can be evaluated.

All participants in this study were volunteers. The American subjects were recruited for the first group-administered set of tests through a standard sign-up procedure used for psychological research at a large public university in the United States. They were compensated for the first two sessions by credits which would contribute to their final grade in a psychology course. For the last, longer session, they were each paid seven dollars. The Chinese WS2 readers of English were recruited by the researcher, who visited one of their classes. After hearing the researcher's explanation (in Chinese) of the study, its goals, and the time required from participants, students were asked to sign up for the first group-administered set of tests. Both American and Chinese subjects were scheduled for subsequent individual testing after they had completed their first group tests. To avoid loss of subjects part-way through the experiment, all individuals were contacted before the second and third sessions to remind them of their appointment. In Taiwan, the reminder was left in writing in students' campus mailboxes; in the U.S., contact was made by telephone.

A number of the Taiwan volunteers turned out to be overseas Chinese from other countries such as Hong Kong, Malaysia, and Indonesia. Since their experience with Chinese reading as well as with English reading and language use was highly variable and difficult to ascertain in some cases, it was decided to drop these subjects from the analysis. In addition, one Taiwan senior was discarded from the study for three reasons. (He vocalized during the same-different visual matching task, he speeded through the guessing-from-context passage, and he then showed great discomfort when asked to write a recall protocol, claiming to be ill and needing a long break which he was given before continuing the rest of the third session.) There remained 32 senior and 28 freshmen Taiwan students who attended both of the first two testing sessions, 15 in the American sample. (A slightly smaller number attended the longer third session, 29, 25, and 9, respectively).

3. Visual same-difference matching materials

Each same-different matching test followed the same format (Appendix B): three pages each containing 16 items of paired stimuli, one directly below the other, with an *s* (for same) and *d* (for different) to the right of each stimuli pair. The student's task was to circle the *s* or *d* for each item, completing all 48 as quickly as possible. Half of the items were same, half different, mixed randomly together.

a. Number matching

Developed by the researcher, this test consisted of pairs of three-digit numbers which either matched or differed by one digit. The position of difference was varied so that there were eight pairs different at each of the three positions. Each digit appeared approximately the same number of times in each position.

This test was used as a measure of general efficiency at the same-different matching task. As explained in Chapter II, individuals vary in their speeded task performance, regardless of the stimuli. Since the focus was not on variance in performance of speeded tasks but on variance with alphabetic stimuli, the number matching performance was measured so that it could be entered as a covariate, controlling for irrelevant differences between groups in ability to perform speeded tasks with visual stimuli. The format and response requirements were kept identical to those of the alphabetic matching task (below) in order to remove as much variance as possible which was associated with the task itself rather than with the alphabetic stimuli.

b.Word matching

The stimuli for the three visual matching tasks with letter stimuli were those developed by Brown, Carr, and Chaderjian (1987). The word stimuli were

> ...selected from the Kucera and Francis (1967) word tables. All pairs consisted of four-letter words and differed at only one letter position, with one fourth of the pairs differing at each of the four serial positions (e.g., line-fine, list-last, step-stop, real-read). [The] Twenty-four pairs consisted of relatively high-frequency words with a mean frequency of 670.0 occurrences/million (range 62-3618)... (p.132)

Because these were high frequency words, it was expected that the Chinese participants in the study would have encountered them a sufficient number of times to be familiar with their meanings and visual forms (see Appendix B for the format and list of word pairs). Thus speeded matching performance with this set of stimuli, when compared with performance on number matching or pseudoword matching, should indicate the degree of benefit gained from <u>lexicality</u>, or meaningfulness of letter sequences.

<u>c. Pseudoword matching</u>

These stimuli were derived from the word stimuli described above

> by a letter substitution strategy in which a noncritical letter [i.e. not at the location of difference between two words of a matching pair] at one or more positions of the word pair was replaced by another letter so as to produce meaningless and unfamiliar but orthographically regular and pronounceable pseudowords [for example, <u>lize</u>-<u>fize</u>]... The critical pairs of letters that distinguished the words in each pair were preserved, and substituted letters were chosen to keep single letter and bigram frequencies of occurerrence approximately the same for words and pseudowords...(Brown, <u>et.al.</u>, 1987, p. 130).

<u>d. Letter string matching</u>

The letter strings also retained the same critical location for the difference between two non-matching words. They were

> ...generated from the word pairs by a letter permutation and substitution strategy in which the letters held in common by the two words of each pair were permuted while preserving the position of the critical letters distinguishing the words until a meaningless, unfamiliar, orthographically irregular, and unpronounceable string was produced. If this procedure failed, then letter substitutions were made at noncritical positions until random nonsense strings were achieved [for example, <u>lnei</u>-<u>fnei</u>]. (Brown, <u>et.al.</u>, 1987, p. 130.)

4. Visual same-different matching procedures

Same-different matching was completed in the second meeting, which was the first one-on-one session for the participants. First, to put the individual at ease with the researcher, the questionnaire (Appendix A) filled out in the first testing session (described in detail in chapter 4) was discussed. A few questions were asked to clarify information on the questionnaire and the participant was encouraged to talk freely about points of interest in his or her English background. After a maximum of fifteen minutes, the visual matching task was explained, practiced, and completed.

All students were given the tests in the same sequence: instructions, timed number practice, number matching test, instructions, timed orthographic practice, then word, pseudoword, and letter string tests. It was necessary to follow a standard sequence so that scores could be validly compared to one another in the multiple regression analysis to be described in Chapter 5. The instructions emphasized both speed and accuracy. Students were instructed to avoid error, but also given a quick method to redress any error if they became immediately aware of it. They were told to X out the mistaken circle and circle the correct letter. Cumulative times for each 48-item test were recorded by stopwatch and noted at the end of each test before preceding to the next one. Practice and tests required 25 minutes at most.

B. ANALYSIS OF DATA

Each test was checked for accuracy by the researcher. The student's same-different matching efficiency score of correct responses per minute was derived from the number of correct responses (c.r.) out of 48 and the time in seconds, using the formula:

(#c.r./# sec.)x(60 sec./minute)

This yields an "items per minute" efficiency score which one can easily compare to "words per minute" reading speed scores on the speed outcome measure to be discussed later.

The mean efficiency scores for each type of stimuli for the three groups are listed in Table 1, along with the means for the orthographic stimuli, once corrected using number matching performance as a covariate. Analysis of covariance for repeated measures (BMDP2v, 1981) was applied to the data to determine whether there were significant differences between groups or interactions between the groups and stimuli.

C. RESULTS AND DISCUSSION

As shown by Table 1, the raw means suggest that the L1 readers were more efficient at orthographic matching than either freshmen or senior WS2 readers, while the seniors were more efficient than the freshmen. The differences were particularly evident with scores from the pseudoword matching.

Nevertheless, inclusion of the covariate of number matching, which indexed general efficiency on speeded tasks, reduced differences between the senior and freshman groups considerably, so that the means corrected for number matching performance were much closer. Evidently the senior group was generally faster on all tasks, while the freshmen were slower as a group.

Table 1: Visual same-different matching efficiency

	Taiwan Freshmen (N=28)	Taiwan Seniors (N=32)	USA (N=15)
Uncorrected means (pairs/minute)			
Words			
Mean	54.38	59.66	60.11
Standard deviation	7.40	7.04	7.53
Pseudowords			
Mean	51.71	56.06	59.99
Standard deviation	6.72	6.46	6.80
Letter strings			
Mean	45.62	48.62	49.82
Standard deviation	6.80	7.04	7.11
Means for covariate (Number matching)			
Mean	58.02	65.13	63.13
Standard deviation	8.70	7.48	8.52
Adjusted means (adjusted for number matching performance)			
Words			
Mean	56.73	57.88	59.50
Pseudowords			
Mean	54.07	54.28	59.38
Letter strings			
Mean	47.98	46.85	49.21

In the analysis of covariance,group differences showed only a trend in the predicted direction without reaching significance ($F=2.91$; $df=2,71$; $p=.0608$). The expected difference between the matching stimuli was confirmed by the analysis ($F=180.59$, $df=2,144$, $p= .0000$): words were easiest and letter strings most difficult for all three groups. The table shows that, for the Americans, words and pseudowords led to nearly equivalent performance, while for readers of Chinese there was a greater drop in performance on pseudowords. This was also confirmed by the analysis, with a significant group-stimulus interaction ($F=2.92$, $df=4,144$, $p=.0233$.

D. DISCUSSION

> Hypothesis 1: That efficiency at visual matching improves as Chinese college students gain experience in reading English (tested through a comparison of entering freshmen with seniors who have had more experience learning from English texts).

> Hypothesis 2: That Chinese WS2 learners' efficiency at visual matching differs significantly from the performance of skilled American readers.

The two research hypotheses are not upheld by the statistical analyses. The overall difference between groups was not significant, suggesting that general performance on speeded tasks is taken into account (number matching covariate) leaving only the differences in efficiency with English orthographic stimuli, the three groups may be more comparable than different. This conclusion must be treated with care, however, since the statistical test showed that the group differences came very close to being significant, at $p=.06$. Thus efficiency differences between groups with varying amounts of experience in reading English can best be characterized as an area in which further study is needed.

> Hypothesis 3: That Chinese WS2 learners' sensitivity to English orthographic regularity is significantly less than that of skilled American readers.

This research hypothesis is supported by the significant group-stimulus interaction. Since the WS2 readers did not benefit as much as the L1 readers from orthographic regularity of the pseudowords, in comparison to the letter strings, it appears that their mastery of the English writing system is as yet incomplete. Though they have had considerable experience with English stimuli and can in no way be considered novices with English orthography (6 years of high school instruction as well as a college entrance exam which included English reading), they still differ from fluent American readers in their sensitivity to orthographic regularity. In the visual matching task, they do not seem to benefit as much from systematic sequencing of letters as did their American counterparts.

This conclusion is only tentative, however, because there are two ways to interpret the observed interaction between groups and symbol sequences. The first is the conclusion stated above, that it was the orthography effect, the difference between letter strings and orthographically regular pseudowords, which distinguished the two groups. On the other hand, one could equally well subtract each pseudoword efficency score from same subject's word efficiency score to claim that the Chinese readers showed a larger lexicality effect, the difference between pseudoword efficiency and word efficiency, than did the English-speaking readers. It could be argued that the important difference for the Chinese readers, in contrast with pseudoword effects found with L1 readers, was whether words were familiar and meaningful, not whether they had a regular structure.

Thus the data are ambiguous at this point. The following chapter will report on the relationship between the lexicality effect, the orthography effect, and these readers' speed, comprehension, and learning of vocabulary from reading.

CHAPTER V: INDIVIDUAL DIFFERENCES ANALYSIS: METHODS, RESULTS, AND DISCUSSION

A. OVERVIEW OF PROCEDURES

Session I: Student volunteers were first given a group-administered series of tests which lasted approximately two and a half hours. Since the seniors in Taiwan start school a month earlier than the incoming freshmen, they were recruited and tested in groups before the freshmen. The session began with an outline of the project and session. Then consent forms were handed out, explained in English and Chinese, signed, and returned. Sudents then were given time to fill out a background questionnaire (Appendix A). The listening test was administered before other tests as it was considered to be the most demanding and fatiguing of the tests. It required 45 minutes to explain and administer. Students were then given a short break during which they began signing up on a schedule for the second individual session.

After this ten-minute relaxation period, the vocabulary range test was explained and adminstered. Students were allowed a maximum of 30 minutes on this test. Finally, directions were given for the grammar test and the test was administered. Students were allowed a maximum of 25 minutes on this test.As soon as each individual completed this test, he or she was given the Chinese reading test. Directions were read silently by the individual for the Chinese test. Everyone was allowed 30 minutes on the Chinese reading test. The only student who required the full time reported that he was using it as a way of preparing for the GRE English reading test he was going to take in a few weeks, since he considered its method of question asking similar to sample items he had seen for that test. (The American group was tested in the same sequence, except that the listening test was omitted due to time constraints and because, when previously given to a group of native speakers, all scored at the top of the scale: 97-100%.)

Session II: The second, one-on-one session began with with an informal discussion about the student's responses on the background questionnaire. This put the student more at ease before testing began and also helped the researcher clarify ambiguities concerning the student's educational and English background.

After ten to fifteen minutes, the visual matching task was administered, as explained in Chapter IV. After the letter string match was completed, instructions and practice were given on the meaning matching test. Practice and tests of matching required about 25 minutes at most.

The last part of the session was spent on the timed reading comprehension test from Henderson (1983). After instructions, students were timed as they read a practice paragraph; after the reading was removed they were given five questions about it. Each of the four test paragraphs were then presented in the same manner. At the end of the session, students were informed of their reading speed and comprehension scores for each of the four passages as well as given feedback about their scores from the first testing session. (Promising these scores at the first session was one way to persuade students to continue their participation in this time-consuming series of tests.) Scores were given in percentage correct and students were informed of the ranking of these scores within the group tested with them (seniors or freshmen).

Session III: The third session, also one-on-one, began with instructions identical to those on the paragraph reading test which students had completed at the end of the previous session. Thus it was hoped students would approach both the timed reading for comprehension tasks in the same manner, striving for about the same level of comprehension. Individuals were timed as they read a 3-page booklet (500-word passage) from a text on medical treatment of injury. The experimenter recorded notes on observable strategies such as rereading parts or all of the text, referring to illustrations, or scanning to a different text location. Students were then given a maximum of 20 minutes to write a free recall. Afterwards they were asked to reread, underlining any words which had confused them on the first reading. Then they were given instructions on filling out categories and definitions for selected words from the passage which were listed on a response form. This first part of the session usually took about an hour for Chinese readers, less than half an hour for Americans.

After a short break, the rereading interview began. Students were informed that they would have a chance to revise their categories and definitions at the end of the interview and thus should try to learn as much as possible about the target words from their rereading. They were then directed to reread each paragraph silently and then point out any words still problematic for them. They were asked a series of questions about each word, questions designed to focus subjects' attention on context and give them the opportunity to reevaluate their original definitions with the passage available. The interview concluded with a few general questions about the passage. For Chinese readers this interview took a good deal of time, often more than an hour. For the Americans about twenty minutes were sufficient. The time difference resulted from the greater number of words which the Chinese found confusing and thus ended up discussing, and from the need to clarify both experimenter questions and subject responses using paraphrase in Chinese. Also, the Chinese subjects took a great deal more time to plan their responses before speaking in English.

After the taped rereading interview, subjects filled out the second category and definition form, thus completing the third session in two to three hours for the Chinese, in an hour or less for the Americans.

(See Appendix C for an outline of all three sessions with the participants.)

B. MEASUREMENT OF LINGUISTIC COMPONENTS OF READING

The skills measured may be divided into two groups, visual efficiency skills and language proficiency skills. Visual efficiency materials and procedures have been described in Chapter IV.

Materials and procedures for all tests were pretested by the experimenter before administration in Taiwan. The listening test was given to a group of 50 non-native speakers at an intensive language center. Other tests were given to several individuals from Taiwan (n = 3-10, depending on the test) including both graduate students and students from two-year schools, new arrivals and those who had lived in the U.S. for a number of years. This provided a broad range of L1 reading ability as well as a range of L2 proficiency. Scores on all tests ranked as predicted based on information about individual subjects' background, with a broad range of scores, indicating that the tests were appropriate for use with students in Taiwan.

Language proficiency skills included a speed of lexical access measure designed by the researcher. This was included for two reasons. First, controlling for meaning access time in the regression equation allows a more precise estimation of theoretically separate visual processing of orthography. Second, Haynes (1984, p. 166) hypothesized that lexical access time was an important component of reading speed, causing the longer fixation times observed with L2 readers of English (Tullius, 1971; Oller, 1972). Since the stimulus format and response requirements were identical to those for the visual same-different matching, except that the match was to be based on meaning rather than visual similarity, this measure could be included in the battery economically.

The other language proficiency tests were chosen to represent the types of linguistic knowledge that have been considered important in L1 reading: syntactic knowledge, vocabulary range, and listening proficiency. How L2 proficiency in these separate areas relates to L1 and L2 reading proficiency is a question little examined by L2 reading research (Alderson, 1984). Also, since similar tests are frequently used for evaluating international student English proficiency at intensive language centers in the U.S., their relationship to L1 and L2 reading is of practical as well as theoretical interest.

The last of the language proficiency components was an L1 reading comprehension test, given in English to the American students and in Chinese to the students in Taiwan. It was essential to include this measure in order to compare the contribution of visual processing of orthography with that of first language reading comprehension skill.

Each section below explains the materials for each task. Except for the lexical access synonym/antonym matching task described just below, a task which was practiced and performed immediately following the same-different visual matching, these language skills were measured in the first group testing session described above.

1. Synonym/antonym matching

The synonym/antonym matching task required s or d responses on paired words, much like the visual matching task. In this case, however, the basis for responding was not the form but the meaning of the words. If two words had similar meanings, the subject was to circle s, d if they had opposite meanings. After two sets of warm-up items on which the subject practiced speeded response and was given accuracy feedback, each subject was timed on a 48-item set of word pairs, all high-frequency items (taken from West's (1953) General Service List of English Words) and the defining word list from Longman's Dictionary of Contemporary English. This provided an estimate of the reader's efficiency of access to lexical meaning in English. On this test, unlike the visual matching one, feedback was given after completion of each of the two practice sets to encourage the student to go as quickly as possible while still maintaining a high accuracy rate. If a word on the practice tests was unfamiliar, the student was told to make a guess and go on, not to pause for a long time. (See

Appendix D for instruction sheet, practice items and test items.)

Cumulative times for the 48-item test were recorded by stopwatch as in the visual same-different testing. In addition, after times were taken on the meaning matching test, students were asked to look over the items again and point out any which were unfamiliar. This was done in order to check on the validity of the test by using self report about the familiarity of the words. Scanning to find a word which an individual had noted as unknown was often a little difficult for students to do quickly. At most only one or two words (frequently the word "beneath" on p. 3) was considered unknown. Students also reported particular difficult with the lend/borrow pair (perhaps because the same word-form is used for both in Chinese. Student response to the invitation to identify unknown words indicated that almost all of the words were indeed familiar to them and they were accessing meaning as they performed this task. The accuracy scores confirmed this observation ($x = 45.6$ for the meaning match, in comparison with $x = 46.2$ for letter string match).

<u>2. Grammar and vocabulary</u>

The grammar and vocabulary test items (see Appendix E for instruction sheets, response sheets, and test items) consisted of a sentence with one part left blank; four response options were listed below. On the vocabulary test, all options were the same part of speech and of approximately the same length and word frequency. On each test, 30 items were contributed by English Language Testing Associates.[7] These items were all of medium to high difficulty with high discrimination, based on pretesting with a heterogeneous group of L2 students of English. Since not enough items of this type were available for the grammar test, the other ten items were written by the experimenter in consultation with an expert in test design for second language learners. The extra items were chosen on the basis of the researcher's knowledge of frequent written errors of Chinese students.

There were two special attributes of the vocabulary test. First, an additional 14 items were mixed in with the 40 other items. Each of these tested one of the target words from the passage on which word learning would be measured.[8] These were mixed in with the other 40 items so that students would be less likely to learn or remember much about them from this pretest and thus bias the later word-learning interview. The sentence contexts for these 14 words was consistent with the usage of the words in the word-learning passage to be read, but were carefully worded so that a reader who did not know the word would not be able

[7]ELTA (English Language Testing Associates) is a second language testing company that produces a variety of custom-matde English as a Second Language tests, including reading tests for students of several proficiency levels and grammar and vocabulary tests generated from an item bank of pretested items.

[8]The fifteenth target word, "Langer's lines", was assumed to be novel to all testees, so this word was omitted from the vocabulary pretest.

to guess components of its meaning from the context given. Distractors were chosen from the scientific terminology at the end of West's list and from the University Word List developed by Xue and Nation (1984). These last are "sub-technical" words of somewhat lower frequency but which appear across a wide range of academic fields, words such as "tangible," "rudimentary," or "fallacies." In addition, every effort was made to keep distractors of similar length and even sometimes with identical first letters. The main goal was to prevent readers from guessing the meaning of the word by eliminating familiar distractors.

A second special attribute of this vocabulary test was its attempt to estimate guessing and eliminate the target-word items on which the correct answer had been chosen by luck. (See J. Read, 1988, for a discussion of alternate methods for estimating vocabulary knowledge.) Students were instructed to rate their confidence (on a 1-5 scale) after choosing each of the 54 multiple choice answers. These ratings were ignored in scoring the 40 items which constituted the vocabulary range measure. However, responses to the 14 pretest items could be evaluated according to whether right answers were the result of conscious guessing or previous word knowledge, according to self-ratings of students. Conscious guessing was defined as a confidence rating below the average confidence computed from the 54 items on the test as a whole. If the confidence rating was below that average, it was assumed that the student did not know the word, even if the answer was correct. This test-within-a-test provided an estimate of students' prior knowledge of the target words in the third session's word-learning passage--in effect a vocabulary pre-test.

3. Listening proficiency

The listening proficiency measure was a practice test developed by Michigan State University's English Language Center. In contrast with many listening tests used in reading research, this did not consist of longer passages followed by a series of questions. Instead, each item had either a single utterance or a short interchange of four utterances or less. Furthermore, of the 94 items, only the first 38 required students to read anything before responding. The other 58 items were forced-choice (either true/false or good/bad). This test was considered a cleaner measure of listening proficiency in the second language, since it was less confounded by a concurrent reading task than most listening tests and since the type of listening tested was interpretation of everyday utterances rather than remembering more extended academic passages.

4. L1 reading comprehension

An L1 reading comprehension test was included in the battery of group tests (see Appendix F for English and Chinese versions). The researcher slightly modified reading comprehension tests provided by English Language Testing Associates which contained passages with multiple choice questions on literal detail, paraphrase, integration of information from different text locations, and inference.

First, the passages and questions were translated into Chinese by a Taiwanese student who had majored in English, graduating as the top student in English from what is considered the best public university in Taiwan. This student had resided in the United States for over a year at the time of translation. The translated multiple choice items were pretested by having a native speaker of Chinese from Taiwan answer them without having seen the reading passage. Items which were easily guessed were modified so that they would be more difficult. Then the text and questions were given to another Taiwanese student who was subsequently interviewed about the passages and items afterwards. He reported being disturbed by the quasi-English syntax of the Chinese translated from English. Therefore the test was given to two Chinese language teachers who made a few changes. Pilot testing with a small group of Chinese literates known to represent a wide range of academic experience indicated that the test was sensitive to reading proficiency differences among Chinese readers. The Chinese test was typed on a Chinese typewriter when the experimenter arrived in Taiwan. The L1 reading tests were administered in English to the American subjects and in Chinese to the Taiwan sample. This provided an estimate of L1 reading comprehension for both language groups.

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C. MEASUREMENT OF READING OUTCOMES

1. Henderson reading measures

The first set of reading measures required subjects to read four paragraphs (about 180 words per paragraph) each followed by five questions. Participants read these passages after they had completed the visual and meaning matching tests in the second test session.

The passages and questions (see Appendix G), along with the practice passage, were taken from Henderson (1983), with one passage omitted due to time constraints, thus providing an opportunity to compare these subjects with Henderson's Spanish and Arabic readers. Reading time was taken for each paragraph (words per minute rates were averaged to constitute the Reading Speed outcome). The passage removed before questions were answered. Therefore, rather than ability to scan back over a text to locate answers, this Reading Comprehension outcome reflected ability to retain information comprehended from reading.

2. Word-learning measures

The second set of reading outcome measures was designed to estimate both reading speed on a longer, more typical academic text and the amount of information L2 readers can learn about new vocabulary from reading.

In the third session, subjects were given instructions identical to those for the general reading comprehension measure, that is, to <u>read the passage</u> as quickly as possible while comprehending, since there would be a follow-up test (see Appendix H for the instructions given during the word-learning session). Participants were then given the booklet with a 500-word passage on treatment of injury. Just before handing it to each reader, the researcher leafed through to the last page and pointed out the Stop instruction where the reader should stop reading. Subjects were timed as they read the passage. This time yielded the "Speed--word learning" outcome measure.

Upon completion, participants were asked to write a written recall. This was done so that they would have a chance to consolidate whatever ideas they had gained from reading. Then they were asked to reread the passage, underlining any words which had confused them during the first reading; this allowed the experimenter to determine which words were difficult from the subject's point of view, so that these could be asked about in the rereading interview.

The selection of the text (Shiller, 1977) on treatment of skin wounds was based first on its topic, one with which all young adults would have some familiarity. Secondly, it contained numerous "lexical familiarizations" (Bramki & Williams, 1984)--definitions, examples, stipulations, synonyms, paraphrases, illustrations, etc., which the author had provided to clarify the meaning of new terms introduced in the text. The 15 target words on which subjects were tested for "word learning" were explained to varying degrees within the text. For example, "suturing" was introduced as one of "The two most common methods of keeping wound edges together..." and followed by a parenthetical synonym "(stitching)"; in addition, there was a labeled illustration of suturing within the flow-chart on the facing page. A list of the words and the familiarization devices provided for them are listed in Appendix H, along with a copy of the reading passage.

There were several reasons for choosing a text with an abundance of fairly explicit contextual clues. First, personal experience in teaching ESL had shown the researcher that students often miss or misinterpret even explicit explanations of new words in a text. Not only was this measure expected to produce a wide range of scores, but it also indexed an important skill for L2 readers. Despite Nagy, Herman, and Anderson's (1985) critique of research requiring explicit "guesses" rather than allowing readers to make implicit ones in tasks with more "ecological validity" (i.e., tasks more similar to what people do in the "real", non-experimental, world), L2 readers may need to be more explicit in order to learn more efficiently (Schmidt, in press). They do not have the 12 years of schooling available to L1 children to develop their word knowledge gradually. They must compensate in some way for their lack of language experience by actively building their word knowledge. Furthermore, lexically familiarized vocabulary is likely to carry the major proportion of new concepts introduced in scientific and technical texts, crucial for disseminating knowledge throughout the world. From the point of view of information exchange and education, the L2 reader's success at understanding the new concepts introduced in a text may be one of the most important components of comprehension, enabling the reader to acquire, more than new words, new ideas.

A final reason for the choice of lexical familiarizations is that a researcher cannot study everything at once. Articles recommending contextual guessing for the learning of new L2 vocabulary are increasingly frequent (ERIC search on Reading Strategies in Second Languages, 1986). To weigh the usefulness of this strategy, it seems reasonable to start with the most obvious textual clues. These provide the strongest test of the L2 readers potential to succeed at guessing from context. If readers fail to "guess" words for which the author has deliberately provided explanatory clues, it is likely they will fail even more often when clues to meaning are less explicit and more haphazard.

For ecological validity, pages were copied on both sides so that, when the "spine" was stapled together, the booklet preserved the page breaks and layout of the original book. The last page was overlaid with a fuzzy copy of the part of the text (and one illustration) which came after the point at which readers were to stop. This was copied "out of focus" to prevent readers from reading further, but at the same time to approximate a reader's phenomenological experience while reading, sensing the upcoming text without actually beginning to read it.

After their two quick readings of the text, subjects were given instructions to define a list of words from the passage by writing down a category and definition for each one. The instructions included sample answers (ex.: Category = "'Fruit' is a kind of food." Definition = "It is the part of a plant which contains the seed. It is usually sweet. We often eat it raw. An example is an apple"). Subjects were then provided with sheets on which they were to write categories and definitions for each of 15 target words. These written protocols were later rated to provide a measure of "Incidental word learning" from reading.

After the category and definition response sheets had been filled out, the subjects were given a rereading interview during which their responses were tape-recorded. It was explained that their goal should be to try to learn as much as possible about the target words from their rereading, since they would have a chance to improve their definitions at the end of the interview. After they reread each paragraph and pointed out any words they still found confusing, they were asked a series of questions about each word:

> 1)Would you like to add anything to your definition here (on the category and definition response sheet)? or (if no definition written) Please explain to me what you think this word means;

2)How did you decide on that meaning?

3)Is there any [other] information provided in the passage that helps you?

4)How important is this word for understanding the passage...very important, so-so, or not at all? Why?

5)If you were reading this in your room, what would you do about this word when you came to it? Why?

These questions were designed to focus subjects' attention on the context and give them an opportunity to reevaluate their original definitions (which they could consult on the response sheets) in relation to the passage context which was now available. This attempt to foster attended word learning (in contrast with the incidental word learning of the first two readings) was undertaken in order to maximize their comprehension of new word-forms and concepts in the text.

At the end of the rereading interview, subjects were asked to respond to several integrative questions:

1) What is the main idea of this reading?

2)What do you think the writer is planning to discuss next?

3)(an augmented clustering tasks using 15 cards with one target word on each) a.Which of these words can be grouped together? b.(on completing groupings) How are these words [in the group] related? c.Are there any larger groups possible? d. Why, how are these words related?

4)Please tell me what kind of wounds you would treat by suturing? Why? And what kind of wounds would you treat by bandaging? Why? Does your decision to suture or bandage depend on anything else?

clustering task (based on Black et.al., 1984) were intended *both* to probe the subject's knowledge and to foster a coherent understanding of the text and its new word-forms and concepts. This approach was derived from Vygotsky's (1978) theory of the "zone of proximal development" and Feuerstein's (1979) work on dynamic assessment, both emphasizing that it is as important to know what a individual is capable of when given some direction in how to approach a task as it is to know what he or she can do without any support whatsoever (see also Lipson and Wixson, 1986).

After the rereading interview, students were given a new sheet with a list of target words and, being allowed to refer back to their original definitions but not to the text, were asked to define the words again, showing what they had learned from the rereading. Thus this second outcome offered a more dynamic measure of the student's reading comprehension: "Attended word learning".

D. CODING THE DATA

1.Scoring of word learning measures:

Each subject's categories and definitions protocol was evaluated by at least two raters. For all words, one point was awarded for category and one for definition. Whether a category or definition had been understood was often unclear, however, particularly since the L2 readers' responses were often phrased in nonstandard English. After scoring pilot data, raters discussed and agreed to the following criteria for scoring:

1.If the definition was clear, a category point was automatically awarded, even if the category response was unclear or missing.

2.If the definition (or category) was unclear, but it seemed likely the subject had understood the target word (or category), a half-point was awarded for the response.

3.If the definition was echoic (was expressed in the same words that were given as definition in the text) a half-point was awarded. An echoic response did not demonstrate thorough understanding, but even verbatim information, when accuractely recalled, could help learners gain greater understanding of the new word.

In addition to the two points given for responses on each word, a stipulation point was awarded on six of the words whose meanings were restricted in particular ways by the text. These included the following words:

1) Cuts: category = wound
definition = wound to skin
stipulation = "smooth, clean slices

2) Lacerations: cat. = wound
def. = wound to skin
stip. = "jagged, rough tears

3) Langer's lines: cat. = lines
def. = lines in the skin
stip. = on the skin surface
(in pilot testing, even L1 readers showed a tendency to infer from Fig. 2-1 that these were muscle lines under the surface of the skin, an interpretation which clashed with the significance of these lines for skin wound healing in the reading and shows that the new concept had not been well understood.

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4) Approximation: cat. = a method of healing
def. = bringing wound edges together
stip. = in order to allow the skin to heal

5) Suturing: cat. = a method of healing
def. = sewing the wound
stip. = in order to allow the skin to heal

6) Bandaging: cat.: a method of healing
def. = taping the wound
stip. = in order to allow the skin to heal

Thus for each of these six words the highest possible score was three points. The total possible points for each word-learning measure (incidental or attended) was 36 points.

After ratings were completed, all pairs of raters discussed any discrepancies of more than a half point. When the disagreement could not be resolved, a third rater was consulted. Final word-learning scores were within one-and-a-half points for all but two subjects (who differed by two points). Inter-rater reliabilities were calculated for all item ratings of American responses and for 20% of the Taiwan responses. When identical score for each word response was the criterion, reliabilities with American responses were .68, with Chinese, .81; when scores within a half point of each other were counted as acceptable agreement, reliabilities were .91 for both groups.

Although this response-format and scoring procedure was "messier" than a multiple-choice test would have been, it seemed the best approach in order to avoid cueing readers who would subsequently be rereading the text and writing definitions again. Furthermore, it was felt that written responses could provide more information about readers' misinterpretations than could an experimenter-written multiple choice test.

After final ratings of all category-and-definition protocols, each student's score was corrected for prior knowledge. Prior knowledge of a word was defined as a correct score for that word on the multiple choice vocabulary pretest, plus a confidence rating higher than that individual's average rating. For example, if a person happened to mark the right definition for "Approximation," but rated confidence at that item as 2, the item would be scored "known" if that person's average confidence for the whole 54-item vocabulary pretest was at or below 2, while it would be scored "unknown" if that person's average confidence were higher than 2. This method was adopted to correct for guessing on the vocabulary pretest, since for these individual items it was essential that the estimate of prior knowledge be as accurate as possible. Each subject's "known" words were removed from the analysis of word definition protocols. Therefore, each participant's incidental and attended word learning scores were converted to percentages representing the proportion of knowledge gained about previously "unknown" words.

2. Scoring of other measures

Two scores were derived from the same-different matching data described in Chapter 4. The first, termed "lexicality effect," was defined as the amount of benefit the individual derived from a stimuli's familiarity as a meaningful string, as opposed to pseudowords which had no meaning and were unfamiliar. This lexicality effect was calculated for each subject by subtracting the pseudoword matching efficiency score from the word matching efficiency score (see Chapter IV for calculation of efficiency scores).

An estimate of the amount of benefit each reader derived from orthographic regularity (pronounceable structure conforming to the orthographic rules of English) was calculated from performance on the same-different matching task by subtracting nonsense word (letter string) matching efficiency from pseudoword matching efficiency for each individual. This orthography effect was of central interest as a measure of readers' progress in mastering the English writing system.

The "speed of access to vocabulary" measure was scored as were the other matching responses, explained in chapter 4. The efficiency score shows the number of correct pairs matched per minute.

The listening, vocabulary range, grammar proficiency, and L1 reading scores were used as raw scores.

E. RESULTS AND DISCUSSION

1.Descriptive analysis

a. Visual efficiency and language proficiency

Table 2 lists the components of reading which were estimated by the measures described above. The visual efficiency scores are mathematical transformations of those discussed in Chapter IV.

It was decided to include visual matching of numbers as a predictor variable, even though originally number matching was only to be used when comparing group performance on the three visual matching tasks, to control for processing differences not attributable to orthographic knowledge. However, there was surprising similarity between efficiency means on the number matching task and the English letter and word visual matching tasks (see Table 1). This was borne out by the intercorrelations between number matching and word, pseudoword, letter string, and synonym/antonym matching ($r = .715, .705, .675, .512$, respectively). Since these tasks all involved similar stimuli formats and response requirements, such correlation is not surprising, though inconvenient in that number matching was not originally a variable of theoretical interest. Nevertheless, its relationship to other variables in the study extended to reading outcomes, with $r = .306, .345, .339$, and $.375$ for Short passage speed, Word-learning passage speed, Incidental word learning, and Attended word learning, respectively.

Table 2: Visual efficiency and language proficiency

	Taiwan Freshmen (N=28)	Taiwan Seniors (N=32)	USA (N=15)
Visual efficiency measures			
Number matching			
Means (pairs/min.)	58.02	65.13	63.13
Standard deviation	8.70	7.48	8.52
Lexicality effect (word-pseudowd.)			
Means (pairs/min.)	2.66	3.60	.12
Standard deviation	4.56	5.02	3.87
Orthography effect (pseudowd.-letterstr.)			
Means (pairs/min.)	6.10	7.43	10.17
Standard deviation	3.33	4.18	4.34
Language proficiency measures			
Vocabulary speed of access (Matching efficiency with synonym/antonyms)			
Means (pairs/min.)	31.98	33.71	39.73
Standard deviation	4.86	6.09	3.86
	(N=30)	(N=34)	(N=15)
Vocabulary range			
Means (out of 40)	22.27	24.74	39.13
Standard deviation	4.35	5.55	.99
Listening			
Means (out of 94)	56.5	64.60	-----
Standard deviation	10.77	10.12	
Grammar			
Means (out of 40)	26.03	25.68	37.67
Standard deviation	4.83	4.44	1.54
First lg. reading compreh. (Taiwan students' in Chinese, USA's in English)			
Means (out of 35)	27.80	28.74	28.67
Standard deviation	2.54	2.78	3.20

It appeared that visual matching of numbers was tapping some general skill of speeded visual encoding which was associated with English reading performance. Whether number matching performance reflects individual differences in speed of access through visual stimuli to "overlearned memory codes" (Jackson and McClelland, 1979; Palmer, et.al, 1985) or some more general trait related to skill at speeded tasks (Jensen, 1985), it seems appropriate to remove variability associated with this factor when exploring more specific relations between L2 language and writing system knowledge and L2 reading performance. Since whatever cognitive skill this measure is tapping would have developed independently of and prior to acquired knowledge about English, a conservative approach was adopted to retain number matching as a component in the multiple regression models.

The language proficiency measures in Table 2 reveal a considerable gap between American and Chinese readers. To test whether the apparent group differences in language proficiency were significant, the oneway analysis of variance with post hoc comparisons was used (SPSS, 1984, with Tukey-B).

Although the senior Chinese students performed better than the freshmen in all areas of proficiency except grammar, these differences were significant only for listening . This pattern of results seems consistent with these students' educational context. The freshmen had recently finshed high school, where their English courses stressed grammar and translation, and had three months earlier taken the college entrance exam in which grammar, but not vocabulary or listening, was directly tested. The seniors had finished a year of freshman English, which individual interviews indicated was, for almost all students, the first course conducted primarily in English. This experience appears to have had an impact, as shown by the significant listening proficiency superiority of seniors over the entering freshmen.

On all English proficiency measures the L1 speakers of English performed significantly better than the Taiwan seniors, approaching the maximum possible score in both vocabulary range and grammar tests. In L1 reading, however, when the Taiwan students were tested in Chinese but the Americans in English, the Chinese and American group means were not significantly different from one another. From this pattern of interaction one would predict that differences in language proficiency might have a greater impact on L1 and L2 readers than differences in L1 reading skill when they are asked to learn from identical texts.

b. Reading outcomes

To test whether the apparent group differences in reading outcomes were significant, the oneway analysis of variance with post hoc comparisons was used (SPSS, 1984, with Tukey-B).

In reading speed and word learning from reading (Table 3), the Chinese readers performed consistently below the American readers, particularly in reading speed. The American group read two to three times as many words per minute as did the Chinese readers. Comparison between senior and freshmen Chinese groups showed smaller differences in reading speed and comprehension, but the seniors were significantly better in word learning from reading. This suggests that the seniors' more extensive exposure to English textbooks gave them some advantage in comprehending written English, but that advantage does not appear to include faster reading.

The first two outcomes in Table 3--reading comprehension and speed on reading comprehension passages--yield interesting comparisons to L2 readers tested by Henderson (1983) on the same reading passages. The average reading comprehension of the Chinese students is nearly the same as that of Henderson's Spanish readers, but the Chinese reading speed (86.5 wpm) is much slower, falling about halfway between the Spanish group's rate (110 wpm) and the Arabic group's rate (62.8 wpm). Thus the major difference between this Chinese sample and the Spanish group was in reading speed. The finding reported above, that the seniors with considerably more experience in reading did not differ

Table 3: Reading outcomes--comprehension, speed, and word learning

	Taiwan Freshmen	Taiwan Seniors	USA
	(N=28)	(N=32)	(N=15)
Reading comprehension			
Mean (percent)	60.18	67.19	75.33
Standard deviation	11.42	12.63	12.32
Speed on Rcomp passages			
Mean (words/ min.)	83.09	88.00	253.90
Standard deviation	29.76	26.77	37.77
	(N=26)	(N=29)	(N=9)
Speed on Wlearn passage			
Mean (words/min.)	91.58	99.76	265.38
Standard deviation	25.86	31.35	36.15
Incidental word learning			
Mean (percent)	18.27	33.65	59.21
Standard deviation	10.22	18.98	12.65
Attended word learning			
Mean (percent)	34.20	51.30	69.66
Standard deviation	14.38	17.00	10.40

from the freshmen in reading speed suggests, however, that the speed gap between Spanish and Chinese readers, might not be easily overcome. Furthermore, the reading speed gap between all L2 readers and native speakers is enormous--even the fastest readers, the Spanish, read less than half as fast as the L1 college readers here (Table 3), who showed similar speed to the native speakers of English in Henderson's (1983) study. (Statistical comparisons were not possible because no estimate of variability is reported by Henderson).

c. Correlations between components and outcomes

Simple correlations between eight predictor variables and the five reading outcomes are shown in Table 4.

Lexicality was the only variable that had no reliable correlation with any outcomes. Therefore, lexicality was not included in the multiple regresion analysis. However, there was good reason to try to include some other estimate of the association between visual recognition efficiency with familiar words and reading outcomes, if possible. Otherwise it could be argued that whatever association between reading outcomes and orthographic regularity was found could not be clearly interpreted because it would be confounded with the unknown influence of familiarity with specific words in English. If some estimate of the benefit from familiarity is retained in the multiple regression analysis, as a statistical control for that influence, then the influence of orthographic regularity can more clearly be interpreted to represent more general mastery of the orthographic systematicity of English rather than specific learning of individual lexical items. The measure adopted as an estimate of efficiency with familiar words was the rawscore for same-different visual matching (scores are listed in Table 1 of chapter 4). This explains why, in Table 4, the second component is visual matching of words,while correlations of the lexicality effect and reading outcomes are reported, but not included among the

Table 4: Simple correlations between predictor variables and reading outcomes (all Taiwan S's)+

VARIABLES	RCompreh	Speed(RC)	Speed(WLearn)	IncidentalWlearn	AttendedWlearn
	(N=60)	(N=60)	(N=55)	(N=55)	(N=54)
1.Visual matching: numbers	.091	.306**	.345**	.339**	.375**
2.Visual matching: words	.014	.406***	.314**	.441***	.403***
?.Visual matching: lexicality effect	-.031	.074	.095	.056	.066
3.Visual matching: orthograpy effect	.227*	.130	.211	.336**	.280*
4.Meaning matching:	.078	.520***	.301*	.277*	.297*
5.Listening proficiency	.390***	.329**	.427***	.523***	.578***
6.Vocabulary proficiency	.369**	.436***	.319**	.617***	.655***
7.Grammar proficiency	.287*	.516***	.486***	.381**	.418***
8.Chinese reading	.233*	.036	.037	.307*	.256*

+Probabilities: *=p<.05; **=p<.01 ***=p<.001

eight components to be entered into the multiple regression equation.

One particularly interesting pattern in the correlations between components and reading outcomes is the dissociation between predictors of comprehension and predictors of speed. Speeded tasks such as visual matching of numbers and words or lexical matching of synonym/antonym pairs are related to both measures of reading speed, but not to reading comprehension. In contrast, Chinese reading comprehension and orthographic knowledge correlate with English reading comprehension, not with speed.

A second striking pattern, contrasting with the dissociation between speed and comprehension, is that <u>all</u> predictors (except lexicality) are related to word-learning outcomes. This suggests that word-learning from reading may be a combined measure of both accuracy and speed of reading, as predicted by Haynes (1987): if interactive, limited-capacity models of reading are correct, when readers are able to quickly identify the words in a text, they should have more attentional resources available and therefore be better able to integrate diverse clues about unfamiliar words and draw appropriate inferences about them.

The three complex language proficiency measures, listening, vocabulary range, and grammar, correlate with both speed and comprehension outcomes of reading. This is not surprising in the case of grammar and vocabulary, since those tests required comprehension of written sentences.

The strong association between listening and reading is more interesting in that about two-thirds of the listening test involved no reading whatsoever. Furthermore, the test presented only short utterances and dialogues. This type of test contrasts with typical L1 listening comprehension measures which present longer passages --those measures "...of the ability to comprehend written English, with the visual component of reading removed" (Palmer, et.al., 1985, p.81). Performance on the longer passages in L1 listening tests has, not surprisingly, been strongly correlated with reading comprehension (measured with similarly longer passages) in L1 reading. In this case, even though the listening test was based on simple conversational utterances, the correlation was still significant, indicating that general knowledge of L2 as a spoken medium is also reliably associated with L2 reading skill.

Of particular importance is the correlation of orthographic knowledge with comprehension rather than speed. If this relation proves robust in multiple regression analysis, it will indicate that better knowledge of English graphotactic structure most likely facilitates not faster reading speed but rather more accurate encoding of the text.

d. Correlations among components

Simple correlations among the eight predictor variables (Table 5) were examined as a preliminary to the multiple regression analysis in order to check for potential multicollinearity (if r is greater than .80). The only potential problem appeared to be the rather high association between visual matching with numbers and visual matching with words. This does not reflect some special processing similarity between numbers and words, specific to Chinese readers, since the correlation between these two measures was even higher (.80) with the American sample. Instead, it might be an artifact of the sequence of tests. The word matching followed number matching with only a short practice on word-like items in between. It appears that all subjects performed the number and word tasks in similar ways despite the meaningfulness of the word stimuli. On the other hand, there does appear to be some interesting difference in the two tasks, suggested by higher correlations of vocabulary (see Table 5) with word matching than with number matching. This is what would be expected if the word matching were reflecting linguistic knowledge in addition to a more generalized speed skill. For this reasons both variables have been entered into the multiple regression equations, but since they share a great deal of variance, any combined effects will have to be interpreted with caution.

2. Multiple regression analysis:

The relative influence of those components which correlated significantly with the outcomes could be estimated through multiple regression analysis. Before discussing analyses for each of the outcomes, however, the decision to combine two statistical approaches must be explained.

Table 5: Simple correlations among predictor variables (Taiwan sample: n=60)*

VARIABLES	2.	3.	4.	5.	6.	7.	8.
1.Visual matching: numbers	.715***	.028	.512***	.360**	.295*	.165	.077
2.Visual matching: words		.053	.531***	.319**	.412***	.220*	-.019
3.Visual matching: orthograpy effect			.120	.090	.100	.085	.098
4.Meaning matching: synonym/antonym pairs				.301**	.482***	.402***	.177
5.Listening proficiency					.454***	.471***	.263*
6.Vocabulary proficiency						.565***	.214*
7.Grammar proficiency							.062
8.Chinese reading							

*Probability symbols: * =p<.05; ** =p<.01; *** =p<.001

The most conservative statistical approach would be standard regression, in which the variance attributed to each variable is that remaining when all other variables have been accounted for. The hierarchical method, in contrast, allows the experimenter to specify the order in which variables are entered into the equation (assuming there are valid reasons for the order adopted). This analysis produces a model which, as it adds each additional variable (or group of variables, in the semi-hierarchical approach), controls only for the variance shared with previously entered variables. The two methods produce different estimates of the amount of variance in the outcome which is associated with the predictor variable. The hierarchical method is more powerful, while the standard method more conservative. Here, for each reading outcome, the hierarchical multiple regression equation is shown, followed by the corresponding standard regression equation which will be used to determine whether the results are reliable or not.

The predictors which correlated significantly with a given reading outcome were entered into the multiple regression equation. With the hierarchical approach, those variables which are logically prior to English proficiency, including "number matching" (performance on speeded visual tasks possibly including efficiency of symbol activation) and "Chinese reading comprehension" were always entered first. This conservative step decreased the likelihood that other variables would still be associated with the outcome, since the first-entered variable removed all variability associated with that measure, even that which was shared with other measures. Therefore any other significant associations that are found should be considered quite robust.

After these _general components_, the second set of variables to be entered into the equation (if they correlated with the given outcome) were those termed _basic components_. These are measures of less complex performance than the three _language proficiency_ components of "vocabulary range", "listening" and "grammar", all of which combine elements of one another plus the basic components, and therefore were entered last.

Basic components included the writing system components of "word visual matching" and "orthography" (orthographic regularity: pseudoword matching efficiency minus letter string matching efficiency,) and "meaning matching" from the synonym-antonym matching task. These are not necessarily developmental precursors to the complex language proficiency measures. The opposite could also be true. For instance, better listeners might have created for themselves more opportunities for the type of contextualized listening experience with high-frequency words which could increase the rapidity of access to word meaning in the "meaning matching" task (in Table 5, these two measures, "listening" and "meaning matching," correlated significantly). Though not necessarily developing earlier in time, the basic components can be thought of as elements underlying performance on the more complex tasks at the time of testing. For example, both vocabulary and grammar tests required a good deal of reading. This of necessity called repeatedly on processes of visual word perception and meaning access. Thus it is not surprising to note that the measures estimating "word matching" and "meaning matching" in this study correlated significantly with scores on vocabulary and grammar tests (see Table 5). It is more logical to consider these latter two processes basic components than the converse, that performance on word and meaning matching tasks depended on the complex performance required by the tests in grammar or range of vocabulary. However, that is why the second, standard regression analysis has been included, to make sure that the patterns observed in the hierarchical multiple regression can be believed.

Sensitivity to orthographic regularity is also treated as a basic component in the hierarchical regression analyses. As a measure of the reader's sensitivity to systematic letter sequencing in a task calling on visual perception, it seems logical to consider it a component of more complex tasks such as recognizing words on the grammar or vocabulary tests. Again, the possibility that this theoretical approach is incorrect has been acknowledged by the inclusion of standard regression equations which, if not in agreement with the hierarchical model, may be taken as a refutation of the validity of its modeling.

a. Reading Speed

First entered for the two reading speed outcomes (Tables 6 and 7) was the variable of number matching, since skill at that task correlated with the outcome and was independent of English language knowledge and logically prior to it. Second entered were basic components: word visual matching and synonym/antonym meaning matching. In the third step complex language proficiency measures were entered--listening, grammar, and vocabulary.

As shown in Tables 6 and 7, for both measures of reading speed, speeded number matching accounted for about 10% of the variance, while grammar proficiency seemed to account for slightly more. The variable of interest--the orthography effect--did not correlate with reading speed and thus was not entered into the equation. A related variable of interest, however, was word matching. When number matching performance is entered first, the remaining variability in performance on this task should indicate readers' efficiency at recognizing the visual shapes of familiar word strings. This variable, however, did not enter significantly into the multiple regression equation. Instead, meaning matching (performance on the synonym/antonym task) accounted for about 18% of the variance in the first reading speed measure. It did not

Table 6: Semi-hierarchical Multiple Regression with Reading Speed as the dependent variable

Step	Significance	Additional variance*
1.General component		
a.Number vis matching	.017	9.36%
2.Lexical access component		
a.Meaning matching	.000	17.88
3.Language proficiency		
a.Grammar	.002	11.44
Total explained variance	.000	38.69

* In this and following tables, variance is expressed as a percentage for ease of reading.

Table 7: Semi-hierarchical Multiple Regression with Word Learning Reading Speed as the dependent variable

Step	Significance	Additional variance
1.General component		
a.Number vis match	.010	11.91%
2.Language proficiency		
b.Grammar	.001	18.30
Total explained variance	.000	30.22

show up as a predictor in the second reading speed measure, however. Likewise, in the standard regression analysis

Table 8: Standard Multiple Regression with Reading Speed as the dependent variable

Predictor	Significance	Additional variance
Meaning matching	.000	27.03%
Grammar	.002	11.25
Total explained variance	.000	38.27

Table 9: Standard Multiple Regression with Word Learning Reading Speed as the dependent variable

Predictor	Significance	Additional variance
Grammar	.000	23.62%
Number visual matching	.031	6.59
Total explained variance	.000	30.22

(Tables 8 and 9), it proved to be the strongest predictor of the first reading speed measure, but did not enter into the "word learning reading speed" multiple regression.

What can be concluded about the efficiency of meaning access as a predictor of reading speed is not clear from the mixed results in both analyses. It may be that on short passages with no cues to context, as in the multiple choice comprehension measure, speed of meaning access from individual words comes into play more than it does with longer passages including illustrations and diagrams, which allow the reader to generate more top-down inferences about the topic and content. But this speculation cannot be tested by any other pattern in the data.

Another surprise is the robustness of grammatical proficiency as a predictor of reading speed in both hierarchical and standard analyses. Its appearance contradicts the arguments advanced by Ulijn (1981; 1984) that normally L2 reading requires little syntactic analysis, but much lexical/conceptual processing. Nevertheless, the possibility that lexical access time and grammatical knowledge are both predictors of reading speed, rather than comprehension, is interesting enough to deserve follow-up studies for replication, both with Chinese readers of English and with other language groups.

Returning to the central question of the effects of writing system knowledge on reading outcomes, neither of the two measures of visual efficiency in perceiving English stimuli were significant. It appears that, with these Chinese readers in these tasks, orthographic knowledge is not related to reading speed.

b. Reading comprehension

In the hierarchical regression with reading comprehension, the first variable entered was Chinese reading comprehension, since this correlated significantly with the outcome and was logically prior to English language knowledge. Second, the component of orthographic knowledge was entered, and finally the three language proficiency measures which had correlated with reading comprehension were entered in the third stage of the analysis.

Table 10: Semi-hierarchical Multiple Regression with Reading Comprehension as the dependent variable

Step	Significance	Additional variance
1. General components		
a. Chinese read comp	.074	5.41%
2. Writ system components		
a. Orthography	.109	4.22
3. Language proficiency		
a. Listening	.008	20.33
b. Vocabulary	.123	3.40
Total explained variance	.004	23.73

As shown in Table 10, for the Chinese reading and orthography components, the association with reading comprehension was only marginally reliable. Only the English listening proficiency variable reached significance of $p<.05$ in either the hierarchical or the standard regression analyses (see Table 11). This replicates the reliable association between reading comprehension and listening comprehension in L1 reading (Sticht & James, 1984).

The marginal association between orthography and comprehension should not be overemphasized, since the association proved even less reliable in the standard regression analysis. However, these results should also not be taken as the final word on the role of orthography in reading comprehension. As was mentioned earlier, the 20-item comprehension measure did not allow for a large range of variability; thus it is not surprising that this outcome

Table 11: Standard Multiple Regression with Reading Comprehension as the dependent variable

Predictor	Significance	Additional variance
Listening	.002	15.23%
Vocabulary	.086	4.32
Orthography	.132	3.22
Chinese reading comp.	.407	.01
Total explained variance	.004	23.78

was not reliably associated with a large number of predictors in the regression analysis. Subsequent research should include a more sensitive measure of reading comprehension.

c. Word learning outcomes

The two word-learning outcomes (incidental and attended), were significantly correlated with all predictors except the lexicality effect. The eight predictors were entered into multiple regression equations in three stages. In the first step were general (logically prior) components, number visual matching and Chinese reading comprehension. Second were the basic components word visual matching, meaning matching, and orthography. At the third stage, thethree language proficiency variables were entered into the equation.

As shown in Table 12 and 13, the general components predicted about 20% of the variance in word learning from reading. Basic components accounted for over 15% of additional variance in incidental word learning, though much less with attended word learning. This reduction with the attended word learning outcome makes sense in terms of the opportunities available in the rereading interview (which preceded the attended guessing measure of definition writing) for rereading, comparing different parts of the text, and reevaluating initial guesses. It is likely that fluency of orthographic processing has less impact when a person is reading material for the third or fourth time, that is, when material has become more familiar. Also, readers may be able to compensate strategically forlimitations in orthographic sensitivity when, as in the rereading interview, they are encouraged to check the surrounding text and reevaluate their initial guesses. Thestandard regression analyses (Tables 14 and 15) clarified this difference between types of word learning, for there the orthography effect was significant only in the incidental word learning outcome.

Table 12: Semi-hierarchical Multiple Regression with Incidental Word Learning as the dependent variable

Step	Significance	Additional variance
1.General components		
a.Number vis match	.011	11.47%
b.Chinese read comp	.024	8.34
2.Basic components		
a.Word visual match	.011	9.73
b.Orthography	.019	7.41
3.Language proficiency		
a.Vocabulary	.000	15.45
Total explained variance	.000	52.40

Table 13: Semi-hierarchical Multiple Regression with Attended Word Learning as the dependent variable

Step	Significance	Additional variance
1.General components		
a.Number vis match	.005	14.04%
b.Chinese read comp	.072	5.35
2.Basic components		
a.Orthography	.045	6.31
3.Language proficiency		
a.Vocabulary	.000	25.86
b.Listening	.019	5.33
Total explained variance	.000	56.88

It is of importance to consider how small a role Chinese L1 reading comprehension appears to play in the analyses conducted above. With measures of comprehension,

Table 14: Standard Multiple Regression with Incidental Word Learning as the dependent variable

Predictor	Significance	Additional variance
Vocabulary	.000	38.1%
Orthography	.010	7.52
Listening	.026	5.11
Chinese reading comp.	.243	1.34
Total explained variance	.000	52.06

Table 15: Standard Multiple Regression with Attended Word Learning as the dependent variable

Predictor	Significance	Additional variance
Vocabulary	.000	42.85%
Listening	.003	9.06
Orthography	.054	3.46
Number visual matching	.226	1.33
Total explained variance	.000	56.7

at best it accounted for about the same amount of variance as did the orthography effect, and in the standard analysis of incidental word learning from reading it was much less reliable. Its complete lack of association with English reading speed may be taken as further indication that WS2 reading is not strongly influenced by L1 reading skill. This is an important point, for there was a greater magnitude of difference between these students and their American counterparts in reading speed than there was in comprehension or word learning.

On the other hand, it must be recalled that the Chinese reading measure was a comprehension test with a generous time limit of 30 minutes. Had it been presented with shorter time and participants made aware that they had to use time wisely in answering, perhaps more variability, higher correlations with English comprehension and word learning , and correlations with speed would have been found.

Furthermore, the conclusion that linguistic knowledge, possibly including orthographic knowledge, has a greater influence on WS2 reading than do differences between individuals in L1 reading should be qualified, by statistical considerations. The Chinese reading test contained slightly fewer items and produced a narrower band of variance than did listening or vocabulary measures. Thus it may be a relatively insensitive measure of differences in reading skill existing in the population.

On the other hand, it may be that there is little variation in L1 reading skill among this highly educated elite selected from the top 20% of high school graduates who took the college entrance exam in Taiwan. Pilot testing (with a mixed group of graduate students and their relatives who had not attended four-year schools) had indicated that there would be wider variation of scores than were found in the sample at the private university in Taiwan. Perhaps the lack of variation is due to a combination of homogeneity of the sample and short length and relatively low difficulty of the test.

3. Evaluation of hypotheses

The second set of hypotheses, those concerning the association between orthographic knowledge and reading success, must now be addressed.

> Hypothesis 4: That individual differences in efficiency of visual matching correlate significantly with success in reading for comprehension in English. Reading speed, comprehension, and ability to learn new words from reading English should show a statistical association with measures of visual processing efficiency.

This hypothesis is supported in part by the findings. Three components of visual processing efficiency were treated in the analysis: lexicality effect, orthography effect, and word-matching efficiency. Lexicality showed no association with reading outcomes, suggesting that it is the orthography effect rather than the benefit derived from familiarity with specific words which best characterizes the differences observed between American and Chinese readers in the analysis of covariance.

Once lexicality was dropped from further analyses, it became possible to include the word-matching efficiency scores. This measure of efficiency in matching familiar words correlated with both speed outcomes as well as both word learning outcomes, thus supporting the research hypothesis. However, it is not really a measure of orthographic knowledge, but of the ability to visually encode quickly and accurately individual words that have been learned in the new orthography. Still, it can be characterized as one measure of visual processing efficiency with the English written code, and as such does support the hypothesis. In a single-factor study, this might be accepted as weak evidence that efficiency of visual processing plays a role in the English reading speed of Chinese literates.

The final component of visual processing, the orthography effect, combines performance on two sets of matching stimuli to estimate the benefit gained by readers when visually comparing structured, as opposed to unstructured, sequences of letters. The orthography effect correlated significantly with reading comprehension, incidental word learning, and attended word learning. Again, in a single factor study this would be accepted as evidence that learning about the writing system benefits reading for meaning, though not the speed of reading.

> Hypothesis 5: That the statistical association established in (4) above still holds even when L1 reading proficiency is accounted for (entered into a multiple regression equation along with measures of visual processing efficiency).

> Hypothesis 6: That the statistical association established in (5) still remains significant, even

when other important influences on L2 reading are accounted for, including English language measures of speed of lexical access, range of vocabulary recognition, listening proficiency, and grammatical knowledge.

(Though not mentioned explicitly in the original hypotheses, the number matching variable was retained in the analysis. Like L1 reading comprehension, it was entered first in hierarchical equations because it was both correlated with the outcomes and logically prior to other English language variables, thus constituting a potential confounding variable.)

The last two hypotheses were tested concurrently by the multiple regression analyses. The results of each analysis will be discussed in turn, with the hierarchical analysis pertaining to hypothesis 5 and the standard regression applying to hypothesis 6.

The two speed outcomes appeared to be sensitive to individual variation in number matching and grammatical knowledge. But they did not reflect the influence of any component of orthographic knowledge. The basic component of speed of meaning access (from the synonym matching task) was robustly associated with the first reading rate, the average of four rates on shorter reading passages. But meaning access efficiency did not show this association with reading speed when students were reading a longer passage that had diagrams and headings. Whatever this may signify about importance of rapid access to word meaning in reading, the results show that for Chinese readers of English, reading rate is determined by factors other than efficient visual recognition of orthography. With reference to speed of reading, then, the research hypothesis found no support.

The comprehension outcome, with just twenty items, did not offer a great deal of variance to be explained. Only listening proficiency was reliably related to this outcome. Nevertheless, there was a trend in which orthography explained a small proportion of the variance (3-4%), but failed to do so reliably ($p = .109$ and $.132$ in hierarchical and standard analyses, respectively). Though the research hypothesis must be rejected due to the probability that this result could be due to chance, when one considers the final two outcomes, incidental and attended word learning from reading, it is clear that there is a need for further study of the link between comprehension and orthographic sensitivity.

The incidental word learning outcome was associated with two visual processing variables, orthographic regularity and visual word matching, when L1 reading comprehension variability was first controlled. But in the standard multiple regression analysis, only orthography remained reliably associated with the ability to learn new words incidentally through reading. It explains a modest amount of the variance in this complex task (7.5%) whether entered earlier into the equation or concurrently with other language proficiency variables. This robust association supports both research hypotheses 5 and 6. In combination with the trend observed with reading comprehension, one can conclude with fair assurance that the ability to efficiently perceive those letter strings that follow a systematic sequence in English is reliably associated with reading comprehension, whether of passages or of new words explained in context.

This conclusion receives some support as well from the analysis of attended word learning, based on definitions written after readers had reread the passsage paragraph by paragraph and had been encouraged to clarify confusing vocabulary by using contextual clues. In the hierarchical analysis of attended word learning, differences in sensitivity to orthographic regularity accounted for about 6% of the variance, although in the standard regression analysis, when the influence of vocabulary and listening were concurrently controlled, this was reduced to 3% of the variance, with marginal reliability ($p = .054$). This raises the possibility that the impact of orthographic knowledge on comprehension of new terms is greater during an initial reading, but lessened when readers have the opportunity to reread strategically, with a more deliberate problem-solving approach to learning specific new words.

This suggestion of differences between incidental learning of vocabulary from reading and attended deriving of word meaning through rereading deserves further study. Nevertheless, the evidence here does point to an association between knowledge of graphotactic regularities of English and learning from reading, particularly when that learning involves incidental understanding and memory for meanings of new words encountered in reading.

In combination with the group comparison in Chapter IV, this pattern of results indicates that writing system knowledge should not be taken for granted. Though students may have learned the symbols and begun reading in the new orthography, their writing system knowledge is still limited in comparison to that of experienced L1 readers. Furthermore, individual differences in writing system knowledge among Chinese readers of English continue to be involved in learning from text and word context well beyond the beginning stages of language learning.

CHAPTER VI: CONCLUSIONS: ORTHOGRAPHY AND READING

A. SUMMARY

1. Context of the study

This study has been motivated by the lack of attention given to orthographic (writing system) differences among L2 readers in the theory and practice of second language acquisition and teaching. Linguistics has fostered a focus on spoken language, while so-called "psycholinguistic" models of reading have drawn attention to the higher-order linguistic and world knowledge that the reader brings to the text. Thus the role of visual perception in reading and its impact on WS2 readers (those from a different writing system background) has been somewhat neglected.

In contrast to psycholinguistic models, which posit anticipation and selective sampling of the code as the mechanisms enabling readers to bypass time-consuming visual perception during reading, the interactive-compensatory (I-C) model predicts that learners gain automaticity of visual perception with a specific written code, gradually learning to perceive symbols and sequences easily and quickly, without focusing attention on the perceptual to the task of integrating and inferencing at the same time that they continue to perceive the written code.

These two models make different predictions about the impact of a new writing system on L2 readers. The psycholinguistic model predicts that learners with strong L1 reading strategies will apply these strategies fairly easily in L2 and that learning the code will cause insignificant difficulty. In contrast, the I-C model predicts that difficulties in higher-level reading processes will persist as long as automaticity with the written code has not developed.

The little research that has been done on alphabetic readers learning new letter symbols suggests that learning to recognize sequences of new symbols may take a long time even though these readers are familiar with the sound-symbol principle of mapping between language and code.

Studies comparing alphabetic and non-alphabetic readers have produced suggestive patterns in which the former tend to be slowed by their speech-recoding during reading, while the latter can more easily proceed directly from visual code to meaning. This difference can be related to differences in the orthographic systems, but these differences are continuous rather than categorical, and so are their apparent effects on readers, who show a range of strategic options. Thus, depending on task requirements, readers of the English alphabet can engage in visual coding, while readers of Japanese or Chinese can engage in speech recoding, though perhaps without reference to the analyzability of speech at the level of individual phonemes.

A few studies of Japanese literates reading in English indicate a contrast between fast visual coding in some tasks and cumbersome speech recoding when overt pronunciation is required. The connection between this contrast and Japanese readers' ability to read accurately and efficiently in an alphabetic writing system has not been thoroughly explored.

There has been even less research concerning Chinese readers learning the English writing system. At this time, any study of Chinese literates' reading in English as a WS2 (second writing system) must be considered exploratory. This study builds less on the distinctions between visual coding in Chinese and speech coding in English than on the methodological guidelines provided by earlier work. The goal of the study is to apply wuch guidelines to the job of determining whether orthographic knowledge does indeed consitute a factor that must be given consideration in order to understand WS2 reading acquisition.

The most reliable finding from earlier work is that readers appear to be extremely task-sensitive, showing different capabilities with different stimuli and response requirements. Information processing analyses of performance when subjects are faced with systematic variations in task definition indicates that in order to isolate visual processes a researcher must take great care.

2. First analysis: comparing Chinese and English literates' visual matching of English orthography

The first part of this study compared differences in visual processing of English orthography by Chinese and English literates. Sampling of two groups of college students in Taiwan, freshmen and seniors having different amounts of experience with English, provided a contrast from which it was hoped developmental inferences could be drawn. Selection of the visual same-different matching task was guided by evidence that it indeed isolates visual processing. In this task, pairs of stimuli must be quickly judged as identical or different. By varying sets of stimuli, an estimate was derived of individual differences in general efficiency on speeded visual tasks, as well as efficiency with familiar English words, unfamiliar ones which conformed to graphotactic regularities of English, and strings of letters which were neither familiar nor orthographically regular.

There were three research hypotheses in the first part of the study. Each is listed below and discussed in terms of the findings from the same-different matching task.

> Hypothesis 1: That efficiency at visual matching improves as Chinese college students gain experience in reading English (tested through a comparison of entering freshmen with seniors who have had more experience learning from English texts).

Although there were suggestive differences in the raw scores from the matching task, inclusion of the covariate of number matching, which indexed general efficiency on speeded tasks with visual stimuli, reduced the differences between freshmen and senior groups. The analysis of covariance showed that the differences between groups were not significant, though they showed a trend in the expected direction ($p=.06$). This research hypothesis is rejected, though the evidence justifies further study of this issue.

There is at least one other reason that this research hypothesis should be examined further with other Ws2 learners. Informal interviews with students and faculty during the researcher's stay in Taiwan suggested that the freshman and senior groups were probably closer in reading experience than had been predicted. Preliminary research about classes and textbooks had indicated that almost all of the seniors' major classes in the past three years of college used textbooks in English, but interviews showed that one could survive these classes without doing much, if any, reading in the assigned texts. Students in particular reported that many of their classmates substituted close study of lecture notes and reference to textbooks in Chinese which covered related material. In consequence, the senior group may not have had as much English reading experience as had been assumed by the design of the study. Therefore, relying on the contrast between these groups may not have been the best way to test whether knowledge of a writing system continues to grow beyond the beginning stages of learning about the orthography.

Hypothesis 2: That Chinese WS2 learners' efficiency at visual matching differs significantly from the performance of skilled American readers.

This hypothesis is likewise not strongly supported by the marginal result ($p=.06$) from the analysis of covariance for the effect of group differences. Although this finding does not support an across-the-board advantage for Americans that is independent of the graphotactic structure of letters strings being processed, consideration of the third hypothesis reveals a specific and significant group difference.

Hypothesis 3: That Chinese WS2 learners' sensitivity to English orthographic regularity is significantly less than that of skilled American readers.

In this case, the null hypothesis is rejected in favor of the research hypothesis. A significant group-stimulus interaction ($p = .023$) on the visual same-different matching task indicated that the Chinese readers benefited less from the systematic ordering of letters in pseudowords, in comparison with non-structured letter strings, than did the American readers, whose matching efficiency was virtually the same whether they were matching familiar English words or pseudowords.

In a sense, this is a remarkable finding: high-achieving college students in Taiwan who are literate in a visually complex orthography appear to have the same difficulties as English-speaking children who are learning visible language for the first time. Furthermore, these students are no longer beginners at English. After six years of study in secondary school, they have even written a composition in English on the college entrance exam. Yet their mastery of the English orthographic system is still incomplete in comparison with a sample of American college students.

In another sense, this finding remains difficult to interpret: is it lack of benefit from systematic graphotactic structure (orthography effect) or overreliance on specific, familiar, meaningful words (lexicality effect) which distinguishes these Chinese readers from the Americans? Furthermore, do the differences observed in this matching task have any correspondence to performance in complex reading tasks more typical of academic contexts? A second part of this study attempted to provide some answers to these questions.

3. Second analysis: weighing the significance of orthography as Chinese literates learn from English text

This analysis was necessarily more complex than the first. By a correlational approach it attempted to gauge the significance of variations in orthographic knowledge among the Chinese on their ability fo learn efficiently from reading.

The five measures of successful reading included: <u>two reading rates</u> (the first an average of reading rates on four short passages, the second a reading rate for a longer instructional passage including headings and diagrams); one multiple choice comprehension score (the average of five follow-up questions on each of four short passages); and two estimates, based on definition protocols, of the amount of word learning from reading (participants wrote categories and definitions for fifteen words, once after reading the instructional passage, then again after rereading and answering questions about contextual and conceptual information which were designed to help in word learning). The first outcome was termed "incidental word learning," the second "attended word learning."

> Hypothesis 4: That individual differences in efficiency of visual matching correlate significantly with success in reading for comprehension in English.

Correlations between the outcomes and the orthography and lexicality effects from analysis 1 can be used to test this hypothesis. Positive correlations with either of the two visual processing effects would suggest that orthographic knowledge is related to WS2 readers' success in reading English texts.

The lexicality effect did not correlate with any of the outcomes. However, when one of the component scores, word-matching efficiency, was entered into the analysis instead, it showed an association with the outcomes of reading speed and word-learning from context. In addition, the variable of particular interest, orthographic sensitivity, was positively related to performance on comprehension and word matching outcomes. Thus the research hypothesis is supported, though the final two hypotheses must be tested in order to avoid overgeneralizing from simple correlations.

> Hypothesis 5: That the statistical association in (4) above still holds even when L1 reading proficiency is accounted for (entered into the multiple regression equation)

> Hypothesis 6: That the statistical association established in (5) above still remains significant, even when other important influences on L2 reading from L2 linguistic knowledge are also accounted for: speed of lexical access, range of vocabulary recognition, listening proficiency, and grammatical knowledge.

These research hypotheses are both supported by statistical associations which proved reliable in the multiple regression analysis. Both hierarchical and standard patterns were examined, the former providing greater likelihood of finding predicted associations if they are indeed present, the latter providing a conservative indication of the robustness of the individual associations.

In hierarchical models, both L1 reading comprehension and efficiency of number matching were entered before the two visual processing variables, efficiency of word matching and sensitivity to orthographic regularity. Word matching efficiency made a reliable contribution only to the model of incidental word learning. Orthographic regularity was reliably associated with that same outcome as well as with attended word learning, but in the standard equations was only marginally associated with attended word learning. In addition, in both hierarchical and standard models it was marginally associated with comprehension.

This pattern of results supports the research hypotheses and provides further analytical information as well. First, in the outcome which correlated significantly with the most components, incidental word learning, the amount of variance explained by orthographic sensitivity (7.5%) was comparable to that explained by L1 reading comprehension (8.5%). For the English reading comprehension outcome, the orthographic variable explained less variance (3-4%) than it did for incidental word learning, and with only marginal reliability, but this was also true for the L1 reading comprehension measure. Furthermore, in the more conservative standard regression analysis, orthography had a stronger association with English reading comprehension than did Chinese reading comprehension. Finally, for attended word learning, orthography was again more robust. In the hierarchical analysis, it explained a similar proportion of variance (6.3%, as opposed to 5.3% for L1 reading comprehension), and in the standard analysis it just missed significance ($p = .054$), while L1 reading comprehension was not reliably involved at all.

The pattern of results is fairly clear: Ability to visually match familiar English words and sensitivity to the orthographic structure of letter sequences in the English writing system are both reliably associated with the most sensitive outcome of the battery, incidental word learning from reading. This measure characterizes the amount of information a reader learns about new words when the reader is not particularly focused on that task, but instead is reading for general comprehension. When attention is focused on word learning, the benefit gained from orthographic regularity still is associated with the word learning outcome.

Though the last three research hypotheses are supported, further questions abound. First, as in any correlational study, one must ask what direction of causality underlies the statistical association. Does one learn to comprehend better as a result of clearer perception of the orthographic structure of English words? Or does this sensitivity to structure develop in response to being a better comprehender of text? Or perhaps it develops in response to some third factor which is correlated both with the orthographic component and with reading comprehension?

One might expect to find clues in the patterns of correlation between linguistic variables and the orthography effect, but in this study orthographic sensitivity was uncorrelated with factors related to word recognition--speed of lexical access and range of vocabulary knowledge. Further, it was also uncorrelated with listening proficiency, indicating that its development is probably not the result of having available a better analysis of the speech sounds of the language. In fact, the orthography effect correlated with no other component in the study. Nevertheless, its relationship to learning from reading suggests that graphotactic patterns in English orthography do have an impact on learners of English as a second writing system.

B. IMPLICATIONS

This study implies that psycholinguistic models of reading fail to take account of an important factor that is easily accomodated by the interactive-compensatory model. In this model, the development of automaticity in visual processing of the written code has a central impact on reading comprehension. The results of this study are not only consistent with this view, but also suggest that reading strategies learned in L1 may play a less significant role for L2 readers of a different writing system than some scholars have asserted.

Among the many methodological implications for researchers are the following: the importance of testing the impact of L1 reading comprehension rather than assuming it; the need to develop more sensitive measures of the variability in comprehension, such as the incidental and attended word learning measures; the importance of experimentally isolating the factor of interest (visual processing of orthography, in this case) and pitting it against a wide range of alternate explanatory candidates via regression analysis; and, above all, the need to study learners from different orthographic backgrounds separately rather than generalizing about the nonexistent nomothetic "second language learner."

Implications for language teachers are more limited. At the theoretical level, teachers should note that comprehension is not independent of lower level influences such as the vocabulary knowledge or the orthographic experience of the reader. Teachers of reading, therefore, should seek ways to facilitate acquisition of lower level processes as well as focus on comprehension. This may be doubly important given the lack of differences observed in the orthographic sensitivity of freshmen and senior students, which indicates knowledge of orthography may develop quite slowly. Furthermore, this study offers no insight on how to foster orthographic sensitivity, since this measure seemed unrelated to any other components of the study. Much more research is needed, in particular training studies, before the operation of orthographic regularity in learning to read English is understood.

For those who are involved in international education and information transfer, implications can be drawn from significant differences observed between these students from Taiwan and their American counterparts. It was only after the WS2 readers had spent a long time rereading and studying the word-learning text that their comprehension of new words and concepts even approached the level achieved by the American readers during two quick readings. This difficulty with unfamiliar terminology and ideas has sobering implications for reliance on L2 reading as part of education projects aimed at disseminating new ideas and approaches.

Furthermore, the gap in reading speed remains huge, for seniors as well as freshmen, when they are compared to American college students. The mean reading speeds of Chinese college students after six years of secondary English instruction (freshman mean = 83 words per minute, senior mean = 88 wpm; the fastest Chinese reader, at 162 wpm, was still slower than the slowest American, 178 wpm, and the U.S. mean was 253 wpm). If English is to be the medium of technical and scientific information exchange, Chinese literates are likely to be at a disadvantage as they struggle with the bottleneck of slow, inaccurate reading in English.

C. LIMITATIONS

This is preliminary exploratory research. The measures were either developed by the researcher or taken from other preliminary studies of WS2 reading. No standard measures were used.

Nevertheless, a follow-up examination of correlations between the subjects' background--variables such as performance in Chinese and English on the college entrance exam (for the freshman sample), class rank, (for the seniors), and freshman year grades in Chinese and English for both groups--support the validity of at least some of the measures. For the freshmen, the grammar proficiency exam correlated .73 with the English section of the college entrance exam, while listening correlated .83 and vocabulary .51. The same three measures, for the seniors, correlated with freshman English grades .59, .69. and .55, respectively. Efficiency of lexical access (meaning matching) also showed this pattern of correlation with independent Taiwan institutional measures of English skill: with r = .41 for the college entrance exam of the freshmen and r = .49 for the freshman English grades of the seniors. Therefore the language proficiency estimates may be considered valid.

However, the L1 reading comprehension test showed less sensitivity than other measures in the study. This could be due to insufficient items and ones that were too easy, as well as homogeneity of the sample in L1 reading skill. In any case, the results of the regression analyses may underestimate the effect of variations in L1 reading proficiency on WS2 reading. The measure can also be considered suspect in that subjects reported they felt as if the Chinese used was not natural, like reading "English-Chinese" as one said. The correlations with Chinese background information reinforce this contention, since the Chinese reading test showed a small positive association with students' freshman English grades (.272) but a negative correlation with the freshman group's performance on the Chinese section of the college entrance exam (-.358), just the reverse of what would be expected if this were a valid measure of Chinese reading ability. This negative correlation must be interpreted in relation to the nature of the college entrance exam test in Chinese, however. Student interviews indicated that this tests rote memory for the specific texts and interpretations studied by all students in high school, rather than ability to understand new texts written in Chinese. It is also possible that the inexperience with multiple choice format and such question types on Chinese tests (some students mentioned in this inexperience during interviews) also contributed to the unexpected patterns of correlation. Perhaps one can more easily translate a reading test linguistically than translate a testing approach into one familiar to students from another educational culture.

In addition to doubts about the L1 reading comprehension test, questions may be raised concerning the visual same-different matching tests in this study. These were used pencil and paper response and cumulative scoring, rather than the usual item-by-item reaction time measurements based on stimuli that are mixed, not blocked. In fact, careful experimental control has indicated that subjects are extremely sensitive to varying expectations of lexicality created when stimuli are presented in blocks and the sequence of blocks is varied (Carr, Posner, Pollatsek, and Snyder, 1979). Since only one sequence was used in this study (numbers, then words, then pseudowords, then letter strings) there may be alternate explanations for the findings of this study. For example, it is possible that the measure termed "orthography effect" is rather an index of individuals' flexibility in readjusting strategies to deal efficiently with unfamiliar stimuli.

Finally, the sample and the population sampled might limit the validity and generality of the findings. Other things being equal, the study would be more credible with random selection rather than volunteers. Still, it is not clear to this researcher that participation of volunteers in the study was any more a threat to validity than is that of the many college students who volunteer for psychological studies by the thousands throughout the United States. More serious threats to validity involve the assumption of subject independence. These students came from only a few major fields. In Taiwan, one's major tends to determine one's peer group, with students of a given year taking all or almost all of their major subject classes together. Students were asked, as part of the consent form, to promise not to disclose the contents of any test to any other student. It can only be hoped that this promise was carried out. The systematic and sensible patterns observed in the data as a whole and the word-learning from reading in particular indicate that confidentiality was well maintained.

Limitations on the generality of this study must also be pointed out. Taiwan readers of English are different from those in Mainland China who share some linguistic background. In the People's Republic children study a Roman alphabet, pin-yin, as they begin learning to read in (see Dai, 1985). This may affect their later learning of English orthography only superficially, but possibly could make the transition to English much easier for them. This is an interesting empirical question.

D. FUTURE RESEARCH

In addition to attempting a replication of this research with subjects who have learned the pin-yin romanization as children, investigation of readers from other non-alphabetic writing systems should be carried out to see whether sensitivity to orthographic regularity also varies systematically with their success when reading in English. Larger samples are needed to get a better estimate of the magnitude of association between visual factors and reading speed and comprehension. More analytical designs are needed, and training studies should be attempted to explore the mechanisms by which orthographic knowledge develops for L2 learners. From this study, the mechanisms by which it affects reading comprehension remain obscure.

Further research in WS2 reading might also consider cultural attitudes and applications of literacy, as they affect and are affected by writing system differences. Ethnographic approaches are particularly needed to characterize cultural-specific instructional approaches to reading in L1 (or L2--see Young, 1987) education, such as phonemic/syllabic analysis of language into subunits, oral/silent and individual/group reading, and a host of higher-level variables such as standard/personal interpretation of text or efferent/aesthetic emphasis (Rosenblatt, 1978).

Another area which should reveal much about the effects of literacy background on L2 reading involves alphabetic readers learning non-alphabetic systems. For example, Everson (1988) found that American adult learners of Chinese who had learned to recognize about 200 characters read significantly faster, with better comprehension, when reading romanized Chinese than when reading Chinese characters. This raises the possibility that literacy background exerts an impact not only on L2 reading, but also on language learning in general. Perhaps the orthographic representations which are most familiar to language learners constitute the schema according to which they organize all subsequent language learning, both spoken and written.

The issues raised by this study extend further than this brief conclusion can convey. It is hoped that the methods, results, and questions of this investigation will be found sufficiently provocative so that other researchers may be inspired to explore what it means to acquire a writing system, both for learners from other languages and for ourselves.

APPENDICES

APPENDIX A

QUESTIONNAIRE

STUDENT QUESTIONNAIRE: Fall, 1986

NAME____________ DEPARTMENT____________ TELEPHONE____________

AGE________ YEAR YOU WILL GRADUATE FROM COLLEGE ________ Sex M F

TUNGHAI P.O.BOX ________ ADDRESS ____________________

1.How many years have you studied English? ____________

2.Have you ever lived in a English-speaking country? yes no (circle one)

3.Did you have any English-speaking friends when you were younger? yes no

4.Outside of the normal high school instruction, have you had any special way of learning English? yes no

If you answered yes, explain____________________

5.Where did you attend middle school and high school?

____

6.Right now, do you read in English (outside of your normal study for class)? yes no If you answered yes: What do you read?____________

How long and how often? about______ hours per week

7.Have you studied any other foreign languages? ____________

8. I would like to arrange 2 interviews with you, at your convenience. When is the best time for you to come to a 2½hour interview?

First best time: M T W Th F time ________

Second best time: M T W Th F time________

9.On the chart below, please write your class schedule. When you have a class, write location (room and building) of the class.

	Monday	Tuesday	Wednesday	Thursday	Friday	Sat.
8:00						
9:00						
10:00						
11:00						
12:00						
1:00						
2:00						
3:00						
4:00						
5:00						
6:00						
7:00						

APPENDIX B

VISUAL SAME-DIFFERENT MATCHING MATERIALS

(INSTRUCTION SHEETS, PRACTICE ITEMS,
AND 3-PAGE MATCHNG TESTS FOR
NUMBERS, WORDS,
PSEUDOWORDS, AND LETTER STRINGS)

INSTRUCTIONS FOR NUMBERS MATCHING (1)

1. This is a practice page.

2. For this test, you will see two numbers together Look at the two numbers. Are they the same? If they are the same, circle the s. If they are different, circle the d. Circle one letter each time. Answer by going down, first on the left of the page, then the right.

EXAMPLES:

301 301	s	d

Here, you should have circled the s, because the numbers are the same.

401 491	s	d

Here, you should have circled the d, because the numbers are different.

3. You should read these numbers as quickly as you can. You will find out how much time you need to read all of them. When you finish the last numbers, I'll tell you how much time you took. Try to finish them as fast as you can without making any mistakes.

4. If you make a mistake, make an X and a new circle, like this: ~~s~~ d

5. Use the numbers below the line to practice answering quickly. Remember, answer down on the left, then down on the right. Start answering when I say "GO".

---

437 437	s	d	291 391	s	d
175 176	s	d	903 908	s	d
513 573	s	d	123 173	s	d
346 346	s	d	846 846	s	d

STOP! Find out your time. Then you will take the 3-page test.

1. 147
147 s d

2. 374
324 s d

3. 781
741 s d

4. 374
374 s d

5. 215
235 s d

6. 539
539 s d

7. 901
901 s d

8. 279
275 s d

9. 809
819 s d

10. 650
670 s d

11. 603
203 s d

12. 318
318 s d

13. 862
862 s d

14. 512
518 s d

15. 143
143 s d

16. 147
947 s d

17.	546 596	s	d
18.	137 137	s	d
19.	781 781	s	d
20.	901 902	s	d
21.	539 739	s	d
22.	603 603	s	d
23.	928 928	s	d
24.	368 368	s	d
25.	435 439	s	d
26.	794 794	s	d
27.	862 562	s	d
28.	254 254	s	d
29.	809 809	s	d
30.	279 279	s	d
31.	680 684	s	d
32.	976 176	s	d

215
215

318
618

420
820

143
140

928
908

420
420

137
187

512
512

33.	215 215	s	d	41.	435 435	s	d
34.	318 618	s	d	42.	254 654	s	d
35.	420 820	s	d	43.	650 650	s	d
36.	143 140	s	d	44.	368 361	s	d
37.	928 908	s	d	45.	546 546	s	d
38.	420 420	s	d	46.	794 793	s	d
39.	137 187	s	d	47.	976 976	s	d
40.	512 512	s	d	48.	680 680	s	d

NAME__________

INSTRUCTIONS FOR MATCHING TASKS 2-4

1.This is a practice page.

2.For this test, you will see two words together. Look at the two words. Are they spelled the same? If they are the same, circle the s. If they are different, circle the d. Circle one letter each time.

EXAMPLES: 1.courses courses s d

Here, you should have circled the d, because the words are spelled differently.

2.detlug detlug s d

Here, you should have circled the s, because the words are the same.

3.You should read these words as quickly as you can. You will find out how much time you need to read all of them. When you finish the last words, I will tell you how much time you took. Try to finish them as fast as you can without making any mistakes.

4.Use the words below the line to practice reading quickly. Start reading when I say "GO".

---

1. caught caught s d
2. slatch slutch s d
3. buring buling s d
4. mtula mtula s d
5. mating mating s d
6. cluht clumt s d
7. shouts shoots s d
8. could could s d

STOP! Find out your time. Then, when I say "GO", you will practice again on the next page.

1.	grass gries	s	d	7.	crams crams	s	d
2.	darim darim	s	d	8.	ufldb ufldq	s	d
3.	cluts bluts	s	d	9.	lcofv lcofv	s	d
4.	srmea srmea	s	d	10.	gleme glenè	s	d
5.	gtard gtacd	s	d	11.	arges arges	s	d
6.	aimed ailed	s	d	12.	charm charm	s	d

NAME________________

If you have any questions, please ask them now.

I will now hand out the real test. Remember, work as quickly as you can.

back lack	s	d	fact face	s	d
lost last	s	d	than then	s	d
home home	s	d	hold held	s	d
late date	s	d	mass mass	s	d
step step	s	d	they they	s	d
line fine	s	d	gave gave	s	d
some some	s	d	side size	s	d
find find	s	d	read real	s	d

must must	s	d	stop step	s	d
show show	s	d	last last	s	d
such such	s	d	fine find	s	d
wife wide	s	d	back back	s	d
will well	s	d	case care	s	d
care care	s	d	them they	s	d
feed feed	s	d	same some	s	d
home come	s	d	fact fact	s	d

read read	s	d	then then	s	d
date date	s	d	made make	s	d
miss mass	s	d	gave have	s	d
fine fine	s	d	size size	s	d
shot show	s	d	much such	s	d
held held	s	d	most must	s	d
will will	s	d	wide wide	s	d
feet feed	s	d	make make	s	d

NAME____________________

snep snep	s	d	hane hane	s	d
nake nade	s	d	shey shey	s	d
wilf welf	s	d	helb helb	s	d
cead coal	s	d	phan phan	s	d
keet keet	s	d	suth muth	s	d
vide vide	s	d	lize fize	s	d
tind tine	s	d	dafe dafe	s	d
munt mont	s	d	sare sase	s	d

comp comp	s	d	homp comp	s	d
jome jome	s	d	gane hane	s	d
thot thow	s	d	nade nade	s	d
bact lact	s	d	lafe dafe	s	d
misp masp	s	d	keed keet	s	d
gize gize	s	d	welf welf	s	d
dact dace	s	d	thow thow	s	d
lant lant	s	d	sase sase	s	d

shem shey	s	d
holb helb	s	d
masp masp	s	d
mont mont	s	d
phan phen	s	d
jame jome	s	d
muth muth	s	d
gide gize	s	d
lact lact	s	d
lont lant	s	d
vife vide	s	d
tine tine	s	d
cead cead	s	d
lize lize	s	d
snop snep	s	d
dace dace	s	d

NAME________________

depl
depl
s d

csra
csra
s d

bcak
lcak
s d

liwl
liwl
s d

ohst
ohsv
s d

eefd
eefd
s d

achk
mchk
s d

fnei
fnei
s d

htey
htem
s d

gvae
hvae
s d

iezs
iezs
s d

iwfe
iwde
s d

hmoe
hmoe
s d

aedm
aedm
s d

ltae
ltae
s d

nfie
nfie
s d

tpes tpos	s	d	lcak lcak	s	d
tnah tneh	s	d	sutm sotm	s	d
lnei fnei	s	d	aekm aedm	s	d
cfae cfae	s	d	eeft eefd	s	d
atrl atrd	s	d	dtae dtae	s	d
mchk mchk	s	d	sotg satg	s	d
iwde iwde	s	d	masv masv	s	d
gvae gvae	s	d	csra csra	s	d

sabm sabm	s	d	cfat cfae	s	d
sotm sotm	s	d	atrl atrl	s	d
liwl lewl	s	d	hmoe hmoe	s	d
ohsv ohsv	s	d	tpes tpes	s	d
dopl depl	s	d	nfid nfie	s	d
tneh tneh	s	d	sobm sabm	s	d
misv masv	s	d	htey htey	s	d
ieds iezs	s	d	satg satg	s	d

NAME ____________________

APPENDIX C

OUTLINE OF PROCEDURES

OUTLINE OF PROCEDURES DURING DATA COLLECTION

I. Session I (large group--2 1/2 hours)

A. Explanation of whole project

B. Consent forms filled out

C. Questionnaire

D. Listening test (45 min.-- omitted for English L1 group who could only be tested for 2 hrs.)

E. Vocabulary range test (30 min)

F. Grammar test (25 min.)

B. L1 reading test (30 min.)

II. Session III (individual testing--1 hour)

A. Discussion of background questionnaire

B. Introduction of tests for this session

C. Five timed matching tests (number, words, pseudowords, letter strings, synonym/antonym)

D. Four timed readings each followed by five comprehension questions

E. Feedback about scores on the tests from Session I

F. Questions from participants solicited

III. Session III (individual testing, 1-3 hrs.)

A. Reading of passage (timed)

B. Writing of recall from passage (20 min.)

C. Rereading passage to underline any confusing words

D. Writing of definitions of 15 key words plus any others identified by the individual as confusing

E. Beginning of taping

F. Guided rereading of passage, with questions about each confusing word

G. Follow-up questions about passage

H. End of taping

I. Writing of final definitions of words

J. Further questions solicited from participants

APPENDIX D

INSTRUCTIONS, PRACTICE ITEMS, AND TEST ITEMS

FOR MEANING (SYNONYM/ANTONYM) MATCHING

INSTRUCTIONS FOR SIMILAR AND OPPOSITE MATCHING (5)

1. This is a practice page

2. For this test, you will see two words together. Read the two words and think of their meanings. Do they have a similar meaning? If they are similar in meaning, circle the s If they have meanings that are exact opposites, such as IN is the exact opposite of OUT, then you will circle the d. If the words are not exact opposites, then they are similar in meaning.

EXAMPLES: cry
laugh s d

Here, you should have circled the d, because the words are opposites.

laugh
giggle s d

Here, you should have circled the s, because the words are not opposites, they are similar in meaning.

Now, try a few more examples. Read down from the left.

go
come s d

running s d
jogging

slowly
rapidly s d

funny
amusing s d

odor s d
smell

Here are the correct answers: go/come are d; running/jogging are s (even though they are not exactly the same, they are similar in meaning); slowly/rapidly are opposites, so d; funny/amusing are similar, so s; and the last pair, odor/smell, are also s.

3. Do you have any questions about how to do this

4. Remember, it is important to answer as quickly as you can. You will find out how much time you need to answer all of them. When you finish, I'll tell you how much time you took. Try to go as fast as you can without any mistakes.

5. Use the words on the next page to practice answering quickly. Read down the left side from top to bottom. Then read down the right side of the page. Star reading the words on the next page when I say "GO".

low high	s	d	glad happy	s	d
find locate	s	d	push pull	s	d
hurt injure	s	d	pants trousers	s	d
wide narrow	s	d	up down	s	d
aid help	s	d	late early	s	d

STOP! Wait to find out your time. Then, when I say "GO", start reading the words below this line

floor ceiling	s	d	ugly pretty	s	d
awful terrible	s	d	make build	s	d
well healthy	s	d	black white	s	d
after before	s	d	chief leader	s	d
long short	s	d	lovely beautiful	s	d

NAME ____________________________

If you have any questions, please ask them now.

I will now give you the real test. Remember to work as quickly as you can!

small little	s	d
sorrow sadness	s	d
easy difficult	s	d
joy happiness	s	d
birth death	s	d
send receive	s	d
never always	s	d
talk speak	s	d

weak strong	s	d
seat chair	s	d
lose find	s	d
above below	s	d
cheap expensive	s	d
rush hurry	s	d
lend borrow	s	d
near close	s	d

allow **permit**	**s**	**d**	**big** **large**	**s**	**d**
love **hate**	**s**	**d**	**day** **night**	**s**	**d**
top **bottom**	**s**	**d**	**right** **correct**	**s**	**d**
true **false**	**s**	**d**	**lift** **raise**	**s**	**d**
ill **sick**	**s**	**d**	**road** **street**	**s**	**d**
start **begin**	**s**	**d**	**full** **empty**	**s**	**d**
gift **present**	**s**	**d**	**tall** **short**	**s**	**d**
wet **dry**	**s**	**d**	**past** **future**	**s**	**d**

under
beneath s d

buy
sell s d

danger
safety s d

calm
quiet s d

boy
girl s d

clean
dirty s d

noise
sound s d

maybe
perhaps s d

sure
certain s d

end
finish s d

leave
enter s d

fast
quick s d

afraid s d
fearful

open
close s d

like
enjoy s d

forget
remember s d

NAME________

APPENDIX E

INSTRUCTIONS AND TESTS--GRAMMAR AND VOCABULARY

Instructions for Grammar Proficiency Test

1.Please put your name on the answer sheet.

2.Each item has 4 possible answers. Only one answer is correct. Choose the one you think is correct and mark the letter of that answer on your answer sheet.

3.There are 40 grammar items. You will have 25 minutes to finish. If you do not know the answer to an item, you should make a guess.

4. Here are two examples:

EXAMPLE A: You can't play the piano, ... you?

a. do b. can c. have d. are

The correct answer is b, "can". DO NOT MARK THIS ANSWER DOWN.

EXAMPLE B: None of our plants ..... during the cold weather.

a. died b. were died c. was died d. dead

The correct answer is a, "died". DO NOT MARK THIS ANSWER DOWN.

PLEASE DO NOT MAKE ANY MARKS IN THE TEST BOOKLET. Please do not turn to the next page until your instructor tells you to begin.

Grammar Proficiency Test

1. Only .... . is the winner of the Grand Prize.

   a one of girls   b. one of the girls   c. one of the girl   d. one of girl

2. The President ..... goes anywhere alone.

   a. almost seldom   b. seldom never   c. very seldom   d. not seldom

3. I don't know when I have had ..... as this one.

   a. such enjoyable vacation   b. such enjoyable a vacation
   c. so an enjoyable vacation   d. so enjoyable a vacation

4. ..... the weather gets better, we ..... be able to go tomorrow.

   a. Unless ... won't   b. If ... can't
   c. Should ... would   d. Since ... will

5. This article might be ..... interest to you and your friends.

   a. from   b. in   c. of   d. for

6. He certainly has a way of telling ..... stories.

   a. entertaining   b. entertain   c. entertained   d. entertainment

7. I wouldn't recommend ..... the office without telling the boss first.

   a. that anyone leave   b. anyone to leave
   c. anyone left   d. that anyone leaving

8. Look how long this grass is! I should get it ..... tomorrow.

   a. cut   b. cutting   c. cutters   d. cuts

9. Why don't you arrange ..... spend a week by the sea?

   a. for he   b. he for to   c. for him to   d. him to

10. I sometimes like to watch TV while ..... .

a. to be eat b. I eating c. eating d. eat

11. ..... worked for three hours without any rest, we decided to take a break.

a. To have b. Having c. Because d. Because of

12. The teacher didn't think he should write ..... that difficult topic.

a. under b on c. to d. concerned

13. He disliked exercise, but he made ..... three miles every day.

a. himself running b. that he ran c. himself run d. that he run

14. To be a good teacher, you need to have ..... .

a. patiences b. patient c. patience d. the patience

15. I invited some friends to come ..... the game tonight.

a. on over after b. up after at c. after over in d. at after over

16. Did you suggest ..... apply for work there?

a. he to b. him to c. that he d. for him

17. I ..... another way if I could have thought of one.

a. will be trying b. tried c. had tried d. would have tried

18. She cleaned up her desk, picked up her bag, and headed ..... the door.

a. over b. toward c. from d. at

19. It took me a long time to realize ..... I was in the wrong job.

a. but b. since c. if d. that

20. No one could tell us ..... .

a. he was where   b. where was he   c. where he   d. where he was

21. After ..... awhile, he had more strength to go on.

a. have sleep   b. having slept   c. had slept   d. he had sleep

22. She always wished she ..... a man instead of a woman.

a. had been born   b. be born   c. have been born   d. been born

23. I had lunch with the man .... had written the book.

a. whom   b. which   c. that   d. that which

24. We aren't walking ..... ; we are going to be late for the bus.

a. much fast   b. fast enough   c. enough fast   d. quite fast

25. He answered me immediately, so he must ..... what I said.

a. heard   b. hear   c. to hear   d. have heard

26. I think that ..... is the most difficult part of English.

a. pronounced   b. pronounce   c. pronunciation   d. pronounces

27. He is hoping ..... the money we need for our vacation.

a. us to earn   b. we to earn   c. that we earn   d. that us earn

28. It is often necessary ..... to work outdoors in bad weather.

a. for construction workers   b. of construction workers

c. for construction worker   d. of construction worker

29. Few students ..... the soccer games lately, ever since our team started to lose.

a. are attending   d. were attending   c. have been attending   d. had been attending

30. He was eager ..... his older brother.

a. for pleasing b. to please c. pleasing d he please

31. Could you please explain to me what ..... in that picture?

a. place taking b. take place c place is taking d. is taking place

32. ..... me in these old clothes, I would have died of embarrassment.

a. Noticed had they b. Had they noticed c. Had noticed they d. They had noticed

33. I had a number of opinions, but recently some of them ..... .

a. was changed b. are changed c. was changing d. have changed

34. ..... the water be boiled before we drink it?

a. Haven't b. Shouldn't c. Didn't d. Weren't

35. Some people think that California's wines are better than ..... .

a. that of France b. of France c. France d. France's

36. I like this coffee, but you should taste it so you can judge ..... yourself.

a. of b. on c. for d. with

37. ..... you need more supplies, you must obtain them by next weekend.

a. Should b. Could c. Ought d. Must

38. They arrived in this country exactly six months ..... today.

a. after b. ago c. since d. until

39. You have a beautiful home. Does anybody help you ..... your housework?

a. in b. at c. about d. with

40. Some people feel that ..... is not very different from animals.

a. man b. the man c. the men d. men

VOCABULARY TEST

Instructions:

On this test, you will see a sentence with a missing vocabulary word. Choose the best answer for each sentence. There may be more than one word that can fill the blank, so remember to choose the answer with the BEST meaning for the sentence.

After you write the letter of the answer on your answer sheet, you will also report how confident you are about your answer. For example, if you guessed, without any idea of what answer is right, you will circle 1. That means you have no confidence that you have chosen the right answer. But if you are completely sure of the answer, you will circle a 5. That means you know your answer is correct. If you're sort of sure, but not completely, circle a number between 1 and 5. You may circle any number from 1 to 5 to show how sure you are of your answer.

You may practice with the following examples:

EXAMPLE A. We drove from Taipei to Taichung in our new sports .... .

(A) plane (B) car (C) train (D) boat

EXAMPLE B. The teacher needed some ..... to write with.

(A) chalk (B) corn (C) class (D) corner

		GUESS				SURE
YOUR ANSWER SHEET will look like this:	A._____	1	2	3	4	5
	B._____	1	2	3	4	5

Now, fill in the answer sheet above. Write the letter of your correct answer in the blank space. Then, circle the number which shows how sure you are about your answer. DO YOU HAVE ANY QUESTIONS? RAISE YOUR HAND.

PLEASE DO NOT MAKE ANY MARKS IN THE TEST BOOKLET. You should mark all you answers on your answer sheet. First, write your name on your answer sheet. Then, when the teacher tells you, you may begin the 54 questions on this test. You will have 30 minutes to complete this test.

ANSWER SHEET--VOCABULARY

NAME________________

	GUESS				SURE
1.____	1	2	3	4	5
2.____	1	2	3	4	5
3 ____	1	2	3	4	5
4.____	1	2	3	4	5
5.____	1	2	3	4	5
6.____	1	2	3	4	5
7.____	1	2	3	4	5
8.____	1	2	3	4	5
9.____	1	2	3	4	5
10.____	1	2	3	4	5
11.____	1	2	3	4	5
12.____	1	2	3	4	5
13.____	1	2	3	4	5
14.____	1	2	3	4	5
15.____	1	2	3	4	5
16.____	1	2	3	4	5
17.____	1	2	3	4	5
18.____	1	2	3	4	5
19.____	1	2	3	4	5
20.____	1	2	3	4	5
21.____	1	2	3	4	5
22.____	1	2	3	4	5
23.____	1	2	3	4	5
24.____	1	2	3	4	5
25.____	1	2	3	4	5
26.____	1	2	3	4	5
27.____	1	2	3	4	5
28.____	1	2	3	4	5
29.____	1	2	3	4	5

	GUESS				SURE
30.____	1	2	3	4	5
31.____	1	2	3	4	5
32.____	1	2	3	4	5
33.____	1	2	3	4	5
34.____	1	2	3	4	5
35.____	1	2	3	4	5
36.____	1	2	3	4	5
37.____	1	2	3	4	5
38.____	1	2	3	4	5
39.____	1	2	3	4	5
40.____	1	2	3	4	5
41.____	1	2	3	4	5
42.____	1	2	3	4	5
43.____	1	2	3	4	5
44.____	1	2	3	4	5
45.____	1	2	3	4	5
46.____	1	2	3	4	5
47.____	1	2	3	4	5
48.____	1	2	3	4	5
49.____	1	2	3	4	5
50.____	1	2	3	4	5
51.____	1	2	3	4	5
52.____	1	2	3	4	5
53.____	1	2	3	4	5
54.____	1	2	3	4	5

1. Most people today are ..... of the benefits of regular exercise.

   (a) wise (b) alert (c) aware (d) sense

2. They put up a wooden ..... to keep people away from the construction area.

   (a) barrier (b) ballet (c) banquet (d) benefit

3. When you hurt a young tree, the ..... can still be seen many years later.

   (a) mull (b) scar (c) role (d) cord

4. The baby ..... behind the sofa while his mother was watching TV.

   (a) crept (b) crammed (c) craved (d) crushed

5. I love this sweater because it's so warm and ..... .

   (a) savory (b) fleecy (c) giddy (d) bubbly

6. Most people received small ..... on the body during childhood.

   (a) pores (b) cuts (c) aids (d) bits

7. The cat's ..... made a hole in one of her new stockings.

   (a) rag (b) tar (c) claw (d) waist

8. You can see the poor birds ..... about in the snow, looking for food.

   (a) hopping (b) swearing (c) waving (d) winding

9. When you go out in New York City, it's a good idea to ask someone to ..... you.

   (a) withdraw (b) command (c) accompany (d) guarantee

10. For many days, the explorers were hopeful, thinking to see their goal over the next .... .

(a) reign (b) rape (c) realm (d) ridge

11. When you are sitting, watch your ..... and sit up straight.

(a) postscript (b) precept (c) posture (d) premium

12. ..... enough, rich people never seem to have enough money.

(a) definitely (b) curiously (c) roughly (d) sharply

13. It is strange that some trees don't grow exactly ..... to the ground.

(a) perpendicular (b) rudimentary (c) interminable (d) tangible

14. He has ..... to be a boxer ever since he saw the movie about boxing.

(a) perspired (b) inspired (c) aspired (d) expired

15. I told the boys to put the wagon in the ..... .

(a) range (b) wave (c) crew (d) barn

16. His face looks like his mother's, but in coloring and height he takes ..... his father.

(a) in (b) for (c) with (d) after

17. ..... was difficult because of the large size of the wound.

(a) Ovation (b) Approximation (c) Seclusion (d) Reverberation

18. The crust of a pie should be crisp and ..... .

(a) flaky (b) lusty (c) beady (d) flashy

19. He was out of work for six months with a ..... illness.

(a) demanding (b) fasting (c) delayed (d) prolonged

20. The army decided to give him the Silver Cross because of his ..... during the Second World War.

(a) identity (b) galantry (c) beauty (d) anxiety

21. Your friend just ran out, saying that he would be back in a ..... .

(a) shine (b) burst (c) flash (d) light

22. The horse ..... across the field and disappeared into the forest.

(a) logged (b) steered (c) hovered (d) galloped

23. It is impossible to see any ..... in rice fields when they are covered with water.

(a) furrows (b) flurries (c) frontiers (d) fallacies

24. The old church roof seemed to ..... under the weight of the snow.

(a) swallow (b) puff (c) grasp (d) groan

25. He didn't exactly say that he would take the job, but he ..... it.

(a) remarked (b) implied (c) imposed (d) reassured

26. Our team tried to save the game in the last period, but it was a ..... attempt.

(a) vain (b) rural (c) grassy (d) tan

27. It's impossible to think about the war without feeling a lot of ..... .

(a) paddle (b) grief (c) brake (d) crab

28. He couldn't figure ..... how his bird had gotten out of the cage

(a) through (b) out (c) with (d) at

29. Everyone ..... their voices when the President entered the room

(a) shivered (b) gloved (c) hushed (d) winked

30. The tree branch ..... her face, leaving ugly permanent marks.

(a) frustrated (b) repudiated (c) lacerated (d) aspirated

31. She was afraid to ..... telephone numbers with the strange man.

(a) annoy (b) exchange (c) delay (d) occur

32. He won the school ..... this year for perfect attendance.

(a) trust (b) progress (c) budget (d) award

33. No one ever ..... a skinned knee or scraped elbow—you just put medicine on it.

(a) assumes (b) jumbles (c) manifests (d) sutures

34. John's mother ..... his report that school would be closed tomorrow, so she called his teacher about it.

(a) discouraged (b) directed (c) decided (d) distrusted

35. The company got lots of customer calls after they ..... the new toy in the paper.

(a) advertised (b) stabilized (c) individualized (d) realized

36. Their mouths ..... when he poured the pile of money out on the table.

(a) awed (b) gaped (c) fused (d) skidded

37. The wind sent the floating leaf ..... over the water.

(a) rusting (b) ripping (c) skimming (d) tagging

38. The writer summarized the history of the subject in the ..... of the book.

(a) bibliography (b) table of contents (c) preface (d) biography

39. Instead of ..... in the discussion, she preferred to sit and listen.

(a) participating (b) recovering (c) revolving (d) anticipating

40. After falling from his bicycle, he saw fresh drops of blood on his ..... leg.

(a) confronted (b) straggled (c) bandaged (d) integrated

41. It is always a ..... to get my car started on a cold day.

(a) stratum (b) starch (c) status (d) struggle

42. The blacksmith couldn't find a horseshoe to fit the horse's ..... .

(a) hoof (b) fist (c) thigh (d) oar

43. If you cut this rectangle ..... with a straight line, you will have two of them.

(a) virtually (b) perpetually (c) respectively (d) transversely

44. This ..... will include exploring two caves and climbing a mountain.

(a) expedition (b) occupation (c) accomodation (d) proposition

45. Last week she found out that her former teacher had passed ..... .

(a) in (b) up (c) away (d) back

46. We can't use this rope to tie up the dog because it's got too much ..... .

(a) commodity (b) elasticity (c) hierarchy (d) revelry

47. If you are going to court with this case, you should have a good ..... .

(a) clergy (b) manager (c) executive (d) attorney

48. I sat in some grease and got this ..... on my pants.

(a) stain (b) ditch (c) stitch (d) drain

49. The arm of the robot ..... as soon as it had finished the repair.

(a) retained (b) repressed (c) retracted (d) retrieved

50. The ..... of pictures on the wall looked strange.

(a) accountant (b) assistant (c) assignment (d) arrangement

51. Since she was no longer ..... , her son would carry her over to sit by the window.

(a) discrete (b) mobile (c) respective (d) candid

52. They always go to ..... resort by the sea for their vacation.

(a) an exclusive (b) an expository (c) a mortality (d) a crystal

53. We ask the priest to say a ..... for the succes of our cause.

(a) capsule (b) knot (c) fate (d) prayer

54. I wish the children wouldn't ..... the door every time they go out.

(a) slam (b) wrap (c) stoop (d) snarl

APPENDIX F

READING COMPREHENSION TESTS GIVEN IN L1

(IN CHINESE TO TAIWAN STUDENTS, IN ENGLISH TO AMERICANS)

READING TEST (English L1)

Instructions. Please put your name on the answer sheet. Your instructor will show you how to mark the answers on your answer sheet. Be sure you use the special pencil to mark your answers.

There are five reading passages, each with seven questions. Each question is worth one point. If you do not know the answer to an item, you should make a guess.

Here is a sample reading passage with two example items:

People everywhere enjoy eating good food, and New Yorkers are no exception. That is why New York has some of the finest restaurants to be found anywhere in the world. There are plenty to choose from, too. You could go out to eat every night for a year and never eat in the same restaurant twice!

EXAMPLE A: According to the passage, there are more than..... restaurants in New York.

a. 300 b. 500 c. 700 d. 1000

The correct answer is a, " 300 ". (A year has 365 days.) DO NOT MARK THIS ANSWER ON YOUR ANSWER SHEET.

EXAMPLE B: The word "plenty" in line 3 refers to ..... .

a. good food
b. anywhere
c. restaurants
d. New Yorkers

The correct answer is c, " restaurants ". DO NOT MARK THIS ANSWER ON YOUR ANSWER SHEET.

PLEASE DO NOT MAKE ANY MARKS IN THE TEST BOOKLET. Please do not turn to the next page until your instructor tells you that you may begin.

READING COMPREHENSION TEST

PASSAGE 1:

For thousands of years, we have been catching fish for food and getting salt from seawater. Today, we believe that the sea can give use even more—the answers to many of our problems. Perhaps that is why young people from all over the world are enrolling in ocean studies programs. They hope to find new ways to increase the world supply of food and mineral resources.

Many scientists think that the sea can give us an endless supply of food. In many countries, shrimp and oyster farms are already very common. Now, some scientists are teaching fishermen how to raise fish in ocean "fish farms", where they keep the fish safe and give them plenty of special food to eat. When they grow large enough to eat, the "fish farmers" catch them and sell them to restaurants. Other scientists are trying to grow special sea plants that people might even like to eat instead of vegetables.

We have been getting oil from wells under the sea for many years. Today, we are learning how to get important minerals from the sea also. Some minerals, such as magnesium and bromine, can be taken out of the seawater itself with special equipment. Other valuable minerals like copper and manganese are being taken from the bottom of the oceans. There may be enough mineral resources in the sea to supply our needs for hundreds of years.

The products of the sea have been important to Man since the beginning of history, but maybe we are just beginning to learn how much the sea can give us in the future.

QUESTIONS:

1. A good title for this reading passage would be ..... .
   a. How the Sea Can Help Us
   b. Getting Oil From The Bottom Of The Sea
   c. Raising Fish On "Fish Farms"
   d. Young People Study The Ocean

2. Fishermen can catch fish more easily on "fish farms" because ..... .
   a. the fish are kept in one place in the ocean
   b. the fishermen will sell them to restaurants
   c. the fish are always safe and hungry
   d. the fishermen feed the fish to make them grow larger

3. According to the writer, the reader might be surprised to find ..... for sale at supermarkets in the future.
   a. fish
   b. shrimp and oysters
   c. vegetables
   d. sea plants

4. The writer tells us that the sea can supply us with both food and minerals, but ..... .
   a. there are only a few oil wells under the sea
   b. the fish and other food from the sea will be gone first
   c. the supply of minerals from the sea will be gone first
   d. there are only a few products that we can get from the sea.

5. "Maybe we are just beginning to learn how much the sea can give us in the future." This sentence means that ..... .
   a. We are beginning to learn what the sea will be like in the future.
   b. We are going to learn the price of things that we can get from the sea.
   c. We don't know much yet about new products that we can get from the sea.
   d. The sea can give us things if we can begin to sell them.

6. According to the passage, we can find two kinds of minerals in the sea. One kind comes from the sea bottom, while the other kind ..... .
   a. comes from fish farms.
   b. is taken from sea water.
   c. is from a plant that grows in the sea.
   d. is like copper or manganese.

7. From this article, we know that there are young people who believe ..... .
   a. the sea might make them economically successful.
   b. the sea will supply the answers to our problems.
   c. mineral resources are more important than fish and sea plants.
   d. it is important to specialize in studying the sea.

PASSAGE 2:

The following article was taken from a 1974 newsletter on international educational exchange. The article brought an important issue to the attention of foreign student advisers and admissions officers, whose responsibility it was to study the new ruling and modify their office procedures in accordance with its restrictions.

"In September 1973, an important revision was made in the Foreign Affairs Manual of the U. S. State Department's Visa Office. It stated that an alien applying for a student visa has to establish that sufficient funds will be available to defray all expenses incurred during his entire period of anticipated study in the United States. Foreign student advisers and admissions officers in many U. S. institutions of higher education are now seeking to assess the impact of this unexpected change which affects all non-sponsored foreign students."

"Some of the rationale behind this new interpretation is valid. With costs high and chances for aid low, it is grossly unkind to allow a foreign student to come here on a wing and a prayer with little knowledge of how he will support himself. On the other hand, a strict"guarantee" policy would surely lead to a loss of tens of thousands of foreign students, including many of the most highly qualified ones. It would represent a response of total "overkill" to the financial problems of perhaps ten to fifteen percent of our foreign student population."

QUESTIONS:

8. The phrase"this unexpected change" (line 13) refers to ..... .
   a. the new efforts by foreign student advisers and admissions officers
   b. the period of time needed for study in the U.S.
   c. the foreign students who apply for visas
   d. the revised student visa requirements

9. The author thinks that the new student visa rule ..... .
   a. is partly justified
   b. is complete nonsense
   c. is too concentrated on students
   d. is not clear and needs restrictions

10. The expression "on a wing and a prayer" (line 17) means ..... .
   a. with inadequate resources and a lot of faith.
   b. prepared to meet the demands of the situation
   c. by means of some kind of aircraft or other transportation
   d. hopeful for the help of religious organizations

11. A "response of total overkill" (line 21) means ..... this situation.
   a. an answer which means life or death
   b. a point of complete control over
   c. an obvious over-reaction to
   d. an intelligent approach to

12. The revision in the Foreign Affairs Manual may result in ..... .
   a. higher costs to foreign students
   b. financial help to sponsored foreign students
   c. fewer non-sponsored foreign students
   d. a strict policy of anticipated study in the U.S.

13. The author believes it is not kind to allow students to come to the U. S. for study if they ..... .
   a. are not the most highly qualified ones
   b. have financial problems of ten to fifteen percent
   c. are aliens applying for a student visa
   d. don't have enough money to cover their expenses

14. The author guesses that the change in the visa requirements will prevent ..... from getting a student visa.
   a. at least 10% to 15% of new visa applicants
   b. all non-sponsored students
   c. the most poorly qualified foreign students
   d. most of the company-sponsored or government-sponsored foreign students

PASSAGE 3:

There is a story of the English scientist Michael Faraday that illustrates that most people do not believe a new discovery is of much value unless it has a clear and immediate application. Faraday was in his time an enormously popular lecturer as well as a physicist and chemist of the first rank. In one of his lectures in the 1840's, he illustrated the peculiar behavior of a magnet and a spiral coil of wire which was connected to a galvanometer that would record the presence of an electric current.

There was no current in the wire to begin with, but when the magnet was thrust into the hollow center of the spiral coil, the needle of the galvanometer moved to one side of the scale, showing that a current was flowing. When the magnet was withdrawn from the coil, the needle flipped in the other direction, showing that the current was now flowing the other way. When the magnet was held motionless in any position within the coil, there was no current at all, and the needle was motionless.

At the conclusion of the lecture, one member of the audience approached Faraday and said, "Mr. Faraday, the behavior of the magnet and the coil of wire was interesting, but of what possible use can it be?"

And Faraday answered politely, "Sir, of what use is a newborn baby?"

15. "...of what possible use can it be?" (lines 19-20). The pronoun "it" here refers to ..... .
 a. the magnet
 b. the new discovery
 c. the coil of wire
 d. Mr. Faraday's lecture

16. The author suggests that as far a scientific discoveries are concerned, the member of the audience who spoke to Faraday was ..... .
 a. like most people
 b. a physicist or a chemist
 c. like a newborn baby
 d. not interested in the lecture

17. A "galvonometer" can show ..... .
 a. if a needle is moving in response to a magnet
 b. a position within the spiral coil
 c. the number of circles in the spiral of a screw
 d. if an electric current is flowing in a wire

18. The author of this passage is probably ..... .
 a. a scientist
 b. a lecturer
 c. a poll-taker
 d. a medical doctor

19. The author used this story about Faradav to illustrate that most people do not ..... .
 a. understand how an electric current is produced
 b. care about new discoveries unless they are immediately useful
 c. see how useful a newborn baby is
 d. know about the behavior of a magnet and a spiral coil of wire

20. Which of the phrases below probably describes Faraday best?
 a. quite pedantic
 b. very generous
 c. very fast-thinking
 d. quick to become angry

21. The main point of Faraday's demonstration was that ..... .
 a. galvonometers are sensitive to magnetism
 b. magnets can cause electricity to flow
 c. coils can be shaped into spirals
 d. new discoveries always have great potential

PASSAGE 4:

We asked a well-known professor in the English Department of an American university about the writing ability of his beginning freshman students. This was his answer:

"Well, first of all, it's easy to criticize the poor writing skills of beginning freshmen. All of the national tests used in American high schools show that their vocabulary, their reading skills, and their general writing ability are not very good. In fact, these tests indicate their English language skills have been getting worse, rather than better. However, over the years, more students from the lower economic levels of society have been entering college. Instead of having at least one parent who has graduated from college, most of the new freshmen have parents who have not gone to college and in fact never even thought of the possibility.

Also, many of these students come from homes where standard educated English is not spoken and books are not read. Most of them would not have even tried to get into college 30 years ago, when I first began my teaching career. The language abilities of our present-day students from better academic backgrounds, the type of students who have always been successful in getting a college degree, have not changed very much. But the large numbers of non-traditional students that we see today have affected the national averages, because they are mostly basic writers who don't bring the same level of language skills to college.

QUESTIONS:

22. In line 21, the word "they" refers to ..... .
   a. non-traditional students
   b. the parents of students 50 years ago
   c. most writers
   d. most college professors

23. If a student is "non-traditional" (line 20), it means that ..... .
   a. he/she probably will not attend college
   b. he/she has had many bad habits
   c. he/she took the national test more than once
   d. he/she would not have attended college in the past

24. According to the professor, recent scores of American high school students on national English tests ..... .
   a. are beginning to increase
   b. have been lower than before
   c. have not changed
   d. have not been criticized

25. In lines 12-13, "the possibility" refers to ..... .
   a. knowing a fact which no one has thought of
   b. having at least one parent who has finished college
   c. going to an American College or university
   d. being parents who have not gone to college

26. According to the professor, thirty years ago most students from the lower economic groups ..... .
   a. were afraid to take national exams
   b. could not speak English well or read books
   c. were in college when he began teaching
   d. would not have tried to apply for college admission

27. The professor hinted to us that non-traditional students ..... than students from good academic backgrounds.
   a. have become more numerous at most colleges
   b. have smaller vocabularies and weaker reading skills
   c. are more in need of a college education
   d. have fewer problems getting admission to college

28. How would the professor probably have felt if a college student with a poor academic background came into his writing class thirty years ago?
   a. somewhat pleased
   b. too elementary
   c. quite surprised
   d. very hopeful

PASSAGE 5:

Campers from all over the U. S. will come to Michigan's upper peninsula this summer for a wilderness vacation. There, In peaceful forests they will find great hiking trails, and in the many lakes and streams, unparalleled angling. However, there is one thing they might find that they did not expect--the Michigan black bear.

The black bear has sometimes been called "the clown of the woods" because of its comic antics and seemingly friendly behavior. Portrayed by television as amiable oafs, these woodland denizens are, in truth, much different than that. While true that the vast majority of the big mammals will turn tail at the first sight or smell of a human, they definitely are not craven cowards. They are merely shy by nature, but, when grown accustomed to human contact, can readily overcome such reserve. When this happens, they run the risk of becoming "problem" bears, prime candidates for relocation or ultimate disposal.

Highly unpredictable and potentially dangerous, that mother bear with the adorable cub begging for food one moment may use her powerful claws to rip you up the next. Then again, she might just be content to have a couple of your fingers. The moral of this tale should be obvious to campers--do not feed the bears. Ever!

QUESTIONS:

29. Apparently, most people who visit Michigan's upper peninsula ..... black bears.
   a. expect to discover
   b. come to feed
   c. know little about
   d. watch television in order to see

30. Black bears have been called "clowns" because they ..... .
   a. often appear on children's television shows
   b. behave in a friendly manner toward campers
   c. often do funny things that amuse people
   d. are really different from the way that they seem

31. The author of this article stresses the idea that black bears ..... .
   a. in the wilderness usually grow accustomed to humans
   b. are not to be trusted, even when they seem friendly
   c. are often a problem if they run risks
   d. are able to see and smell people before the people see them

32. In line 12, the word "this" refers to some bears ..... .
   a. being naturally shy
   b. getting used to being with humans
   c. overcoming humans that they contact
   d. becoming accustomed to being reserved

33. The author of this article probably ..... "problem" bears.
   a. feels hatred for
   b. feels friendship for
   c. is very angry about
   d. is concerned about

34. The author says "the moral ...should be obvious" because ..... .
   a. many people are afraid of feeding bears, thinking they may be dangerous
   b. bears should not eat the same kind of food that humans eat
   c. it is against Michigan law to feed bears unless they are in a zoo
   d. common sense should tell us not to feed wild animals that could hurt us

35. Many people probably visit the upper peninsula in Michigan ...
   a. to have a comfortable vacation
   b. to learn about wild animals such as bears
   c. to enjoy a less civilized environment
   d. to go fishing and hunt bears

中文閱讀測驗

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本試題共有五篇短文，每篇各有七個問題。如果你不知正確答案，請以你認為最佳之猜測作答。

下面是一個例子：

任何地方的人都喜愛吃好東西，紐約亦不例外。這是為什麼紐約有一些世界上最精緻的飯店，且足夠由你隨意去選擇，你可以連續一年每晚出去吃飯，而不會走進同樣的餐館！

例A 根據上文，紐約有____家以上的餐館

a 300，b 500，c 700，d 1,000

正確的答案是a〝300〞（一年有365天），請不要將此題答案寫在答案紙上。

例B 第二行的〝足夠〞是指____

a 好吃 b 任何地方 c 餐館 d 紐約

正確的答案是c〝餐館〞請不要將此題答案寫在答案紙上

請不要在試卷上做任何記號，在老師未告訴你開始之前，請勿將試卷翻開。

幾千年來，我們由海中捕魚爲食並由海水提取食鹽。今天，我們進一步相信海洋所能提供的會更多——它將是我們很多問題的解決之道。也許這是爲什麼世界各地的科學人不斷的加入海洋研究行列。因爲他們希望能找到新方法來增加全球的食物供應及礦產資源。

很多科學家認爲海洋可以供應我們所需的食物。在不少國家，蝦和牡蠣養殖早已很普遍。現在，有些科學家正教導漁民如何在海洋的"漁業農場"中養魚。在魚場中，漁民可以照顧魚的安全並用以充足的特殊食料。等魚長大到可食用時，漁民便將它們捕撈出售。另有些科學家則嘗試讓人們可接受用來代替食用蔬菜的特殊海洋植物。

多年來，我們從海底油井中抽取石油。今天，我們正學習如何也從海中獲取重要礦產。有些礦產如鎂及溴，可以利用特殊設備由海水中抽取出來。另有些重要的礦產，如銅及鈷則取自海洋底部。海洋中的礦產資源可能足夠供應我們幾百年的需要。

海洋中的生物自有史以來對人類就很重要。不過，也許我們現在才正開始了解海洋在將來能供給我們多少東西。

57 這一段文章的適當標題可爲＿＿＿＿＿＿

a 海洋如何幫助我們　　b 自海底抽取石油

c 在"漁業農場"中養魚　　d 年輕人研究海洋

58 漁民在"漁業農場"比較容易捕捉魚，因爲＿＿＿＿＿＿

a 魚都集中在海洋的一處　　b 漁民將牠們賣給餐館

c 魚總是安全而又飢餓　　d 漁民餵養魚以使牠們長得更大

59 根據作者，在將來讀者可能會因爲發現超級市場出售＿＿＿＿而感到驚奇。

a 魚　　b 蝦和牡蠣　　c 蔬菜　　d 海洋植物

60 作者告訴我們海洋可以供應我們食物和礦產，但是＿＿＿＿＿＿

a 海底只有少數的油井　　b 魚蝦及其他海洋食物會先用完

c 海中礦產的供應會先用完　　d 從海洋中我們只能獲取鹽及植物

61 "也許我們現在才剛開始了解海洋在將來能供給我們多少東西"。這句話的意思是＿＿＿＿＿＿＿＿

a 我們正開始了解海洋在將來會是什麼樣子

b 我們將要知道我們由海洋中所得東西的價值

c 我們還不很清楚我們能從海洋獲得什麼新產品

d 海洋能給我們東西只要我們開始去出售它們

62 根據這段文章，我們在海中可以發現兩種礦產，一種來自海洋底部，另一種則

＿＿＿＿＿＿

a 來自魚類及蝦　　b 取自海水　　c 是從一種長在海中的植物

d 類似鋼或鐵

63 從這段文章，我們知道有些年輕人＿＿＿＿＿＿＿＿

a 希望海洋可以使他們致富　　b 知道海洋將來能解決我們的問題

c 相信礦產資源比魚和海洋植物更重要　　d 認為從事海洋研究是很值得的

下文摘自一篇1974年的國際教育交流週報，這篇文章把一些重要事件提出，以提醒專門研究新規章並修正辦事程序以配合規章限制的外國學生顧問及入學許可處理人員的注意。

「1973年9月，美國移民局為正式外籍學生手冊做了一項重要修正。它指定外國人士在申請學生簽證時須出示足夠財力證明以支付在美預期就讀時間的所有費用。許多美國高等教育機構之外國學生顧問及入學許可處理人員正設法評估這項意外的修改所可能帶給全部自費留學生的影響」

「這項新說明背後的部分理由是成立的，隨著生活費高漲而獎學金可能性銳減，任意讓一個外國學生"乘風破浪"的來此而本人卻毫無概念將如何養活自己，這是相當不人道的，但在另一方面來說，嚴格的"保証"政策必然導致損失成千上萬的外國學生，包括許多條件較好的，它將對大約僅佔百分之十到十五具有經費問題的外國學生表現出一種"趕盡殺絕"的反應。

64 第7行"意外的修改"是指____________

a 外國學生顧問及入學許可處理人員所做的新努力

b 在美就讀所需的時間增長

c 申請簽證的外國學生之經濟背景

d 修正後的學生簽證規定

65 作者認爲新的學生簽證規定____________

a 部分是合理的　　b 完全不合理

c 太過集中於學生　　d 不夠清楚、需加以澄清

66 第9行的"乘風折翼"意思是____________

a 財力不足但雄心壯志　　b 學生簽證對財務的要求

c 搭乘某種飛機或其他交通工具　　d 國家未能處理的幫助

67 第12行「"超越設想"的反應」是對這些情況的____________

a 事關生死之反應　　b 完全的控制

c 強烈的過度反應　　d 政治政策之改變

68 外國事務手冊的修正可能導致____________

a 提高外國學生的費用　　b 公費或公司資助之外國學生得到財力幫助

c 自費外國學生減少　　d 學生簽證時限的問題

69 作者相信讓學生來美就讀而強迫________，是不人道的

a 不是學業程度最好的　　b 有百分之十到十五的財力問題

c 沒有資助公司或保證　　d 無足夠金錢支付他們的費用

70 作者覺得簽證規定的修改將阻止________獲得學生簽證。

a 至少百分之十到十五的新簽證申請人　　b 所有的自費學生

c 經濟拮据的外國學生　　d 大部分公司或政府資助的外國學生

發生在英國科學家麥克法拉第身上的一個故事可以說明大多數人不但對新發現會有什麼價值沒有興趣，除非它具有實用而且能見功效。法拉第是他那個時代的著名實驗家及第一流的物理學家和化學家。在1840年代的一次演說中，他示範了磁石及連接在檢測電流存在的檢流計上的螺旋狀電線所發現的奇特現象。

在開始時，電線內並無電流，但是當磁石插入螺旋狀線圈的中空部位時，檢流計的指針就移到刻度表的一端，顯示電流在流動。當磁石自線圈抽出時，指針即移動到另一端去，顯示電流往反方向流動。但是當將磁石置在線圈內任何位置靜止不動，則完全沒有電流，指針也不動。

演說結束後，一位聽眾走向法拉第說：「法拉第先生，磁石和螺旋線圈的作用的確很有趣，但它究竟還有什麼用處呢？」

法拉第有禮貌的回答：「太太，一個剛出生的嬰兒能有什麼用處呢？」

71。……它究竟還有什麼用處呢？。（第10行），這裏的。它"是指________

a 磁石　b 這個新發現　c 螺旋狀線圈　d 法拉第先生的演講

72 作者暗示，就科學上的發現而言，與法拉第談話的這位聽眾__________

a 像大多數人一樣　b 是位物理學家或化學家

c 像剛出生嬰兒　d 對演說不感興趣

73。檢流計"可顯示__________

a 磁石上是否有指針在動　b 螺旋狀線圈的內部位置

c 螺旋狀線圈的線圈數目　d 電線內是否有電流的流動

74 本文作者可能是位__________

a 科學家　b 演說家　c 聽眾之一員　d 醫生

75 作者以法拉第的故事來說明大多數人並不__________

a 了解電流是如何產生的　b 關心新發現除非它們可以立刻派上用場

c 了解新生嬰兒的用處　d 知道磁石和螺旋狀線圈作用的現象

76 下列哪一句可能最適於形容法拉第？

a 很無聊　b 很勇敢　c 思想敏捷　d 容易生氣

77 法拉第的示範是指在＿＿＿＿

a 強光計對產生熱感　b 磁石可造成電的流動

c 電線可產生之交狀　d 新發現磁很有潛力

我們曾詢問一位著名的大學英文系教授有關他一班上學生的寫作能力，以下是他的答覆：

「首先，要批評大一新生的地方寫作技巧很簡單，在美國高中所做的所有全國性測驗顯示他們的字彙、閱讀技巧和一般寫作能力都不很好，不但如此，這些測驗甚至顯示他們的英語技巧只有愈來愈糟，而不是愈來愈好。以往大一新生的父母至少有一位是大學畢業的，但是近年來，愈來愈多的大學新生是來自經濟情況較差的家庭，這些學生的家長大多數沒上過大學，而且實際上根本就不會考慮過這種可能性。

同時，這些學生很多是來自不講標準英語，不閱讀書籍的家庭，在三十年前，我剛開始教書的時候，這樣的學生大都不會想要進入大學，在我們目前的學生當中，那些來自較佳的學術背景，也就是那些通常會獲得研究學位的學生，其語言能力改變並不多。但是，目前那些為數眾多的非傳統性學生卻影響了全體的水平，由於這些學生大多屬於初級寫作者，他們進入大學時自然無法具有同等的語言水平。」

78 第13行，「他們」是指＿＿＿＿

a 非傳統性的學生　b 三十年前的學生家長

c 大多數的寫作者　d 大學教授們

79 如果一個學生是「非傳統性的」（第12行），其意是＿＿＿＿

a 他也許不會上大學　b 他有許多不良的習慣

c 他至少考過二次全國性測驗　d 在過去，他是不可能上大學的

80 根據這位教授，最近美國高中生在全國性測驗所得的分數______

a 開始提高　　b 比以前低　　c 沒有改變　　d 沒有受到批評

81 第8行，「[illegible]可能性」是指______

a 知道一件沒人想過的事實　　b 至少有一位家長是大學畢業的

c 上美國的學院或大學　　d 當一名「不曾上過大學」的家長

82 根據這位教授，三十年前來自經濟狀況較差家庭的學生大多數______

a 害怕參加全國性測驗　　b 英文說得不好或甚至不會

c 已在上班，而他那時才剛開始教書　　d 不會嘗試申請大學入學許可

83 這位教授指示：非傳統性的學生比來自良好學術背景的學生______

a 上大學之人數更多　　b 字彙較少，閱讀能力較差

c 更需要大學教育　　d 申請入學許可的問題較少

84 三十年前，這位教授的寫作課如果來了一位學生是缺乏良好的學術背景，他可能會覺得______

a 有點沮喪　　b [illegible]太低　　c 相當驚訝　　d 很有希望

今夏將有來自全美各地的露營者至密西根北部半島度野外假期。那裏，在寧靜森林裏他們能找到隱僻的荒涼小區；在眾多的湖泊及河流中則有無比的垂釣勝地。然而，有樣東西卻可能是他們不曾預期的———密西根黑熊。

因為牠們滑稽的動作及看似友善的舉止，黑熊有時被稱為"林中小丑"。在電視上牠們常被描繪成和氣的溫順。但實際上，這些森林地的住民與之大不相同。雖然大多數的此種大哺乳動物的確會在見到或聞到人類時即掉尾逃逸，但牠們絕不是良善的懦夫，牠們只是天性害羞。只要習慣與人類接觸之後，牠們便能輕易克服此種內斂。這種情形發生時，牠們會成為問題熊之家，而淪為被遷置甚至·施以極刑的首要對象。

母熊是非常難以捉摸且可能很危險的。有一分鐘帶著可愛的小熊向你乞食的母熊，後一分鐘可能就用有力的前爪將你劈裂。但牠也可能只抓走你所提着雙心滿意足。這個故事的教訓對野營者還是很明顯的——不可餵食黑熊，絕對不可！

85 雖然大多數訪問密西根北部半島的人______黑熊

a 很關懷保護　b 想來餵食　c 不太知道　d 故意惹它以欣賞

86 黑熊被稱為"小丑"因為牠們______

a 常出現在兒童節目中　b 對野營者表現友好的態度

c 常做出令人發笑的趣事　d 實際上與外表看來不大相同

87 本文作者強調黑熊______

a 在荒野常常攻擊人類　b 即使在顯得很友善的時候也不可信任

c 在冬眠的時候常會成為問題　d 能夠在人類看見牠們之前先看見或嗅到人類

88 第8行的"這種情形"是指有些熊的______

a 天性害羞　b 習慣與人類接觸　c 攻擊牠們所接觸的人　b 喜於肉食

89 本文作者可能對"餵熊______"

a 感到厭惡　b 感到友善　c 非常生氣　d 相當關切

90 作者說"……教訓……還是很明顯的"因為______

a 許多人害怕餵黑熊，因為牠們很危險

b 熊不應該跟人類吃相同的食物

c 在動物園以外的地方餵熊違反密西根法律

d 從常識我們應知不可餵食可能會傷害我們的野生動物

91 許多人訪遊密西根北部半島的目的可能是______

a 享受舒適的假期　b 去了解像熊之類的野生動物

c 享受較原始的環境　d 獵熊及釣魚

APPENDIX G

INSTRUCTIONS, PRACTICE READING AND QUESTIONS, AND

FOUR READINGS AND QUESTION SETS FROM HENDERSON (1983)

NAME______________

INSTRUCTIONS FOR THE TIMED READING COMPREHENSION TESTS

This is a test of reading speed and reading comprehension. You will read some articles in English. As you read each article, I will keep track of your reading time. You should read as fast as you can, while still understanding the meaning of what you are reading.

Please tell me when you have finished reading each article. I will put the article away. Then I will give you a test to find out how much of the article you comprehended.

We will start with a practice passage. The title of the article is given at the top of the page.

Answer Sheet for the timed reading comprehension tests

(Write the letter of the correct answer in the blank space.)

Practice passage	Passage 1	Passage 2	Passage 3	Passage 4
1.____	1.____	1.____	1.____	1.____
2.____	2.____	2.____	2.____	2.____
3.____	3.____	3.____	3.____	3.____
4.____	4.____	4.____	4.____	4.____
5.____	5.____	5.____	5.____	5.____
________	________	________	________	________

ENGLISH READING COMPREHENSION TEST

PRACTICE PASSAGE: The Titanic

In an effort to produce the largest, fastest, and most luxurious ship afloat, the British built the Titanic. It was so superior to anything else on the seas that it was called the "unsinkable." The owners were so sure of this that they provided lifeboats for only 950 or its possible 3500 passengers. Many passengers were aboard the night it hit an iceberg. A fire also contributed to the ship's submersion. Panic increased the number of casualties as people jumped into the icy water or fought to get on the lifeboats. Four hours after the accident, another ship, the Carpathia, rescued the survivors--less than a third of those originally aboard. The Titanic enjoyed only two days of sailing glory on its first voyage in 1912 before plunging into 12,000 feet of water near the coast of Newfoundland, where it lies today.

ENGLISH READING COMPREHENSION TEST

QUESTIONS FOR PRACTICE PASSAGE

1.Which of the following statements is not true?
a. Only a third of those aboard the Titanic died.
b. The Carpathia rescued the survivors.
c. The Titanic sank near Newfoundland.
d. The Titanic was the fastest ship in the world in 1912.

2. Which of the following factors did not contribute to the large death toll?
a. Panic among the passengers.
b. A fire on the ship.
c. The speed of the ship.
d. Another ship, the Carpathia.

3. How many days was the Titanic at sea before it sank.
a. 2
b. 4
c. 6
d. 12

4. How many people could fit into the lifeboats?
a. 500.
b. A third of the passengers.
c. 950.
d. All of the passengers.

5. When did the Carpathia arrive?
a. Just before the accident.
b. Four hours after the accident.
c. Two days after the accident.
d. Forty-five minutes after the accident.

ENGLISH READING COMPREHENSION TEST

PASSAGE 1: Ecology

Ecology is the study of organisms in relation to their environment, including the interrelationships of many organisms themselves and their relationships with the non-organic environment. The total complex of relationships is called the "web of life." When the relationships among the fundamental components of the environment -- plants, animals, minerals, and water -- do not change much from year to year, we observe a balance of nature. When the balance of nature is disturbed, either by a geological change such as a change of climate, or a local agitation such as a fire, a period of rehabilitation must occur. The first life to appear, called pioneer flora and fauna, is temporary and is soon replaced. A series of transitional life forms successively appears, preparing the environment for the forms that will replace them. Eventually, a new balance is established. The final stage in the relationships of plants and animals in transitions, called a "climax association," tends to be stable for a long time. Interestingly, the climax association may not have the same kinds of plants and animals as were prevalent before the original balance was disturbed.

ENGLISH READING COMPREHENSION TEST

QUESTIONS FOR PASSAGE 1

1. What is the total complex of organic relationships called in ecology?
   a. The "period of rehabilitation."
   b. The "web of life."
   c. The "transitional flora and fauna."
   d. The "climax association."

2. Which of the following is not one of the fundamental components of the environment?
   a. Animals.
   b. Minerals.
   c. Fire.
   d. Water.

3. What is the principal characteristic of a balance of nature?
   a. There are equal proportions of the various components of the environment.
   b. Life forms are replaced by a series of transitional elements.
   c. Relationships among organisms are stable over time.
   d. Geological changes occur frequently.

4. Why is pioneer life important after a disturbance in the balance of nature?
   a. Because it prepares the environment for other forms of life.
   b. Because it is ecologically stable.
   c. Because it assures that life forms will be replaced with identical flora and fauna.
   d. Because it is the only life that will ever be able to grow under those conditions.

5. Which of the following statements is not true about a "climax association"?
   a. It is the final stage in the relationships of organisms in transitions.
   b. The same kinds of organisms as were prevalent before the disturbance reappear.
   c. The "climax association" tends to be stable for a long time.
   d. It represents a new balance of nature after an ecological disturbance.

ENGLISH READING COMPREHENSION TEST

PASSAGE 2: Mount Rushmore

Towering over the Black Hills of South Dakota at 6,000 feet above sea level can be seen the majestic and lifelike figures of four of the greatest presidents of the United States. Gutzon Borglum spent fourteen years carving these huge busts in Mount Rushmore as a lasting tribute to the country's leadership. Borglum began this monumental task in 1927 when he was sixty years old, a time when most men are preparing for retirement, and not for a lengthy project. Upon Borglum's death, his son continued the project until the funding ran out. Of the four presidents, George Washington's bust is the most prominent, looking as serious as we tend to think of him. Behind him is Thomas Jefferson, who has a friendlier appearance. Teddy Roosevelt is tucked off into the corner next to the last of the four, Abraham Lincoln, whose bust is the least complete. It is unbelievable that such a monumental masterpiece should sit in a now quiet area, once the scene of deadly battles between the Sioux Indians and the white man.

ENGLISH READING COMPREHENSION TEST

QUESTIONS FOR PASSAGE 2

1. Why was the work on Mount Rushmore finally discontinued?
   a. The sculptor died.
   b. The sculptor ran out of money.
   c. There were too many Indian attacks.
   d. The sculptor lost interest in the project.

2. Which of the following presidents is <u>not</u> represented on Mount Rushmore?
   a. Abraham Lincoln.
   b. Andrew Jackson.
   c. Thomas Jefferson.
   d. George Washington.

3. How old was Gutson Borglum when he died?
   a. 60 years old.
   b. 81 years old.
   c. 68 years old.
   d. 74 Years old.

4. Where is Mount Rushmore located?
   a. In the Black Hills.
   b. In the Rocky Mountains.
   c. In North Dakota.
   d. In Washington, D.C.

5. Which of the following statements is true?
   a. Gutson Borglum completed Mount Rushmore in 14 years.
   b. George Washington's bust has a friendly appearance.
   c. Abraham Lincoln's bust is not complete.
   d. Borglum carved Mount Rushmore in honor of the Sioux Indians.

ENGLISH READING COMPREHENSION TEST

PASSAGE 3: F. Scott Fitzgerald

There have been a number of important novelists in the United States in this century, but F. Scott Fitzgerald is one of the more interesting ones. Born in 1896, educated at Princeton, his novels describe the post-war American society very much caught up in the rhythms of jazz. In 1920, the same year that he published his first book, This Side of Paradise, he married Zelda Sayre, also a writer. His most famous book, The Great Gatsby, appeared in 1925. Fitzgerald had a great natural talent, but he was a compulsive drinker. A brilliant success in his youth, he never made the adjustments necessary to a maturing writer in a changing world. His later novels, All the Sad Young Men, Tender is the Night, and The Last Tycoon, were less successful, so that when he died in 1940 his books were out of print and he had been almost forgotten. His reputation is far greater now than it was during his lifetime, especially since the film version of his novel, The Great Gatsby, was released.

ENGLISH READING COMPREHENSION TEST

QUESTIONS FOR PASSAGE 3:

1. What does the paragraph say about F. Scott Fitzgerald's novels?
   a. That they describe the Jazz Age.
   b. That they describe life in the deep South.
   c. That they were based on Fitzgerald's war experiences.
   d. That they were written in a modern style.

2. Where did Fitzgerald study?
   a. Harvard College.
   b. Princeton University.
   c. Yale University.
   d. Boston College.

3. Which of Fitzgerald's novels was made into a movie?
   a. <u>Tender is the Night</u>.
   b. <u>All the Sad Young Men</u>.
   c. <u>The Great Gatsby</u>.
   d. <u>Zelda Sayre</u>.

4. According to the passage, which of the following is a true statement?
   a. Fitzgerald had little natural writing talent.
   b. Fitzgerald was a compulsive drinker.
   c. Fitzgerald's writing improved as he matured.
   d. Fitzgerald was able to adjust to a changing world.

5. When did Fitzgerald publish his book <u>This Side of Paradise</u>?
   a. In 1940.
   b. In 1925.
   c. In the same year in which he got married.
   d. In the same year in which he died.

ENGLISH READING COMPREHENSION TEST

PASSAGE 4: Groundhog Day

Why would anyone want to set aside a day to honor the lowly little groundhog? The answer to that question is not certain, but a group of people get together every February 2 in Punxsutawney, Pennsylvania, to watch "Punxsutawney Phil" leave his burrow. What Phil does next, many believe, will indicate whether spring will come soon or is a long way off. In Pennsylvania on this date there is usually a lot of snow on the ground, and the little animal has been hibernating during the long cold winter. He ate a lot during the autumn and then went into his burrow for a long sleep, his body fat helping keep him alive. When he emerges in February, he looks very thin. If the sun is shining and he sees his shadow, according to the legend, it scares him back into his home for another six weeks. But if it is cloudy, the little animal will wander around for food -- a sign that spring is near. While many believe in the groundhog's predictions, it is unwise to accept them as factual.

ENGLISH READING COMPREHENSION TEST

QUESTIONS FOR PASSAGE 4:

1. Why do many people gather every year to watch the groundhog?
   a. He's cute and playful, and children like to watch him.
   b. He's looking for food, and the people want to help him find it.
   c. Many people believe he can predict the arrival of good weather.
   d. The people want to be sure he is still alive after the long winter.

2. How does the groundhog manage to stay alive during the long winter?
   a. People take food to him.
   b. He lives on his stored body fat.
   c. He wakes up on sunny days and hunts for food.
   d. It is a mystery that people don't understand.

3. What does the groundhog look like when he wakes up in February?
   a. His body is very fat.
   b. His fur is long and wet.
   c. His eyes are bright and shiny.
   d. He looks very thin.

4. What does the groundhog do if the sun is shining?
   a. He returns to his burrow.
   b. He runs around to look for food.
   c. He lies down in the sunshine to get warm.
   d. He plays with the children.

5. According to the legend, what will happen if the groundhog does not see his shadow?
   a. Spring will arrive in six weeks.
   b. The snow will disappear very soon.
   c. The groundhog will go back into his burrow.
   d. The people will stay home for six weeks.

APPENDIX H

INSTRUCTIONS DURING THE WORD-LEARNING SESSION

INSTRUCTIONS FOR READING ON THE SECOND INTERVIEW DAY

This is a test of reading speed and reading comprehension. You will read part of a book chapter in English. As you read the passage, I will keep track of your reading time. You should read as fast as you can, while still understanding the meaning of what your are reading.

Please tell me when you have finished reading the passage to the word STOP. I will put the passage away. Then I will give you a test to find out how much of the passage you understood.

INSTRUCTIONS FOR THE SECOND INTERVIEW: AFTER READING

I. (After reading the passage)

This comprehension test requires you to do some writing. Imagine that you want to tell a friend about what you have learned from this reading. Write a composition explaining to your friend what you have read. Include as many details as you can remember.

You may have 20 minutes to write.

II. (After writing I above)

Now, I would like you to show me which words made you feel confused when you read the passage for the first time. Please look at the passage again and draw a line under any words which you didn't understand or which made you feel confused the first time when you read those words. Do not draw lines under whole sentences, just under the words which caused you to have difficulty in understanding what you were reading.

INSTRUCTIONS FOR THE SECOND INTERVIEW:
WRITING DEFINITIONS

Beside each of the following words, please write a definition in English. Your definition must explain the word's meaning in relation to the passage you just read.

Your definition should start with a general category, then give details.

Here are two examples:

1. fruit   Fruit is a kind of food. (general category)
Fruit is the part of a plant which contains the seed. It is usually sweet. We often eat it raw. An example is an apple. (details)

2. running   Running is a kind of body movement. (general category)
It is faster than walking. The legs change quickly and both feet leave the ground. One kind of running is jogging. (details)

Be sure to define the word in relation to the passage you just read. Each definition should include: (1) a general category ;
(2) an explanation of the word's meaning in the passage.

NAME________________

I. DEFINITIONS

Instructions: Beside each of the following words, please write a definition in English. Your definition must explain the word's meaning in relation to the passage you just read.
Your definition should start with a general category, then give details.

1. cuts: Cuts are a kind of ________________

2. lacerations: Lacerations are a kind of ________________

3. scarring: Scarring is a kind of ________________

4. mobility: Mobility is a kind of ________________

5. elasticity: Elasticity is a kind of ________________

6. furrows: Furrows are a kind of ________________

7. ridges: Ridges are a kind of ________________

8. transversely: Transversely is a kind of ________________

9. Langer's lines: Langer's lines are a kind of ________________

10. perpendicular: Perpendicular is a kind of ________________

11. retract: Retract is a kind of ________________

12. gaping: Gaping is a kind of ________________

NAME ________________

13. approximation: Approximation is a kind of ____________________

14. suturing: Suturing is a kind of ____________________

15. bandaging: Bandaging is a kind of ____________________

INSTRUCTIONS FOR THE SECOND INTERVIEW: REREADING

At the end of this interview, you will have a chance to make your definitions even better. But first, we will read and talk about the passage. After we have finished reading the passage again, you will have a chance to improve the definitions you have written here.

What we will do is this: You will read each paragraph of the passage silently. After you have finished reading each paragraph, you will go back and point out each word that you are still uncertain about. Then I will ask you questions about each difficult word in that paragraph.

While we do this, I will be running the tape recorder. This is so I won't have to spend time taking notes. I will tape-record our discussion of the passage so that I will have time now to listen carefully to your ideas..

Now, please read the first paragraph again silently.

GUIDED REREADING QUESTIONS

A. Questions about each problem word pointed out by student(text is present):

1.(reread the definition written by student if one is there)
Would you like to add anything to your definition here?
(If no definition was written, ask:
Please explain to me what you think this word means.)

2. How did you decide on that meaning?

3. Is there any information provided in the text that helps you?
(Insert word "other" if text has already been referred to; skip this question if text has already been referred to extensively in #2)

4. How important is this word for understanding the passage... very important / so-so / not at all Why?

5. If you were reading this in your room, what would you do about this word when you came to it? Why?

(For questions 4 and 5, only ask "why" if student does not give a reason.)

B. Questions to follow at the end of the paragraph-by-paragraph rereading(no text):

6. What is the main idea of this reading?

7. What do you think the writer is planning to discuss next?

8. Augmented clustering task: give student 13 cards, one key word on each.

   a. Which of these words can be grouped together? How are they related?

   b. (after groupings are complete) Are any larger groups possible? Why?

9. Please tell me what kind of wounds you would treat by suturing? Why?
   And what kinds of wounds would you treat by bandaging? Why?
   (If some important considerations in the text have been omitted, ask
   Does your decision to suture or bandage depend on anything else?)

II. Definitions NAME____________________

Instructions: Now you will have a chance to improve your definitions. Beside each of the following words, please write a definition in English. If your definition is the same as before, write only "same". If you want to add something, write "same + " and add on the new information. If your definition is totally new, just write your new category and details. This will show how much more you have learned from reading the passage again.

Be sure to define the word in relation to the passage. Each definition should include a general category and an explanation of the word's meaning in the passage.

APPENDIX I

WORD LEARNING PASSAGE AND LIST OF TARGET WORDS

WITH THEIR LEXICAL FAMILIARIZATIONS

From the book CHILDHOOD INJURY
Originally published by Stein & Day, reprinted
with permission of Scarborough House/Publishers.

2

Cuts and Lacerations—Do They Need Stitches?

Cuts, meaning smooth, clean slices through skin, and lacerations, which are jagged, rough tears of the skin, occur in a variety of sizes, shapes and locations. They usually heal, with or without help and with more or less scarring, if a reasonable amount of care and cleanliness is provided.

However, they will heal more quickly and with less scarring if the edges of the wound are brought together. How best to do this is the problem and an understanding of the properties of skin and how wound healing occurs will be helpful in solving it.

PROPERTIES OF SKIN THAT INFLUENCE HEALING

Mobility and Elasticity

Skin is both *mobile* and *elastic*. The mobility of skin is best demonstrated where it covers a joint. Consider the

skin of your wrist. As the wrist is cocked up and down, the skin moves considerably to accommodate the swing of the hand.

Look at your wrist closely. It has furrows or ridges which run transversely across the wrist. These are called Langer's lines. (Fig. 2-1) Because of the mobility of the skin, when it is cut in the *same* direction as these lines, the wound edges are easy to pull together and less scarring is apt to occur.

On the other hand, when skin is cut perpendicular to Langer's lines, the *elasticity* of skin becomes more obvious because the wound edges *retract* and even the most finely incised line becomes a gaping wound. As you will see below, the direction of a skin cut as it relates to Langer's

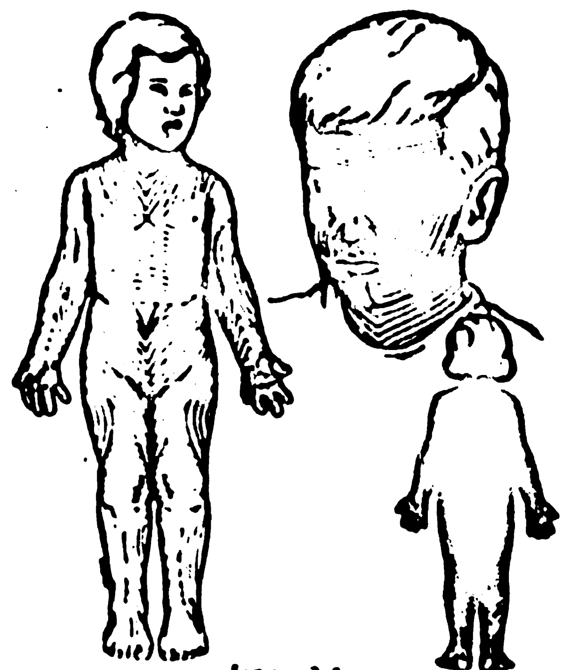

Figure 2-1

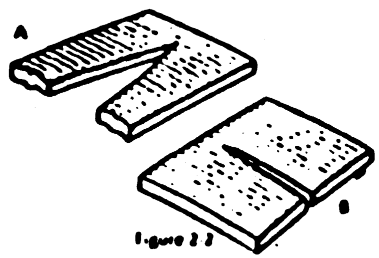

Figure 2-2

lines will influence how best to treat a cut or laceration (Fig. 2-2)

Wound Healing

Skin heals itself by filling its wounds with scar tissue. This process is accomplished from the depth of the wound up to the skin surface, just as you might fill in a deep rut in the driveway, from the bottom up. However, this is where the similarity ends.

The mobility and elasticity of skin allows us to move the edges of the wound closer together, so that there is less of a defect and therefore less tissue to be formed. Moving the skin together is easy; keeping it there while the wound heals is another story (Fig. 2-3)

Skin Approximation (Bringing Wound Edges Together)

The two most common methods of keeping wound edges together are suturing (stitching) and bandaging (taping). From time to time, other methods have been

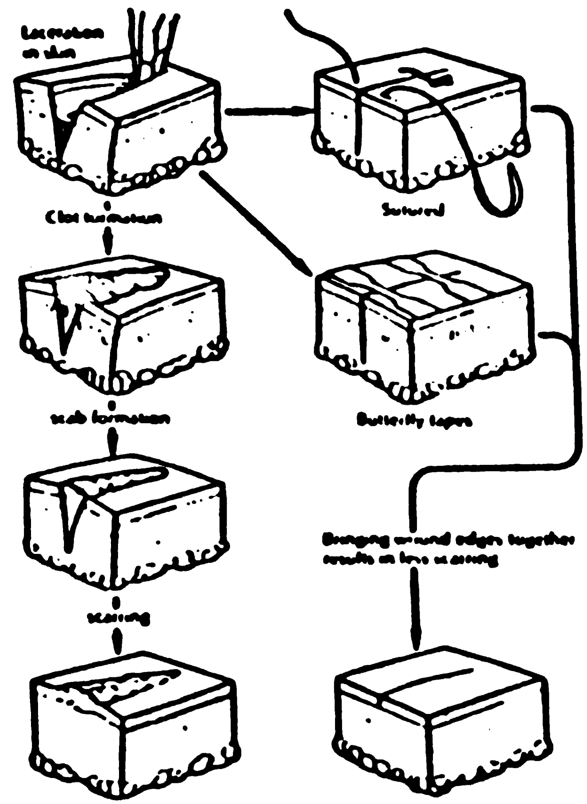

Figure 2-3

tried (staples, clips, etc.) but they have never found favor in this country.

Suturing requires professional care. It is necessary to sterilize the wound, use sterile needles, thread and instruments, and know what one is doing. This type of closure provides the best cosmetic result, with the least amount of scarring and the shortest healing time. But all wounds do not *need* to be sutured. As a matter of fact, I believe that some wounds should *not* be stitched.

The decision to sew or not to sew should be made after consideration of many factors. Let us consider these factors.

STOP!

Size and shape of the wound

... that is, they are longer than ... skin is cut, there usually is no ... of the cloth is there, it just ... wound is straight and clean it ... substitute for bandages rather than

... longer the wound, the more ... where to draw the line ... taping wound of the face ... such wound of the lower ... able to taping.

... ugly, irregular or have ... should probably have ... will usually need to be ... (ers) to improve their ... approximation easier

Figure 2

Some wounds are cut or torn in such a way as to raise a flap of skin, almost completely separate from the body, save for a small bridge of tissue. If the blood supply to the flap has been seriously compromised, the flap may turn very dark, or even black. The best treatment for this type of wound is to have professional care. If the flap is hopelessly devoid of blood supply, it should be removed and the wound revised in such a way as to allow skin closure. If not, sutures will usually be required to give the flap the best possible chance to live.

Orientation to Langer's Lines

As mentioned earlier, lacerations that run in the same direction as Langer's lines heal more readily than those that run across the lines. This will be obvious because of the degree of gaping. Most wounds that gape considerably require stitches, though again, other factors need to be considered.

Appendix I: Key words to be defined
before and after the guided rereading

WORD	SOURCE(S) OF LEXICAL FAMILIARIZATION
1.cuts	definition (to be reworded by researcher, omitting parentheses, as follows:", meaning smooth, clean slices through skin,") p. 42 illustrations pp.44, 45
2.lacerations	definition (to be reworded by researcher, omitting parntheses, as follows: ",which are jagged, rough tears of the skin,") p. 42 misleading illustration p.45
3.scarring	explanation and analogy, p. 44 illustration p. 45
4.mobility	demonstration by example, pp. 42-43
5.elasticity	vague explanation through its consequences, p. 43
6.furrows	paraphrase "ridges", p. 43 illustration p. 43 and p. 44
7.ridges	paraphrase "furrows", p. 43 illustration p. 43 and p. 44
8.transversely	vague clue "across" p. 43 illustration p. 44 misleading illustration p. 43
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