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BOOK REVIEWS

Psycholinguistic Implications for Linguistic Relativity: A Case Study of Chinese. By Rumjahn Hoosain. Hillsdale, NJ: Lawrence Erlbaum Associates, 1991. 198 pp. $27.50

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The content, and indeed the title, of this book brings back to us an old and well-known theory – the Sapir-Whorf hypothesis: that language influences thought and determines the world view of the speaker (Whorf, 1956). Rumjahn Hoosain proposes that "unique linguistic properties of the Chinese language, particularly its orthography, have implications for cognitive processing".

Although it does not seem to be his intention to revive the Sapir-Whorf hypothesis in its original form, Hoosain clearly displays his desire to salvage the theory through extension or revision. This is demonstrated by his remark in Chapter 1 that "the influence of orthography on cognition, particularly the influence of the manner in which the script represents sound and meaning, was not originally recognized in the work of Sapir and Whorf". Thus, Hoosain seems to be trying to keep the spirit of the Sapir-Whorf hypothesis alive while applying it more specifically to the effect of the orthography and particularly to the case of Chinese. This effect is, as he describes it, "more in terms of the facility with which language users process information, and the manner of information processing". Therefore, "such language effects matter more in data-driven or bottom-up processes rather than in conceptually driven or top-down processes".

Though not a large volume (198 pages), the book covers an impressively large number of psycholinguistic studies related to the Chinese language[1] and orthography, especially

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[1] Linguistically, Chinese is actually a large language family consisting of many mutually unintelligible languages. However, because the same writing system is used by the whole Chinese speaking community in China, and because of the close cultural ties among the Chinese people as well as the centralized political traditions, the Chinese languages are often considered dialects of a single language.

those presented at five conferences held in Taiwan and Hong Kong in the last dozen years. The reviews of those studies are spread over six chapters in the book, including an introduction in Chapter 1 and a conclusion in Chapter 6. The second chapter provides an introduction to general aspects of the Chinese language; and the third, fourth, and fifth chapters focus on, respectively, perceptual, memory-related, and neurolinguistic aspects.

Orthography

Chapter 2 provides background information about the Chinese language, especially about its orthography. This chapter is necessary because there have been many myths and misconceptions about Chinese and its orthography that need to be clarified. Hoosain's description of Chinese, in general, is reasonable. However, there are certain remarks that are misleading and are still characteristic of common misunderstandings.

In 2.3, for example, Hoosain states that "a small percentage of characters convey meaning by pictographic representation, either iconic or abstract", though he qualifies this by noting that "whereas these pictographic characters have an etymology related to pictures, this relation is unlikely to have psychological reality in present day usage". The critical issue here is the use of the phrase "convey meaning by pictographic representation". What a character in Chinese represents is a linguistic unit, in the case of the character for *niao3*[2] ("bird", used by Hoosain as an illustration of pictographic characters), a monosyllabic word. The word is a unit in the language – an entry in the lexicon. A lexical entry carries meaning, whereas a character is nothing but a visual symbol created and used to refer to a lexical item. The character by itself carries no meaning whatsoever. It conveys meaning only through its reference to the linguistic unit it represents. Thus, the character for *niao3* conveys the concept of "bird", not because it has the shape of a bird (otherwise, any picture of a bird would do), or because it is associated with the idea "bird", but because that shape is agreed by convention of the Chinese literate community to refer to a spoken word with the pronunciation */niao3/* (in present day Mandarin), which in turn refers to the concept of a feathered animal usually with flying ability.[3] On the other hand, real pictures of birds, whether vivid or sketchy, although they may well convey the meaning of bird directly, are not part of the orthography, and thus are completely different entities from the bird-shaped character for the word *niao3*. The character for *niao3* is (or has been) "pictographic" only in the sense that it was created by depicting the shape of a bird, and the pictographic structure of the character may have served as a mnemonic for the word. So, what can never be overemphasized is the fact that the bird-shaped character represents a *linguistic* unit – the spoken word for 'bird' in Chinese. Therefore, a more accurate definition

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[2] The number 3 at the end of the spelling indicates the tone of the syllable.

[3] Incidentally, but perhaps more importantly, there are many different shades of meanings attributed to this word, as is the case with almost all the words in any language. This quality is apparently lacking in any true picture of a bird.

for so-called pictographic characters would be: They are characters created to represent spoken names of objects by depicting the visual pattern of the object the spoken names refer to. The shapes of the characters, when they are still reminiscent of the object the corresponding spoken words refer to, can be used as mnemonics for the spoken words.

In 2.5, while rejecting as a misconception the claim that characters in Chinese are logograms in the sense that each of them represents a whole word, Hoosain insists that "the meaning of a character is represented by the character directly, not mediated by sound symbols, and a syllable is indicated as a whole rather than spelled out, as in alphabetic languages". There are two confusions in this statement. First, as discussed above, Hoosain takes orthographic symbols as the meaning-carrying units by themselves. Second, by stating that "a syllable is indicated as a whole rather than spelled out", Hoosain sounds as if phonemes were the only possible meaningless linguistic units that can be represented by orthographic symbols. Apparently, Hoosain does not realize (or often forgets) that syllables are also meaningless units that can be used to construct (i.e., to spell) meaningful morphemes and words, and it is the syllable sign that is the basic graphemic unit in the Chinese orthography (DeFrancis, 1984, 1989; Mattingly, in press). Instead, Hoosain takes the characters as the smallest graphemic unit in the Chinese writing system. As pointed out by DeFrancis (1989), the basic graphemes in Chinese are characters that singly represent whole syllables. They may themselves constitute frames, i.e., graphic units that are separated by white spaces in writing, or combine with other nonphonetic elements to form more complex characters constituting frames. Those graphemes, i.e., characters that provide phonological values when combining with other graphic elements to form other characters, are usually called phonetics, or phonetic radicals.

In his discussion in 2.4, Hoosain reports that there are about 800 phonetics in Chinese, and about 90% of Chinese characters are phonetic compounds. But in the discussion that follows, he belittles the function of the phonetics in Chinese orthography by emphasizing the irregularities and unreliabilities of their phonetic values, and by citing studies that show the semantic cueing function of the radical to be greater than the phonemic cueing function of the phonetic. It is not made clear by Hoosain what exactly is meant by "cueing function" in the unpublished study he cites. The other two studies (Yau, 1982; Peng, 1982) Hoosain cites show that semantic radicals tend to be located at the left or the top of the characters, "Because", Hoosain argues, "character strokes tend to be written left to right and top down, the beginning strokes therefore are more discriminative". Being more discriminative, however, is different from being more crucial. As a matter of fact, the common use of the word 'determinative' to refer to the semantic radicals in Chinese characters implies that their function is to help distinguish between characters that are otherwise homophones because they share the same phonetic radical. The premise here is that the phonological values of the phonetic radicals are already being used to the fullest possible extent. Of course, there do exist many irregularities and unpredictabilities in the phonological values of the phonetic radicals in Chinese. What is wrong in Hoosain's account of the Chinese orthography is that he is using those irregularities to deny the basic organization principles in the construction of the characters. This is like denying the phonemic principle in the construction of English words merely because there are tremendous irregularities in the letter-phoneme correspondence.

Psychological studies of languages and reading can not and should not be totally independent of the knowledge gained over the years about the basic principles of language and speech and of writing systems. Hoosain's failure to fully appreciate those principles is reflected in his view that Chinese characters represent both meaning and sound directly, which is best illustrated in the diagram on page 12 of his book:

$$\begin{tikzcd} & & \text{sound} \\ \textit{Chinese:} & \text{sign (script)} \arrow[ur] \arrow[dr] & \\ & & \text{meaning} \end{tikzcd}$$

$$\begin{tikzcd} \textit{English:} & \text{signs (script)} \arrow[r] \arrow[rr, dashed, bend right] & \text{sound} \arrow[r] & \text{meaning} \end{tikzcd}$$

Notice here his ambiguous use of the words 'sign' and 'sound'. Apparently, by 'sign' he means letters for English but characters for Chinese. By 'sound', he seems to mean phonemes for English but syllables for Chinese. As discussed above, while letters and letter combinations representing phonemes are the smallest graphemic units in English, characters are not the smallest graphemic units in Chinese. The smallest graphemic units in Chinese are the phonetic radicals in characters.[4] So, it is the phonetic radicals that map onto syllables directly (although no more accurately than letters map onto phonemes in English), not the characters. Likewise, it is the morphemes that characters map onto, not sound.

As we will see, the confusion in the understanding of the linguistic and orthographic aspects of the Chinese language is bound to affect Hoosain's interpretation of the studies he reviews.

Perception

Chapter 3 reviews studies concerned with perceptual aspects of the Chinese language. The conclusion reached by Hoosain in this chapter is that "the distinctive configuration of the Chinese script as well as its script-sound and script-meaning relations can differentially affect perceptual processes, compared with similar processes in English". The effects include: "(a) lack of acuity difference for characters arranged in different orientations; (b) preference of direction of scan according to language experience; (c) the individuality of constituent characters of disyllabic words in some situations; (d) the more direct access to meaning of individual words, although access to sound could require a different effort due to the lack of grapheme-phoneme conversion rules; and

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[4] A Chinese character is typically composed of a phonetic radical and a semantic radical. Sometimes there is more than one semantic radical in a character, and sometimes there is no semantic radical at all. When the latter is the case, however, it is usually said that the character is a nonphonetic compound. This name is misleading since the whole character by itself represents a syllable, and thus is no less phonetic than a phonetic radical in a compound character.

(e) the variation in eye movements in reading connected with different manners of reading". Due to lack of space, and because they are not essential concerns in the study of reading, the first two effects and the last effect will not be discussed in this review. The only thing that needs to be pointed out is that letters in English and characters in Chinese are at different levels of linguistic representation in the two orthographies, and, therefore, cannot be equated. In other words, differences found between the two may not always unambiguously point to critical differences between the reading mechanisms of the two languages.

When discussing the size of perceptual units in reading, it is essential to make sure the units being discussed are unambiguous. That is to say, when characters are referred to, we should not sometimes mean words and sometimes morphemes, and we should not equate them with other units, say, letters. This is not always easy, because in Chinese morphemes and words often coincide. This difficulty, however, makes it all the more important for a reviewer of reading studies to watch out for dubious hidden assumptions ignoring this distinction, and for flawed designs as well as improper interpretations based on those assumptions. This is, however, exactly what Hoosain often fails to do as a reviewer.

For example, in his discussion of the study by Cheng (1981) on word superiority, Hoosain concludes that characters in disyllabic Chinese words have more perceptual salience than letters in English, and he calls this phenomenon a "contrast between the two languages". As discussed above, characters in Chinese correspond to morphemes, and morphemes are the smallest meaning carrying units in languages. Letters in English, however, correspond to phonemes, i.e., the smallest distinctive segments in speech, though the correspondence is often inconsistent. Phonemes do not carry meaning by themselves. They have to combine with other phonemes to form meaning-carrying morphemes. So, perceptual differences found between characters in Chinese and letters in English should be regarded as a reflection of the differences between the two types of linguistic units tested, rather than as an indication of any true difference between the psycholinguistic processing of the two languages.

Liu (1988) found that a Chinese character standing alone was named as fast as the same character occurring as a constituent in a two-character word. In contrast, a simple word in English, such as *air*, is named slower in isolation than as a constituent of a compound word, such as *airways*. Hoosain interprets these findings as an indication that "constituent characters of Chinese words are handled somewhat independently, rather than as integral parts of words". However, there are several problems with Liu's study. First, Liu did not mention whether the constituent characters of his Chinese stimuli could also function as words by themselves. (No sample list of the Chinese words used was provided.) Second, neither word frequency in English and Chinese nor character frequency in Chinese was controlled in the study, which makes any differences found between naming latencies of compound words and their constituents suspect. Third, native speakers of Chinese who had also learned to speak English were used as subjects for both Chinese and English. This use of non-native speakers of English for reading English in comparison with native speakers of Chinese reading Chinese is problematic. Fourth, as Hoosain points out himself, the English compounds like *baseball* were all presented with a hyphen in the middle, no matter whether they are conventionally printed that way or not. There is no telling what effect this arbitrary manipulation may have had. So, the results of this study as evidence of "another difference between Chinese and English" are inadequate.

In summarizing the section on perceptual units, Hoosain concludes that "particularly in cases where component characters are simple and highly familiar, or when individual characters have to be pronounced, there is some degree of individual salience for these characters that is not likely to be found in the case of bound morphemes in English. This individual salience has to do with the character as sensory unit". While the statement about the salience of individual characters may be true to a certain extent, the comparison between characters in Chinese and bound morphemes in English is inappropriate. In Chinese, most of the high frequency characters can function as monosyllabic words by themselves. Of the 1185 characters with frequency of occurrence of 100 or higher per million characters, only 44, i.e., 3.7%, cannot function as monosyllabic words (Wang, Chang, Li, Lin, Liu, Sun, Wang, Yu, Zhang, and Li, 1986). The only comparable situation in English is in cases where words are also used as constituents in compound words. But the only study Hoosain cites that made this comparison is flawed. Without better evidence, therefore, the best conclusion that can be drawn about this matter is that further studies are needed.

In the discussion in 3.3 on getting at the sound of words in Chinese, Hoosain insists that "the only way to get at the sound of Chinese characters is through lexical information, whether directly or indirectly". His major argument is that in Chinese characters, "the phonetics are characters on their own, and their own pronunciations have to be learned on a character-as-a-whole-to-sound-as-a-whole basis and not through grapheme-phoneme conversion rules". Here Hoosain seems to confuse the difference in level of representation of speech sound with the presence or absence of grapheme-speech-sound correspondence. The lack of grapheme-phoneme correspondence in Chinese does not mean the lack of grapheme-speech-sound correspondence altogether. Graphemes in Chinese correspond to speech sound at the level of the syllable (DeFrancis, 1989; Mattingly, in press). This correspondence is not one to one, but neither is the correspondence between letters and phonemes one to one in English. This confusion between levels of representation and existence of grapheme-speech-sound correspondence determines Hoosain's bias when reviewing studies on phonological access in reading Chinese.

In examining studies on naming latency for characters, Hoosain focuses on Seidenberg (1985). In that study, it was found that naming times were faster for phonetic compounds than for non-phonetic compounds, but only for low frequency characters and not for high frequency characters. Seidenberg also did a parallel study with English, in which he found that words with exceptional pronunciations were named slower than those with regular pronunciations. But again, this was found to be true only for low frequency words. Seidenberg took these results to mean that, for both Chinese and English, access to the pronunciation is through the lexicon for high frequency words and through grapheme-to-sound conversion for low frequency words.

Judging from the example given in Seidenberg's paper, there are problems in the material he used in his Chinese experiment. Both of the so-called nonphonetic compound characters can be used as phonetic radicals in many other characters. So, they are in principle also phonetic compounds, except that their semantic radicals are nil. Besides, Seidenberg did not control the frequency or the phonological consistency of the phonetic radicals used in his study. Those problems makes Seidenberg's finding questionable.

Hoosain also notices some of the above mentioned problems in Seidenberg's study, but he questions the results from a different direction. He argues that access to whatever phonological information is provided by the phonetic radicals in Chinese cannot be compared to grapheme-phoneme conversion in alphabetic languages. And he raises an intriguing question: "How can it be argued that access to the sound of such nonphonetic compounds (when they stand alone) is through lexical information, but access to the sound of phonetic compounds (which are actually made up of these same nonphonetic compounds now acting as phonetics) is through graphemic-to-phoneme conversion? After all, how is the sound of these phonetics arrived at in the first place?"

While this question is well posed, Hoosain's answer is problematic. He insists that access to the pronunciations of all the characters in Chinese is through the lexicon, either directly or indirectly. This would imply that the naming latency should be the same whether the phonetic radicals have consistent or inconsistent phonological values in the characters that they are part of. However, this prediction does not agree with the findings by Fang, Horng, and Tzeng (1986), which is also mentioned by Hoosain. They demonstrated that high consistency in pronunciation shared among characters with the same phonetic radical facilitated naming latency for simple characters as well as for compound characters and pseudocharacters. This consistency effect was shown to be comparable to a similar effect found in naming latency for English words (Glushko, 1979).

Another phenomenon taken seriously by Hoosain is the minor finding by Seidenberg (1985) that the overall naming latency was much slower for his Chinese subjects than for his English subjects. Hoosain takes this as an indication that phonological access in Chinese is slower than in English. It is not noticed by Hoosain, however, that the English subjects Seidenberg used were college students, whereas the Chinese subjects he used were described only as native Cantonese. This makes one wonder what their educational backgrounds were and even how much reading experience they had had. Undoubtedly, these factors would have effectively influenced their naming latency.

To summarize the discussion of getting at the sound of words, there is so far no solid evidence for Hoosain's view that phonological access for characters in Chinese is solely through the lexicon. The studies by Seidenberg (1985) and by Fang *et al.* (1986) suggest that more evidence for the use of phonetic components in characters in getting at the sound of characters is very likely to be found.

In 3.4, *Getting at the Meaning of Words,* Hoosain claims to have found evidence that getting at the meaning of Chinese characters is more direct than is the case with printed words in alphabetic writing systems. At the outset, Hoosain rightly warns the reader to bear in mind that "spoken language is prior to written language. . . Therefore sound-meaning relation is prior to script-meaning relation, giving rise to the question of the need for phonological recoding before access to meaning". By "prior", however, Hoosain means the order in historical development, both for human languages in general and for individual speakers of a language in particular, leaving plenty of room for the actual reading process to either involve or not involve so-called phonological mediation. This leads to the next question he asks, namely, "whether phonological recoding is involved to a different extent depending on the nature of the orthography". So, it follows, according to Hoosain, that "if the script primarily represents sounds of the language, script-meaning relation may not be so direct, and getting at the meaning more likely may be mediated by phonological recoding".

With these questions in perspective, Hoosain presents several studies he thinks show a more direct connection between script and meaning in Chinese than in alphabetic orthographies. The first series of studies involve the famous Stroop phenomenon. Stroop (1935) found that when the name of a color was written in ink of another color, it took subjects longer to name the color of the ink than it took them to name the colors of ink patches. This phenomenon was taken to mean that somehow it is unavoidable to process the meaning of the printed words even when the task is to attend to the color of the ink. This explanation, however, is questionable, since the phenomenon can also be understood as an indication that it is somehow unavoidable to process the *pronunciation* of the printed words, thus slowing down the naming process when there is disagreement in pronunciations between the printed color name and the color of the ink. With this alternative explanation, the even greater Stroop effect for Chinese color names found by Biederman and Tsao (1979) could, contrary to Hoosain's interpretation, be interpreted as an indication that it is even more unavoidable to process the pronunciation of Chinese characters. Without further evidence, though, the implication of the greater Stroop effect for Chinese should at least be considered undetermined.

In trying to find more evidence for direct character-meaning connection in Chinese, Hoosain cites the study by Tzeng and Wang (1983), but misunderstands the procedure used in that study.[5] In the study, subjects were asked to choose from two numbers written in characters, the one that is numerically greater than the other. It was found that it took the subjects longer to make the decision when the characters for the larger number had a smaller physical size on the screen. Hoosain, however, mistakenly describes the task as that of deciding on the physical size of the written numbers. He thus interprets the results as indicating that it is unavoidable to process the meaning of the Chinese numbers when the task is only about the physical size of the printed numbers. This interpretation is inappropriate because the actual task in the experiment required subjects to focus on the meaning of the numbers to begin with.

As for the finding that Chinese numbers are translated faster into English than the other way around by native Cantonese speakers (Hoosain, 1986), which Hoosain uses as another piece of evidence for a direct connection between characters and meaning, I find it inconclusive because no comparable results were obtained from native speakers of English. Similarly, the finding that cross-language priming effects for native speakers of Chinese are greater from Chinese to English than in the other direction (Keatley,

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[5] The misunderstanding was probably caused by the ambiguity of the description in the original paper by Tzeng and Wang (1983). I found an unambiguous description only in the caption for Figure 3 in the paper.

1988), is not conclusive evidence for a direct connection between meaning and characters in Chinese.

Another study cited by Hoosain as showing evidence for a direct character-meaning connection was conducted by Treiman, Baron, and Luk (1981). In that study, native speakers of English and Cantonese were required to make truth/falsity judgments of sentences in their own languages. A sentence could be a "homophone" sentence, such that it sounded true when read out loud (e.g., *A pair is a fruit*). It was found that it took longer to reject these homophone sentences than truly false sentences like "A pier is a fruit". In contrast, this kind of delay due to homophony was relatively small for Chinese, and this difference was taken as evidence that phonological recoding was less involved in Chinese sentence processing. However, there is a problem in that study that Hoosain does not notice. In the sample Chinese sentence presented in the paper, *Mei2 shi4 yi1 zhong3 zhi2 wu4*[6] ("*Mei2* is a plant"), the character *mei2*, meaning "coal", is said to be homophonous with the name of a plant. But the character for *mei2* as name of that plant is not a meaningful word in itself in the spoken language (neither in Cantonese nor in Mandarin). In the spoken language, it always combines with some other syllables to form words. The syllable *mei2* by itself corresponds only to one word, namely, "coal". So, the smaller impairment for the Cantonese speakers in that experiment may well be a consequence of using improper test material rather than an indication of less phonological recoding in Chinese sentence processing.

The only study that offers a somewhat stronger case for possible fast access to the meanings of Chinese characters is the one by Hoosain and Osgood (1983) on affective meaning response times. They asked subjects to report the affective meaning of a word by saying either "positive" or "negative" upon seeing the word displayed on a screen. Native speakers of Cantonese could make this judgment faster than native speakers of English. Hoosain and Osgood interpreted this result as evidence that the processing of at least some aspects of meaning of Chinese words was faster than that of English words, and suggested that this was because phonology was bypassed when accessing the meaning of printed Chinese words. Fascinating as the finding may be, it is somewhat in conflict with a recent study by Perfetti and Zhang (1991; also see Perfetti, Zhang, and Berent, in press), in which it was found that phonemic information was immediately available as part of character identification in Chinese. Furthermore, these recent experimental results suggest that whatever the semantic value of a character, it is activated no earlier than its phonological value. If the findings in both studies (Hoosain and Osgood, 1983; and Perfetti and Zhang, 1991) are true, then the faster affective meaning response time for Chinese words should only mean faster decision after the activation of the phonology as well as the semantics of those words, rather than faster activation of the semantics, assuming, of course, that the phonological activation of the Chinese words is no faster than that of the English words.

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[6] The spellings used here are in pinyin. They are only used here to represent the Chinese characters referred to. They do not reflect the phonological values of these morphemes in Cantonese.

In conclusion, I do not find solid evidence for a more direct connection between meaning and characters in Chinese than between meaning and printed words in alphabetic orthographies. Nor do I find solid evidence for lack of phonological mediation in accessing meaning from characters in Chinese. Rather, the studies by Seidenberg (1985) and Fang *et al.* (1986), which are also cited by Hoosain, show evidence of similarity between the processing of Chinese orthography and the processing of alphabetic orthographies.

Memory

Chapter 4 of Hoosain's book focuses on memory-related aspects of the Chinese language. In general, Hoosain shows in this chapter that phonological recoding is used in memorizing printed Chinese, but, at the same time, he cites some studies that he thinks show a greater role of visual coding for Chinese than for other languages.

In 4.1.1, Hoosain cites quite a few studies that found a greater digit span for Chinese than for some other languages. It is shown that this difference can be well accounted for by the working memory model proposed by Baddeley and Hitch (1974) and Baddeley (1983, 1986). This model assumes an "articulatory loop mechanism" for short-term memory which has a span of approximately two seconds worth of speech sound. Hoosain shows that number names in Chinese have shorter duration in pronunciation than in some other languages. Because of this, Hoosain argues, more numbers can be kept in the articulatory loop for the Chinese speakers.

The discussion in this section is interesting, except that there is no emphasis on the fact that the phenomenon is purely linguistic, and has almost nothing to do with orthography. Also, Hoosain does not emphasize that the finding is interesting because it confirms one of the hypothetical principles under which all human languages function (but see Ren and Mattingly, 1990; Mattingly, 1991, for criticism of the working memory hypothesis). Instead, Hoosain seems to be more thrilled by the finding itself, that digit span in Chinese is larger than in some other languages, and uses this as an indication that differences among languages do affect the way information is processed.

In his discussion of the visuo-spatial scratch-pad and perceptual abilties, Hoosain cites a study by Woo and Hoosain (1984). They conducted a short-term memory test, in which subjects had to identify among a list of seven characters those that had appeared among the six characters shown to them a few seconds before. It was found that "weak readers made much more visual distracter errors (when target characters were mixed with similar looking distracters) but not more phonological distracter errors (when targets were mixed with similar sounding distracters)". Hoosain contrasts this finding with that of Liberman, Mann, Shankweiler, and Werfelman (1982), who found that, for American subjects, good beginning readers of English did not do better than weak beginning readers in memory for abstract visual designs or faces. However, they did perform better in memorizing nonsense syllables. In comparing this result with the results of Woo and Hoosain (1984), Hoosain comes to the conclusion that poor readers in Chinese have more visual problems than poor readers in English. Apparently, Hoosain misinterprets the nature and the implication of the results obtained by Woo and Hoosain. The finding that poor readers made more visual distracter errors indicates that they were relying more heavily than good readers on the visual characteristics of the characters when trying to encode them for immediate recall. As a result, poor readers were penalized more by the graphic similarities brought about by the visual distracters. The finding does not, as Hoosain interprets it, indicate that poor readers in Chinese simply have more visual problems. In a comparable study by Ren and Mattingly (1990), it was found that good readers in Chinese were relatively more affected by phonologically similar series than poor readers when performing immediate recall of series of Chinese characters. These results are comparable to those found for English readers (Shankweiler, Liberman, Mark, Fowler, and Fischer, 1979). In neither of those two studies were the results interpreted by the authors as evidence that good readers had more phonological problems than poor readers. Rather, they were taken to suggest that good readers rely more heavily than poorer readers on phonological encoding, hence were penalized more by the phonological similarity introduced in the experimental stimuli.[7] So, the results of Woo and Hoosain (1984) and Ren and Mattingly (1990) both show that one of the crucial differences between good and poor readers in Chinese is in the manner in which they recode reading material: Good readers use more phonological encoding while poor readers rely more on visual encoding. This agrees, rather than contrasts, with findings about the differences between good and poor readers in English (Shankweiler *et al.*).

In a study by Chen and Juola (1982), native Chinese and English speaking subjects had to decide which of the items on separate test lists was graphemically, phonemically or semantically similar to the item just presented visually. Chinese subjects were found to be fastest in making graphic similarity decisions about characters while American subjects were found to be fastest in phonemic similarity judgments. Chen and Juola then concluded, as reported by Hoosain without reservation, that "Chinese words produce more distinctive visual information, but English words result in a more integrated code". Thus the two different "scripts activate different coding and memory mechanisms". Hoosain, however, does not notice at least two problems with the study. First, the study claimed to use words as stimuli both for English and Chinese. However, of the 144 characters used, 26 could function only as bound morphemes according to the frequency dictionary of Wang *et al.* (1986). Using bound morphemes in Chinese necessarily involves more homophones, making graphemic discriminations more indispensable. Second, the task the subjects had to accomplish requires the kind of phonological awareness that most Chinese readers do not need in ordinary reading. Yet, lacking conscious knowledge about the phonemic structure of characters does not necessarily mean the absence, or even less use, of phonological recoding in actual reading. So, here Hoosain is confusing phonological recoding in actual reading with conscious phonological manipulation in performing certain cognitive experimental tasks.

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[7] The difference between the two studies – that is, in Woo and Hoosain, poor readers were more affected by visual similarity whereas in Ren and Mattingly good readers were more affected by phonological similarity – is probably due to the difference in presentation of the stimulus list. In the former, it was simultaneous display, whereas in the latter, it was serial display. See the discussion of the study by Mou and Anderson (1981) later in this review.

Another study Hoosain cites as evidence for existence of a visual coding strategy for Chinese materials is that of Mou and Anderson (1981). These authors found predominant use of phonological recoding in STM for Chinese. Yet, at the same time, they found evidence of visual recoding. In that study, the presentation of stimulus lists was simultaneous rather than serial. As pointed out by Yu, Jing, and Sima (1984) and Yu, Zhang, Jing, Peng, Zhang, and Simon (1985), measured STM capacity varies depending upon the visual presentation method, i.e., visual aspects of the stimuli have greater effect upon the results with simultaneous presentation than with serial presentation. Yu *et al.* (1985) also concluded, based on the results of 14 experiments they carried out in China and the USA, that "no effects were detected that are peculiar to ideographic or logographic languages in contrast to alphabetic languages".

In 4.4 Hoosain looks at memory in relation to reading problems in Chinese. He reports, in particular, an extensive study conducted by Stevenson, Stigler, Lucker, Lee, Hsu, and Kitamura (1982) that compared reading disability among Chinese, American, and Japanese children. The major finding was that the proportion of children with reading problems is very similar among the three different languages, thus disconfirming the previous popular belief that there are fewer reading problems among Chinese and Japanese children. The study did find, however, an interesting difference between Chinese and American as well as Japanese children. Of those Chinese children who failed the fifth grade test, most failed because of a poor comprehension score, whereas most of the fifth grade American or Japanese children who failed the test did so because of their poor vocabulary score. Hoosain suggests that this is because pronunciation tests involve more straightforward answers than word meaning tests, whereas a more open-ended effort is required for questions about meaning. He further suggests in 4.5, that because of the nature of the Chinese orthography, Chinese children have to do more rote learning. And, because this kind of learning calls for a large measure of sustained discipline, authoritarianism is thus tied to this system of learning, which in turn restrains students from giving more open-ended answers. This kind of reasoning, although interesting, is only one of the possible ways to account for the data. An alternative explanation is that the poor comprehension score for Chinese children may be due to improper testing design. Teaching of reading and writing in Chinese is in general character-oriented. However, characters correspond to morphemes, and most of the morphemes need to combine with other morphemes to form words. So, knowing the pronunciation of a character and its meaning in one or several of the words that contain it does not necessarily lead to knowing its meaning in other words it is part of. This discrepancy between the target of teaching and the units of comprehension makes it difficult for people to design tests for measuring progress in comprehension, especially when it is assumed that knowing the pronunciation of all the characters in a text and their meaning in isolation should be sufficient for comprehension of the meaning of the text.

To summarize the discussion of Chapter 4, some of the alleged differences reported by Hoosain between the memory aspect of Chinese and other languages are found to be inappropriate interpretations of the experimental findings, while others derive from studies with defective designs. In conclusion, so-called bottom-up differences, or differences between processing of Chinese and other languages, may well be just a reflection of differences among languages themselves, or merely of the difficulty in finding parallel ways of measuring performance in different languages.

Neurolinguistics

In Chapter 5, *Neurolinguistic Aspects of the Chinese Language,* Hoosain presents convincing evidence that the neurolinguistic aspects of Chinese are not essentially different from other languages, as suggested by some of the early studies. At the same time, however, there is a persisting confusion in Hoosain's review between language and orthography. Though this should not be entirely blamed on him, since most of the studies he reviews did not make this distinction in the first place, as a reviewer he should have been more aware of this confusion.

In 5.1, Hoosain shows that despite a claim (e.g., Hatta, 1977) that characters are processed in the right hemisphere, there are plenty of other studies that demonstrated left hemisphere advantage for printed Chinese words as well as English words. It is further shown that right hemisphere advantage for Chinese was only found with single characters, whereas two-character words always elicited left hemisphere advantage. Also, with single characters the findings are mixed: Both right-hemisphere advantage and left-hemisphere advantage are found, and which hemispheric advantage is obtained seems to depend heavily on the test conditions. Right-hemisphere advantage seems to be related to short exposure time, low illuminaton, and high structural complexity of the characters. This is further confirmed by the finding (Ho and Hoosain, 1989) that, with short exposure time, low luminance, and high stroke number, right-hemisphere advantage could be observed even for low frequency two character words.

In 5.3 and 5.4, Hoosain reviews 21 studies on Chinese aphasics. His general conclusion is that "there is little evidence to suggest any overwhelming neurolinguistic effects of Chinese language uniqueness". Although it was suggested by some earlier studies that Chinese language functions are more lateralized in the right hemisphere, results of more extensive investigations indicate no such tendency. In general, the proportion of right-handed patients with aphasia after right hemisphere damage does not exceed the overall proportion of right handed people who have their speech functions lateralized in the right hemisphere (about 4%). So, Hoosain concludes that "it is quite clear from these studies that specialization for language tends to be in the left hemisphere for the Chinese, as for speakers of alphabetic languages". (Notice, however, his indiscriminate use of the word 'language' when most of the studies used printed materials to test patients.)

There is an indication from some studies that Chinese reading functions may be localized more posteriorly, involving the parietal and occipital lobes, and psycho-motor schemas may play a greater role in memory for Chinese words. However, as Hoosain points out, it is premature to conclude that there is more involvement of the occipito-parietal region for Chinese. As for reports that finger tracing has been used by some patients to help recognize Chinese characters, which Hoosain regards as essentially different from spelling out individual letters for helping read words in an alphabetic orthography, it seems that those patients' reading ability has been impaired so much that they are doing only what beginning learners of an orthography are doing. It is very likely that both finger tracing and oral spelling reflect only the way word composition is learned for different orthographies,[8] and this process could be quite peripheral to the essential mechanisms involved in fluent reading.

The finding discussed in 5.4.4, that processing of tones in Chinese is located in the left hemisphere is interesting, although again this is an aspect of language and is thus not directly related to orthography. A study by Packard (1986) showed that patients with left hemisphere damage had defective production of lexical tones in Mandarin. On the other hand, Hughes, Chan, and Su (1983) found that patients with right hemisphere damage had defects in both production and comprehension of affective intonation, but at the same time had kept their ability to process lexical tones almost intact. The finding that processing of tones is located in the left hemisphere, together with the finding that processing sign language (e.g., Damasio, Bellugi, Damasio, Poizner, and Van Gilder, 1986) is also located in the left hemisphere, reveals the universality shared by all human languages not only in terms of their ability to convey information, but also in terms of the central neural processing mechanism they all utilize.

To summarize the discussion of Chapter 5, the evidence Hoosain provides for similarity in lateralization of script as well as general linguistic processing in the brain between Chinese and other languages is convincing. The tendency for right hemisphere advantage in processing isolated characters shown in some of the studies reviewed by Hoosain, however, does need further exploration.

Conclusion

In final conclusion, Hoosain's major attempt in this book is to introduce a new version of the linguistic relativity hypothesis. The original version is the famous Sapir-Whorf hypothesis that language influences thought. The new version is concerned less with structure of language or world view than with the manner in which linguistic information is processed, and, in particular, with the script-sound-meaning aspects of the Chinese orthography and their effects on information processing. Hoosain's final conclusion in his book is that "there are definite correlations between language characteristics and cognitive performance". However, I find that this conclusion is based mainly on misconceptions about the Chinese language and its orthography, on results obtained under defective experimental designs, and on misinterpretations of the results due to those misconceptions. Besides, the difficulty in separating language differences and orthographic differences from processing differences also affects Hoosain's judgments. More specifically, the difficulty is in finding truly consistent measurements in comparing different languages and orthographies. Unless this difficulty is overcome, there is always the danger of mistaking the differences due to inconsistent measurements for true contrasts in the processing of different languages and orthographies.

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[8] Incidentally, when I was at my preliminary stage of learning English, I did not have the privilege of access to a teacher or even another fellow student, so I learned my English words by writing them over and over again. So, today, I still have great difficulty spelling words orally or understanding other people's oral spelling. But I do not have reading difficulty in English. If I became aphasic, I do not think I would be able to use spelling to help recognize English words. On the other hand, many of my fellow Chinese can do oral spelling fluently, because they started learning English with a teacher.

So, as a final comment on the title of Hoosain's book, to parallel Hoosain's borrowing from physics the notion of 'relativity' to underscore his vision of linguistic processing of different languages, I would like to borrow, also from physics, the notion of 'uncertainty' or 'indeterminacy' to emphasize the caution we should exercise when comparing different languages and orthographies. It is often difficult to determine at the same time both the differences between two languages or writing systems and the differences in their processing. Comparing the processing of Chinese characters directly with the processing of letters, words, or bound or unbound morphemes in an alphabetic writing system is often risky; and, attributing any differences found in this kind of comparison to cognitive or behavioral differences will often prove to be a pitfall.

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