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**HORIZONTAL AND VERTICAL VIEWS OF CHINESE
PSYCHOLINGUISTICS**

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During the past twenty years, there has been a very significant increase in research on Chinese psycholinguistics. Much work has been done by investigators in mainland China, Taiwan, Hong Kong, and elsewhere. Western researchers have also contributed, their interest in many instances aroused by Chinese students, who have entered Western graduate programs in linguistics, psycholinguistics, and psychology in increasing numbers. But nowhere has this development been manifested more directly than in the series of Symposia on Cognitive Aspects of the Chinese Language, of which this is the sixth.

Motivating much of this research has been a basic question: How similar are the psycholinguistic processes of Chinese speakers to those of speakers of Indo-European languages? China has a rich and ancient culture that developed completely independently from Western culture. Moreover, there are certain striking differences between Sino-Tibetan languages and Indo-European languages: Chinese has lexical tones, its syllable structure is relatively limited, its morphemes are mostly monosyllabic, and it lacks inflectional morphology. Again, the Chinese writing system appears to be very different from any present-day European writing system. Its symbols are complex patterns of strokes that stand for monosyllabic morphemes, not phonemes, and no word boundaries are indicated. There are differences in word order and vocabulary between written and spoken Chinese to which European languages offer no parallel. Finally, the Chinese writing system is central to Chinese culture, whereas the European writing systems are little more than traditional tools, having no deep cultural resonance. Given all these differences, are psycholinguistic processes for the two language families likely to be very similar?

One's expectations about the way this question will eventually be answered depend in great part on one's primary assumptions about human psychology. On one view – what Jerry Fodor (1983) has called the "horizontal" view – human cognition consists of a few basic and quite general functions: perception, memory, and motor control, for example. Given the vast range of heterogeneous input and output that human beings deal with, these functions are necessarily very versatile and very powerful. In this respect, humans differ greatly from nonhuman animals, who survive by

virtue of various species-specific specializations that are highly efficient but very narrow. Someone holding the horizontal view would expect human linguistic communication to take many different forms, its variety limited only by obvious functional and anatomical constraints and encouraged by cultural and linguistic variation. A horizontalist would not be surprised to find that Chinese psycholinguistic processes, having developed under very different cultural circumstances, bore no great resemblance to those used by speakers of Indo-European languages.

Opposed to the horizontal view is the "vertical" view, which rejects "perception" and "memory" as false generalizations, and argues for psychological mechanisms, or "modules," specialized for particular domains. Of course, even the most thoroughgoing horizontalist would concede that such processes as color perception and auditory localization are precognitive specializations that can certainly be considered "modular." But a verticalist would claim beyond this that certain so-called higher-level processes, including most especially psycholinguistic processes, are also modular. In support of this view, the verticalist would point to properties that the language input system shares with input systems that are clearly modular: its limited domain, its mandatory operation, its "encapsulation" from information cognitively available to the hearer, and the limited cognitive access to the intermediate representations that it must compute, to name but a few (Fodor, 1983). On the vertical view, the language module is one more species-specific specialization, and our biological situation parallels those of other animals much more closely than the horizontalist supposes. The verticalist holds that, quite aside from functional and anatomical restrictions, psycholinguistic processes are very highly determined by particularities of the structure of the language module. He would thus expect to find only superficial differences in these processes between Chinese and Indo-European languages.

Which of these views is more nearly correct? I think it is not too early to venture at least a tentative and partial answer. Tentative, because many questions remain unresolved, with respect to Indo-European languages as well as to Chinese. Partial, because some cognitive aspects of Chinese have received much more attention than others. But I think it is fair to say that many of the important findings for Indo-European languages have been essentially duplicated for Chinese. I will mention several of these.¹

First, Chinese, like Indo-European languages, appears to be lateralized in the left hemisphere (Tzeng, Hung, Chen, Wu, & Hsi, 1986, and see the case-by-case review in Hoosain, 1991). Aphasia appears far more commonly in Chinese speakers with left hemisphere lesions than in those with right hemisphere lesions, and Chinese characters presented to the right visual field and hence processed first by the left hemisphere are reported more accurately than those presented to the left visual field and hence processed first in the right hemisphere. (e.g., Kershner & Jeng, 1972, and see Hoosain, 1991, Table 5.1., for other studies).

1. I should at once express my debt to Rumjahn Hoosain's recent book, *Psycholinguistic implications for linguistic relativity* (1991), in which most of the relevant research is summarized, and to the review of this book by Yi Xu (1992). I should also say that Hoosain's own conclusions would probably disagree with mine, as is indeed suggested by his title.

Again, Chinese readers, like English readers, take in information from print in successive ocular fixations, and the durations of the fixations are similar (Peng, Orchard, & Stern, 1983; Sun, Morita, & Stark, 1985).

"Word superiority" (Reicher, 1969) is found for Chinese as for European languages. A character is identified faster and more accurately if it is part of a two-character word than if it is part of a two-character pseudoword (Cheng, 1981; Liu, 1988; Mattingly & Xu, this volume). "Word inferiority" (Healy, 1976) is also found, again as in English: a radical that is part of a valid character is harder to detect than when it is part of a pseudocharacter, just as a letter embedded in familiar word is harder to detect than in a misspelled word (Chen, 1986).

The "Stroop effect" (Stroop, 1935) in which subjects, although instructed to report the color of the ink in which a word is printed, respond to a printed color name with that name, has been found for Chinese as well as for English (Biederman & Tsao, 1979).

In the naming task, response times depend on frequency for Chinese, as for Indo-European languages. Low-frequency characters with consistently pronounced phonetic components are responded to faster than those with inconsistent phonetic components, just as low-frequency English words that are regularly spelled are responded to faster than if irregularly spelled (Seidenberg, 1985). Visually similar but phonologically dissimilar character pairs have longer response times than control pairs in lexical decision (Hsieh, 1982, cited in Cheng & Shih, 1988), just as has been found for similarly spelled but phonologically dissimilar word pairs in English (Meyer, Schvaneveldt, & Ruddy, 1974).

Chinese characters, like words in Indo-European languages, are coded in short-term memory phonologically (Tzeng, Hung, & Wang, 1977). This is implied by finding that phonologically similar lists are less accurately recalled. Moreover, it has shown for beginning readers of English that short-term recall ability is correlated with reading ability, suggesting that reading and recall rely on the same mechanism (Shankweiler, Liberman, Mark, Fowler, & Fisher, 1979). Similar results have been found for Chinese (Ren & Mattingly, 1990).

It is perhaps not too much to say that whenever someone has seriously tried to find a Chinese parallel for some psycholinguistic result previously demonstrated for an Indo-European language, he has succeeded.

Differences in the results of psycholinguistic experiments between Chinese and Indo-European languages have of course been found as well, and Hoosain's (1991) argument for linguistic relativity relies heavily on these. But the differences are not very impressive. Many of them are most reasonably interpreted as showing the same basic mechanism responding appropriately to superficial variations. For example, since Chinese is often written vertically and English seldom is, it is not surprising that English readers show acuity differences between horizontal and vertical presentation, but Chinese readers do not (Freeman, 1980). Chinese readers can retain longer strings of

digits in short-term memory than English readers, but this is probably because the names of the digits in Chinese are shorter (Hoosain, 1979, and see Hoosain, 1991, Table 4.2, for other studies). Readers make more fixations per line in Chinese than in English, probably because word-shape and word length information is available parafoveally in English writing, but not in Chinese writing (Peng et al., 1983; Sun et al., 1985).

Other differences found seem to be quantitative rather than categorical. While such a difference may mean something, it probably does not indicate a difference in mechanism. Thus one experiment found that "homophone" sentences are more inhibitory for English readers than for Chinese readers (Treiman, Baron, & Luk, 1981). This may mean that "getting at the meaning of Chinese is really more direct" (Hoosain, 1991, pp. 54-55), or merely that because homophony is ubiquitous in Chinese, readers have more experience in dealing with it. But it surely does not suggest a very different kind of reading process. Again, the Stroop effect is stronger for Chinese than for English (Biederman & Tsao, 1979). This may mean that the meaning of Chinese words is more manifest" (Hoosain, 1991, p.45), or, conversely that "it is somehow unavoidable to process the *pronunciation* of the printed words" (Xu, p.332), but it does not suggest a basic difference, as would be the case if the Stroop effect were found *only* for Chinese.

The most likely source of a basic difference in processing might be differences in the way orthography maps on to phonological structure. One way to describe the difference between Chinese and English orthographies would be to say that, unlike English, Chinese has no grapheme-to-sound conversion rules. The pronunciation of Chinese characters can be accessed only through the lexicon, whereas English words, at least those that are "regularly" spelled, can be pronounced just by using the rules, without lexical access (Cf. Hoosain, 1991, pp.36ff.). If this is the right way to view the matter, one might expect to find evidence at least of a different strategy, if not a different mechanism, in such tasks as naming. (This is a form of the "Orthographic Depth Hypothesis" proposed by Frost, Kate, and Bentin, 1987). But the evidence for such a processing difference is merely the finding that naming takes longer for Chinese than for English (Seidenberg, 1985).² This seems more like a difference of degree than one of kind. Perhaps a better account of the differences between the two orthographies is to say that the graphemes of English are a few score spelling patterns that specify phonemes; the graphemes of Chinese are the 900-odd phonetic radicals that specify syllables and the 200-odd semantic radicals that combine with them to form the characters.³ Both the spelling patterns and the radicals have to be stored somehow, so both writing systems are "lexical." On the other hand, since both orthographies exhibit imperfect but still useful regularities, both can be said to have grapheme-to-sound conversion rules. Because there are so many more Chinese characters than English spelling patterns, naming a word in Chinese takes longer than

2. Xu (1992) questions this finding on the ground that the Chinese and the English subjects in Seidenberg (1985) may not have been at comparable educational levels.

3. On Chinese writing as a syllabary system, see Mattingly (1985, 1992) and DeFrancis (1989).

naming a word in English, just as naming a word in English takes longer than naming a word in Serbo-Croatian, which has even fewer and far more regular spelling patterns than English does (Frost et al., 1987). But there is no good reason to think the underlying psycholinguistic process is very different in either comparison.⁴

It would appear, then, that the results of research on psycholinguistic processes of speakers of Chinese thus far provide substantial support for the proposition that these processes, though not yet well understood, are similar to those of speakers of Indo-European languages. This provides some corroboration for the vertical view. But there is still much to be learned. The present Symposium and its successors can be expected to provide much of the required evidence.

It may be that some Chinese investigators will regard the vertical account of psycholinguistic process as an attempt to force Chinese into a mould made by Western psycholinguists for Indo-European languages. But the vertical account of psycholinguistic mechanism is supposed to apply to all human languages. If it can really be shown not to work for Chinese in some respect, this will mean that the account needs to be revised or rejected. Nor does the vertical view in any sense demean Chinese culture. It simply asserts that all human beings have in common certain highly specialized mental structures and processes on which their cultures must ultimately depend.

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4. For further discussion of the Orthographic Depth Hypothesis, see Frost and Katz (1992) and Seidenberg (1992).

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