

BOOK REVIEW:

OVID J.L. TZENG (ED.), *BIOLOGICAL BASES OF LANGUAGE*.  
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The biological basis of language has become a hot science topic. Set in the backdrop of the flourishing fields of cognitive science, neuroscience, and neural networks, the upsurge of interest in the biology of language has led researchers to ask some of the most fundamental questions about what make us human. In 1993, Ovid Tzeng and William Wang organized a symposium, where psychologists, linguists, and neuroscientists discussed the biological bases of language from the Chinese language perspective. This monograph grew out of the symposium presentations.

Recent years have seen a fast developing interest in the study of Chinese from cognitive and psycholinguistic perspectives. Chinese presents a major challenge to researchers who attempt to understand mechanisms underlying language processing and learning, because the language offers unique properties in its phonological, orthographic, lexical, and grammatical structures – structures that differ significantly from those of Indo-European languages on which major theories of linguistics and psycholinguistics are based. In the past two decades, researchers have applied a variety of theoretical and methodological paradigms, largely with a “Western eye”, in the examination of Chinese. More recently, they are using neural and computational approaches to study core problems about the cognitive and biological bases of language. It is within this context that the symposium took place and the monograph emerged.

In his opening article, Liberman contrasts two opposing views of speech perception or phonological communication, the “horizontal” view and the “vertical” view. The horizontal view considers speech on a par with other cognitive operations, while the vertical view takes speech as a special human activity, part of the human language capacity. Liberman asks seven questions on speech perception, arguing for

the vertical view. It should be noted that the vertical view is a variant of the modular view of language, as expounded most forcefully by Fodor (1983). The vertical-vs.-horizontal debate concerns not only speech perception, but all aspects of language – it reflects a deep opposition in cognitive science between viewing the human mind as a modular system whose architecture is largely predetermined or innate versus viewing it as a highly interactive system in which multiple components can interact simultaneously at all levels (see Elman et al., 1996).

The next two articles are of a very different nature, dealing with reading skills in children and adults. The first paper by Bertelson et al. is a summary of various studies conducted in Belgium, China, and Taiwan, addressing the relationship between different writing systems and phonological awareness. Although the paper ends abruptly with no major conclusions, the gist of its presentation is that readers differ in their phonological awareness as a function of their experience with different writing systems. The second paper by de Gelder overlaps with Bertelson et al.'s position significantly, as it deals with the relationship between phonological awareness and speech processing. One might be tempted to conclude, as these authors would like to, that the differences between readers of alphabetic and non-alphabetic languages point to differences in processes of word identification, or that the non-alphabetic readers are like the poor readers in alphabetic languages. However, it is not clear from these studies how phonological knowledge is related to reading skills, or how phonological awareness is related to the time course of phonological activation in word reading (see Tan & Perfetti, 1998, 1999 for arguments in the later case).

Hung, Tzeng, and Ho's study examines the word-superiority effect in Chinese, following Reicher's original paradigm. These authors provide a detailed overview of previous research that has examined word-superiority effects in Chinese, as well as a review of visual word recognition models. Their experiments consider a number of important variables such as morpheme type, morpheme number, character frequency, and word status. The results show both character superiority and word superiority effects, suggesting that in word recognition characters are the basic orthographic units but words are more salient cognitive units. Although sometimes the reader may find it difficult to piece together the various four-way ANOVA analyses, these are by far the most detailed and careful experiments ever carried out on word superiority effects in Chinese, and the results provide useful bases for any further research on

this topic. One problem, however, is that the authors give only the accuracy data but no RT data, which makes their general discussion of "access speed" to be less meaningful. I was also hoping to find a theoretical discussion of the word superiority effect in connection with top-down vs. bottom-up processes in visual word recognition as modeled by the well-known Interactive Activation Model of McClelland and Rumelhart (1981).

The next chapter by Klima et al. provides important insights into the question of whether experience with a sign language helps the learner derive spatial representations of Chinese characters from static or dynamic displays of character strokes. In three experiments with Chinese signing and non-signing deaf children and American adults, the authors find that signing provides the learner with extra spatio-visual abilities to analyze the visual displays of strokes into discrete character representations. Such ability seems to be independent of whether the learner already has knowledge of Chinese characters, because it is also observed in American signing adults who do not know any characters. The results suggest that linguistic experience with signing can translate into an advantage of reconstructing meaningful representations from spatial segments – an ability paralleling that of building discrete representations from continuous speech in time.

Tai's article on Chinese grammar contrasts with Liberman's opening article directly, in that Tai argues for a horizontal view of language: grammar can be viewed as a complex mapping from human conceptualization of the multi-dimensional world to the one-dimensional linearity of speech (cf. Elman et al., 1996). He shows that the structure of Chinese grammar is non-arbitrary, in domains such as word order, categorization/classification, and temporal and spatial expressions. The non-arbitrariness suggests that in the mapping from conceptualization to speech, other non-linguistic, cognitive, and processing principles are important, undermining the argument for a domain-specific language faculty (Chomsky, 1988). This article represents a strong functional approach to language, along the lines of research by Langacker, Givón, and Lakoff, which has started to gain popularity in linguistics and cognitive science.

In the next article, Kess and Miyamoto review the literature on sentence processing in Japanese (and English where relevant). Previous theories of sentence processing have been based largely on English, with the assumption that there is a universal set of strategies that apply to all human languages. Kess and Miyamoto

examine the processing of left-branching (Japanese) versus right-branching (English) structures, the accessibility hierarchy for empty categories, and sentence processing strategies in Japanese aphasia. They provide support for language-specific sentence processing strategies rather than universal principles as determined by Universal Grammar – a perspective entirely consistent with what I have argued elsewhere: “there is good reason to believe that at least the way in which the sentence processor operates on particular linguistic materials may differ from language to language due to influences from language-specific properties” (Li, 1996).

The last two chapters have to do with the semantic system of language and its dialectal influence and historical change. Lien and Wang examine shape classifiers in Mandarin and their variants in Taiwanese, and conclude that the use of classifiers in Mandarin is conditioned by the linguistic (dialectal) backgrounds of the speaker. This conclusion by itself is hardly surprising, given that speaker’s linguistic backgrounds influence almost every aspect of language use. The authors’ detailed semantic analyses, however, indicate interesting prototypical effects, effects that are revealing about the psycholinguistic mechanisms underlying the complex interaction between the speaker’s background and the use of classifiers. Along a similar spirit I have suggested elsewhere that the use of classifiers can be modeled in a connectionist network, in which the weight configurations that hold among the semantic features of nouns and the characteristics of classifiers can capture the detailed process of language use (Li, in press; Li & Shirai, 2000). Finally, Ogura’s paper discusses diachronic semantic change and biological developments in humans and infants. Although a very short paper, it is perhaps the only one in the monograph that has direct contact with biology. It shows that the metaphoric transfer of meaning from tactile to abstract references and from dimension to color and sound parallels the phylogenetic and ontogenetic development of the sensory modalities. However, the paper falls short of clarity on several important grounds it touches (perhaps because it is too short), for example, on the relationships between language innateness, neurobiology, and preexisting cognitive abilities.

The nine contributions to this monograph deal with diverse aspects of language processing and come from a diverse group of prominent researchers. The issues addressed in this volume are important and have significant implications for language processing in general. While the symposium on which the monograph is based carried the title “biological bases of language”, this title seems to be a misnomer for

the monograph: among the nine chapters, only one deals with some biological aspects of language use; all others are concerned with language or speech processing, sign language, reading, or language use. None of the studies directly addresses the neural bases of language, or uses biological tools (e.g., EEG, PET, or fMRI). The reader should note, however, that the studies reported in this volume were mostly carried out in the early 1990's or even earlier (the workshop took place in 1993), and so there is a huge lag between the time of the actual studies and the time of this volume's publication. The study of the biological bases of language has undergone rapid and substantial developments in just the last few years, and the field today is so much more different than it was in the early 1990's.

This monograph contains a collection of articles from diverse perspectives. Still, to some extent it reflects a lack of research interest in spoken language processing among Chinese psycholinguists. It has been a long-standing tradition for psycholinguists to study Chinese orthographic processing (there are three articles on orthographic processing in this volume, and there is also a special book on this topic; see Wang et al. 1999). Although the importance of orthography and its psycholinguistic examination goes without saying, there is now growing interest among psycholinguists in the study of auditory lexical or sentence processing in English and other languages (see Bates & MacWhinney, 1989 for an example). My own pursuit of auditory Chinese processing was an attempt to revert the "orthographic obsession" in Chinese psycholinguistics (e.g., Li, 1996, 1998; Li, Bates, and MacWhinney, 1993; Li and Yip, 1998), but apparently its success has to await further test of time.

In recent years, there have been several other monographs on the processing of Chinese (Leong & Tamaoka, 1998; Chen and Zhou, 1999; Wang et al, 1999). This monograph distinguishes itself from the others in that the articles in this monograph deal with diverse aspects of language use, including speech, orthography, sign language, and historical change, whereas the other monographs are restricted to specific aspects or limited in one way or another (e.g., orthography was the sole topic in the Wang et al. volume, and nearly half of the papers in the Chen and Zhou volume are written by the editors themselves). Thus, this monograph makes a significant contribution to the field, perhaps not so much to the biological basis of language, but to the psycholinguistics of Chinese.

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