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A CRITICAL REVIEW: THE HANDBOOK OF EAST ASIAN PSYCHOLINGUISTICS VOL. 1: CHINESE

Ping Li, Li Hai Tan, Elizabeth Bates, & Ovid J. L. Tzeng (eds.)
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1. INTRODUCTION

Just as some speakers need no introduction, this handbook really needs no review, at least if the primary purpose of a review is to let readers decide if they should read the book. The international renown of the publisher, editors, and contributors should be sufficient to convince anybody interested in Chinese psycholinguistics to do just that. Although the list price of the handbook is £85.00 (US$150.00), it is highly recommended to university libraries as well as individual scholars who teach and research on psychology, linguistics, Chinese language and other related subjects. Previous anthologies (including Kao & Hoosain 1986, Liu et al. 1988, Chen & Tzeng 1992, Chang et al. 1994, Bond 1996, Chen 1997, Tzeng 1999, Wang et al. 1999, Kao et al. 2002, Nakayama 2002, and McBride-Chang & Chen 2003) are either out of date or have a much narrower focus. This book could hardly help but define the current state of the art, given how large a proportion of the world's leading Chinese psycholinguists are represented in it. It's big enough, and the community small enough, to make this possible (sadly, this community lost co-editor Elizabeth Bates, a major international figure in psycholinguistics beyond Chinese as well, just as the book was being finished; the other editors include a moving tribute to her life and work). The thirty-two concise chapters (with an average length of eleven pages each) cover a satisfyingly wide range of topics, from language acquisition through language processing to language and the brain (the book's three major {146} subdivisions), and there are sixty-six pages of references to further research at the end. The book itself is handsome (though with the minor editing problems inevitable in any project this large, and Cambridge still hasn't found a reasonable-looking Chinese font). The editors have thus gone very far towards achieving their goal of serving "psycholinguists who are interested in cross-linguistic and comparative studies of Indo-European and East Asian languages, and graduate students who are interested in doing research in the fast-expanding field of East Asian psycholinguistics" (p. 7). As a matter of fact, the handbook is also very valuable to psychologists, linguists, neuroscientists, and language teachers who want to put their lesson plans on a firmer empirical basis.

In the Introduction, the editors succinctly point out that the tension between the universality perspective and the relativity perspective stemming from the Sapir-Whorf hypothesis has dominated much of linguistic and psycholinguistic research for the past fifty years. Given the specific properties of the Chinese language on orthographic, phonological, and grammatical levels, Chinese psycholinguistics obviously has a lot to offer for the debates

generated from the tension. The specific properties of Chinese also raise important theoretical issues regarding language acquisition, language processing, and language and brain. The handbook thus provides a timely synthesis of the debates and points to new frontiers in Chinese psycholinguistics.

While recognizing the significance of the handbook as well as the field of Chinese psycholinguistics, the reviewers would like to use this opportunity to point out some limitations of the field for challenging the researchers in Chinese linguistics and psycholinguistics to new frontiers and horizons. Thus, the critical review is not so much of the handbook but rather of the field. In fact, the editors and contributors are so successful in surveying Chinese psycholinguistics that the book makes it easier than perhaps ever before to see three important limitations of the field. In its current state, Chinese psycholinguistics is rather arbitrary, lopsided, and ill-defined. Chinese psycholinguistics is arbitrary in the same sense English psycholinguistics is. The editors are entirely right that psycholinguistics can only benefit from in-depth research into as many languages as possible, but as we discuss below, this is only part of the job that must be done; psycholinguists of all stripes need to put more effort into designing experiments and interpreting results with a clear {147} cross-linguistic framework in mind.

Chinese psycholinguistics is also lopsided, in that research energies are overly focused on a highly restricted range of problems, leaving vast areas almost entirely unexplored. The editors are well aware of this problem, noting, for example, that their volume collects more chapters on language acquisition (thirteen) than on language and the brain (only eight, three of which, as we show below, don't really belong in that category). From a linguistic perspective, however, the most bizarre imbalance (which the editors also acknowledge) is the psycholinguist's unnatural fixation on the reading of Chinese characters, a topic to which over a third (11/32) of the chapters is devoted. The obvious solution to the problem of lopsidedness is to inspire more people, with a broader range of research interests, into doing psycholinguistics on Chinese, and this book is certainly inspirational.

Finally, Chinese psycholinguistics is ill-defined, for the simple reason that psycholinguistics as a whole is ill-defined. Tanenhaus (1988, p. 1) has rightly observed that "[t]rying to write a coherent overview of psycholinguistics is a bit like trying to assemble a face out of a police identikit. You can't use all of the pieces, and no matter which ones you choose it doesn't look quite right." The term "psycholinguistics" is often used as a synonym for "psychology of language", but isn't all linguistics inherently psychological? To their great credit, the editors of this book have included contributions on grammar (albeit only in children and brain-damaged patients), as well as phonetics, alongside the expected research using reaction-time and brain-scanning methodologies. However, as we argue below, the only real solution is to redefine linguistics itself as a branch of psycholinguistics.

Before discussing these three issues more deeply, we first provide, in section 2, brief summaries of all thirty-two contributions. After this, in section 3, we discuss how Chinese psycholinguistics may be more fruitfully embedded within a coherent cross-linguistic perspective. In section 4, we discuss the lopsidedness of the research focus in Chinese psycholinguistics, and what steps can be taken to fix the problem. Section 5 addresses the relationship between linguistics and psycholinguistics, showing that the major "themes or directions" listed by the editors as summarizing "the current state of the art" in Chinese

psycholinguistics (p. 3) in fact also reflect the major themes of contemporary {148} theoretical linguistics. We summarize our main observations in section 6.

2. OVERVIEW OF THE CHAPTERS

As noted above, the thirty-two contributions are divided into three major sections: Part I on language acquisition, Part II on language processing, and Part III on language and the brain. Perhaps because the editors recognize that even this meager attempt to bring some order to psycholinguistic research "may seem arbitrary at times" since "all chapters cut across boundaries to some extent" (p. 8), chapters within each section are arranged alphabetically by author names. Nevertheless, some of the chapters form natural groupings, so in our summaries we have arranged them accordingly.

2.1 Language Acquisition

Perhaps because it is the largest, the section on language acquisition (chapters 1-13) provides the broadest, yet most coherent, survey of any of the sections in this book. There are three chapters on reading, two on second language acquisition, one on phonology/phonetics, three on semantics, and four on syntax (two each on syntactic categories and syntactic constraints).

The most basic chapter on reading is chapter 7, "Emergent literacy skills in Chinese" (pp. 81-89) by Catherine McBride-Chang and Yiping Zhong. The authors focus on mechanical components of reading like speed of processing (in general, not just in reading) and visual skills (again, not just for reading). They also provide a brief introduction to the role of phonological awareness in learning to read, whereby children become aware (typically with the help of explicit instruction) that the spoken words of their language are composed of smaller meaningless parts which orthographic systems make use of. Even Chinese characters, most of which contain a phonetic component that provides information about pronunciation, of varying degrees of reliability. Learning to recognize valid combinations of character components, both phonetic components and semantic radicals, is also important, a skill the authors confusingly call "morphological awareness."

Chapter 9, "Growth of orthography-phonology knowledge in the Chinese writing system" (pp. 103-113) by Hua Shu and Ningning Wu, focuses more closely on phonological awareness, describing it (hyperbolically, perhaps) as "[i]n the past two decades, one of the most important discoveries in psycholinguistic research" (p. {149} 103). They also link it explicitly with the learning of phonetic components in characters, which can be classified according both to regularity (whether a character component is pronounced the same as when it is a free character of its own) and consistency (whether characters sharing a component are pronounced the same). Both regularity and consistency (especially the latter) make characters easier for adults to process and children to learn (unsurprisingly, in our opinion, given that orthographic systems are explicitly designed to express phonological structure; see e.g. DeFrancis 1989). However, children must eventually develop other strategies for reading, since only a small percentage of characters containing phonetic components (17%, in their corpus of school textbooks) are fully regular.

The third reading chapter in this section is chapter 6, "Making explicit children's implicit epilanguage in learning to read Chinese" (pp. 70-80) by Che Kan Leong. After reviewing again

the notion of phonological awareness (which is essentially what "epilanguage" means), the author dives into an extended argument for a specific hypothesis about its nature for Chinese. Namely, the hypothesis that the crucial phonological unit used by Chinese children in learning to read is the syllable, not the segment as is the case for learners of alphabetic systems. This follows, it is claimed, from the central role of the syllable in Chinese phonology in general (i.e. that Chinese phonology requires a "paradigmatic rather than segmental analysis" [p. 73]). The centerpiece of the chapter is a recent study by the author which found that the ability of children to read aloud Chinese pseudowords (nonlexical combinations of genuine Chinese characters) was better predicted by their ability to repeat "Chinese speech sounds" (p. 75), meaning whole syllables, and less by deletion of onsets and rimes.

Of the two contributions on second language acquisition, the more general one is chapter 5, "Second language acquisition by native Chinese speakers" (pp. 61-69) by Gisela Jia. The focus is on immigrants from Chinese-speaking areas to English-speaking countries, which permits relatively precise measurement of the age at which a speaker was first immersed in the second language (age of arrival, or AOA). Unsurprisingly, AOA is a major factor predicting ultimate proficiency in English, with later arrivals remaining more fluent in their first language. This observation is consistent with the so-called critical or sensitive period hypothesis, which claims that there is a sharp drop in the ability of the maturing brain to acquire language after a certain age (though {150} nobody agrees on exactly what age that is). However, as the author notes, the AOA effect is also consistent with the more general hypothesis that learning anything new gets harder with age (see also Hakuta, Bialystok, & Wiley, 2003, too recent to be cited in this book). Moreover, the author emphasizes that AOA co-varies with so many other factors that it's difficult to know what exactly causes what.

Chapter 13, "Early bilingual acquisition in the Chinese context" (pp. 148-162) by Virginia Yip deals with native bilinguals: children who acquire two or more languages simultaneously. Two of the central questions are whether it makes sense to think of one language in a native bilingual as dominant over the other (answer: yes) and whether the different grammars can nevertheless both influence each other (also yes). From a broader psycholinguistic perspective, the most important question concerns the mechanism by which a child grows two or more grammars in the same brain: does she start with a single grammar that splits up, or does she posit separate grammars from the beginning? Unfortunately, this chapter barely touches on this issue, and leaves it essentially unresolved (see Sorace 2003).

The sole chapter on phonological development is chapter 10, "Interaction of biological and environmental factors in phonological learning" (pp. 114-123) by Stephanie Stokes. Biological influences on phonology are represented partly as constraints quantifying articulatory difficulty, and partly as a universal (give or take a few details) implicational hierarchy of phonetic features. Environmental influences are represented by the lexical contrasts actually used in the ambient language. It is difficult to sort out by hand how these complex and competing influences interact to produce a mature phonological system. The author, therefore, advocates the use of computer modeling in a connectionist network, which automatically balances one factor against the other by adjusting the strengths of connections between various features and factors. Corpus data, representing language input to the child, are entered gradually into the system, and before the system has stabilized, errors are produced that are reminiscent of those made by actual children.

Turning now to the three chapters on semantic development, the first is chapter 1, "Actions and results in the acquisition of Cantonese verbs" (pp. 13-22) by Sik Lee Cheung and Eve V. Clark. The chapter discusses a corpus analysis by the authors on a {151} very small issue: productive use of the perfective clitic *zo2* (cognate to Mandarin *le*) and bound resultative marker *dou2* (cognate to Mandarin *dào*), both of which mark information about aspect, the internal temporal structure of events. One finding is that *zo2* is produced quite early (before the age of two), though interestingly, initially only in association with verbs indicating a clear resultant state (like *laan6* "break"), suggesting a link between grammatical and lexical aspect. Another finding is that *dou2* appears somewhat later than *zo2*, when children begin to produce compound verbs. But, as the authors point out, unfortunately such verbs are so productive in adult speech it's hard to determine if the children are generating them online or merely repeating by rote whole compound words they have heard.

Chapter 4, "Child language acquisition of temporality in Mandarin Chinese" (pp. 52-60) by Chiung-Chih Huang , addresses roughly the same topic, but uses data from a different language in a broader focus that goes beyond the perfective to encompass other aspect markers (Mandarin *le*, *guo*, *zai*, *zhe*) and other means of marking time information, including not only overt forms like temporal adverbs but also more subtle discourse-pragmatic devices. Again the heart of the chapter is a summary of the author's own research, which found that children mainly marked time with aspect markers, whereas adults used more adverbials, especially in adult-directed speech. The unsurprising aspect of this is that it takes time for children to develop sufficient pragmatic sophistication to apply more subtle cues for abstract notions like time. But, a further implication, not explicitly drawn in this chapter, is somewhat deeper: children are biased to treat language as a system of formal elements (e.g. aspect markers), rather than as the open-ended communicative tool it is for adults.

This same point is made explicitly in chapter 3, "Chinese classifiers: their use and acquisition" (pp. 39-51), by Mary S. Erbaugh, though this chapter also discusses adult classifier use and breakdown in aphasia. Evidence is primarily from corpus analysis; experimental approaches (e.g. asking speakers to provide classifiers for pictured objects) are quickly dismissed as neglecting the discourse factor. The importance of this factor emerges in the author's observations that classifiers "function primarily to highlight the speaker's optional choice to specify an object as individuated" (p. 43). This drives the choice between sortal (semantically specific) and general (default) classifiers more than the semantic features highlighted in dictionaries. As for acquisition, the central observation is that noted above: {152} "[c]hildren first learn classifiers formally as a grammatical system" (p. 47). Evidence comes, among other places, from Myers & Tsay (2000), though unfortunately the first author's name is misspelled "Meyers".

Two of the chapters on syntax acquisition are concerned with syntactic categories. Chapter 8, "Basic syntactic categories in early language development" (pp. 90-102), by Rushen Shi, is concerned with a very specific hypothesis: children rely on universal acoustic cues to distinguish between function words (reduced) and content words (not reduced), which then gives them a head start in learning syntax more generally. We find this hypothesis interesting in a Chinese context for two reasons. First, it calls attention to the fact that Chinese, despite being a tone language, is like any other language in using acoustic prominence (stress) in a grammatically regulated way. Second, the function/content dichotomy is the only one recognized by traditional

Chinese grammarians (*xūzì* vs. *shízì*). The author's hypothesis is supported by cross-linguistic evidence and experiments showing that six-month-old infants prefer to listen to content words. Again, a connectionist model makes an appearance, successfully learning to classify words by their acoustic properties.

Chapter 11, "The importance of verbs in Chinese" (pp. 124-135) by Twila Tardif, addresses the mystery of why children acquiring Chinese (both Mandarin and Cantonese) produce more verbs than nouns, whereas children acquiring languages like English show the reverse pattern. The English pattern was discovered first, and researchers took it as a universal cognitive principle that nouns are easier than verbs. Work by this author has not only helped to correct this misconception, but also to show how the cross-linguistic difference emerges. Chinese children use more verbs because their parents do, and their parents do because Chinese grammar permits the dropping of nouns, which lowers noun token frequencies (i.e. the number of individual instances) relative to verbs. Meanwhile, noun type frequencies (i.e. the number of lexical entries) are also lowered given that Chinese prefers abstract superordinate category morphemes (e.g. *chē* "vehicle"), rather than the plethora of subordinate category morphemes (e.g. *car*, *bicycle*, *truck*) preferred in English.

The remaining two chapters in the language acquisition section adopt a formal approach to syntax. Chapter 2, "Chinese children's knowledge of the Binding Principles" (pp. 23-38) by Yu-Chin Chien and Barbara Lust, is one of the longest in the book, though only a tiny portion of it (less than three pages) discusses Chinese children. The focus is on the problem that Chomsky's supposedly universal Binding {153} Principles don't work the same way in English and Chinese. Reflexives in English must be locally bound (e.g. *himself* in *Tom thinks that Jerry likes himself* [p. 23] can only refer to *Jerry*, not *Tom*) whereas in Mandarin, *zìjǐ* can be bound by a long-distance referent, as long as it is a subject (e.g. *zìjǐ* in *Gogo gàosù Howhow shuō Xiǎopàng xǐhuān zìjǐ* [p. 25] can refer both to *Xiǎopàng* and *Gogo*). The authors' preferred explanation is that long-distance binding is governed by pragmatic rather than syntactic principles. Since children master pragmatics later than syntax, this correctly predicts that Chinese children should initially accept only local binding, like English speakers, and that the Chinese long-distance subject restriction, involving a blend of syntax and pragmatics, should be particularly hard to learn.

The final chapter in this section, chapter 12, "Grammar acquisition via parameter setting" (pp.12-147) by Charles Yang, has even less Chinese acquisition data (none, in fact). It focuses instead on a comparison of formal models by which parameters (innate switches encoding the restricted cross-linguistic variation permitted by Universal Grammar) are set when children are exposed to adult language. The preferred model is the author's own variational model, which describes child grammars as gradiently shifting over time. An example is the putative null subject parameter, presumably set to "no" in English but "yes" in Chinese. Since English-speaking children often drop subjects, this has been taken by many to mean that the universal default setting for this parameter is "yes". This leads to the sole empirical observation in the chapter: since Chinese grammar blocks null subjects if a topic is a possible antecedent (e.g. the null subject e_1 results in ungrammaticality in *Sue_2, [e_1 *xǐhuān* t_2], where e_1 = *John* [p. 145]), null subjects in child English should obey the same universal constraint, and they do.

2.2 Language Processing

More than half (6/11) of the chapters in the section on behavioral studies of language

processing by adults (chapters 14-24) focus on reading. Of these, three address the question of what role, if any, is played by phonology in Chinese reading. Three other chapters relate to phonology (two of these to phonetics), and the remaining two to syntax.

Readers wanting an entry into the literature on Chinese reading, especially those without a strong background in Chinese, can do no better than chapter 17: "The Chinese character in psycholinguistic research: form, structure, {154} and the reader" (pp. 195-208) by Douglas N. Honorof and Laurie Feldman. Factors affecting the reading of individual characters include the linguistically relevant variables alluded to above (phonological and semantic transparency and consistency of character components), as well as purely visual factors like stroke count and the components' position, position-based distortion, and overall layout. They also highlight the important problem that "Chinese" is hardly a monolithic entity, with both orthographic variation (e.g. traditional vs. simplified characters) and what they call "synchronic and diachronic bidialectalism" (pp. 206-208). Synchronically, different language areas use the same characters in different ways, and diachronic change has sculpted the lexicon in ways that may or may not still be relevant to modern readers.

Chapter 16, "Eye movement in Chinese reading: basic processes and cross-linguistic differences" (pp. 187-194) by Gary Feng, is unique among the reading chapters in focusing on the fact that characters are not actually read in isolation. The essential tool for the study of fluent reading is the eye-tracking device, which has established that eye movements in Chinese reading obey the same principles as for alphabetic orthographies. In particular, in either orthographic system, saccade length (how far the eye leaps from fixation to fixation) and perceptual span are about 1.5 words. The only cross-linguistic differences noted in the chapter are: first, that the lack of word boundaries in Chinese orthography means that saccade length is also affected by character complexity and the frequency of two-character strings (which relates to the probability that the string is a word), and second, that Chinese readers may possibly deal with phonological information in a different way. The latter point is discussed more fully in three of the chapters summarized below.

Before getting to these, however, we consider another reading-related chapter with a unique focus. In chapter 15, "Effects of semantic radical consistency and combinability on Chinese character processing" (pp. 175-186), May Jane Chen, Brendan S. Weekes, Dan-Ling Peng, and Qin Lei discuss precisely what their title promises. A new study by the authors found that semantically transparent characters gave faster responses than opaque characters in semantic categorization tasks but not in naming (phonological) tasks, showing that semantic components are not automatically activated. As in several other chapters, the authors end by highlighting the pedagogical implications of {155} their study, though given that their results come from literate Chinese adults, it's not obvious that they will translate to non-native speakers encountering Chinese orthography for the first time.

The remaining three chapters in this section on reading all address the role of phonology. Chapter 20, "Reading Chinese characters: orthography, phonology, meaning, and the Lexical Constituency Model" (pp. 225-236) by Charles A. Perfetti and Ying Liu, advocates a model (implemented, as usual, in a connectionist network) with two paths that a reader may follow when naming characters aloud: directly from orthography to phonology, or indirectly via semantics. Their empirical centerpiece is Perfetti and Tan (1998), a study that claimed the predicted earlier influence of phonology than semantics on naming. In a footnote on p. 229,

the authors admit minor conflicts in these results with Chen and Shu (2001), who performed a nearly identical experiment. They, however, fail to note that the discrepancy actually involved a *reversal* of the order of semantic and phonological effects. Nor do they point out that subsequent studies by Chen and Peng (2001) and Chen, Wang, and Peng (2003) also failed to replicate the phonology-before-semantics effect.

Chapter 21, "Processing of characters by native Chinese readers" (pp. 237-249) by Marcus Taft, also advocates a specific model which, in opposition to Perfetti and Liu's model, claims that the orthographic representation of a character is not linked directly to phonology at all, but only indirectly via lemmas (abstract word-level representations). Though this is described here as "an important contrast" to the processing of alphabetic systems (p. 248), other work by this same author has argued that readers of alphabetic orthographies also commonly use the orthography-to-semantics route (e.g., Taft and van Graan 1998). Unfortunately, like most of the chapters in this book, this chapter focuses primarily on the author's own research, so there is no dialogue with researchers who, like Perfetti and Liu, take opposing positions.

The final chapter in the phonology-in-Chinese-reading trio is chapter 19, "Phonological mediation in visual word recognition in English and Chinese" (pp. 218-224) by In-Mao Liu, Jei-Tun Wu, Iue-Ruey Sue, and Sau-Chin Chen. The authors agree with Taft in rejecting an essential role for phonology in Chinese reading, concluding after a methodological review of the literature that phonological interference in semantic tasks does not imply a crucial role for {156} phonology because the interference may happen after the character has been identified. In support of this, they present their own (previously unpublished) experiment suggesting that readers activate phonology long after character identification has occurred. In our opinion, however, this experiment merely reconfirms the uncontroversial claim that Chinese readers must access memory representations of visual orthographic forms before the real linguistic system (phonology, lemmas, semantics) can get started.

Two chapters in this section deal with Chinese phonetics, both focused on lexical tone. The first is chapter 18, "Perception and production of Mandarin Chinese tones" (pp. 209-217) by Allard Jongman, Yue Wang, Corinne B. Moore, and Joan A. Sereno. The key findings are that the major cue to tone category for Mandarin listeners, as in other tone languages, is fundamental frequency, and Mandarin tone production, again as in other tone languages, involves co-articulation and interactions with stress and intonation. The authors also make a neurological observation noted in several other chapters as well: speakers of tone languages process lexical tone better in the left hemisphere of the brain, just like any other phonetic feature.

The other tone chapter, with an author list overlapping the first, is chapter 22, "L2 acquisition and processing of Mandarin tones" (pp. 250-256) by Yue Wang, Joan A. Sereno, and Allard Jongman, which looks at how non-native speakers of Mandarin deal with tone. The key results can be summarized quite succinctly: non-natives don't process tone as well as natives, but they get better with training, the effects of which are visible in brain scans. Though hardly surprising in its broad outlines, the real scientific interest of these results, as with second-language research generally, lies in the details, namely the degree to which training works, and whether or not trained non-native adults process in a similar way to natives. Both issues remain unresolved. This chapter is perhaps more important for its

pedagogical implications, however, providing hope for learners that perseverance with tone practice does eventually pay off.

Chapter 14, "Word-form encoding in Chinese speech production" (pp. 165-174) by Jenn-Yeu Chen and Gary S. Dell, also deals with phonology, but only as part of a larger model of word production. Aside from the two phonetic chapters just described, it is the only contribution in the book that deals with speakers as speakers, as opposed to listeners or readers. The focus is on the {157} theoretical and methodological approach to word production reviewed in Levelt, Roelofs, & Meyer (1999). Since natural speech errors can take one only so far (in addition to the Chinese speech error studies cited in this chapter, see also Zhang 1990 and Wan & Jaeger 1998), Levelt and colleagues have developed a set of clever experimental techniques to study word production. Chen and Dell and their students are among the very few to apply them to Chinese (others include Yu & Shu 2003). Their results so far are quite counterintuitive: in word production, Chinese tone acts like prosodic structure rather than the featural content it is taken to be in theoretical phonology, while morphological structure plays no role whatsoever.

The final two chapters in this section deal with syntax, albeit only in relation to other parts of language. In chapter 24, "Lexical ambiguity resolution in Chinese sentence processing" (pp. 268-278) by Yaxu Zhang, Ningning Wu, and Michael Yip, the central claim (based, as usual, primarily on the authors' own research) is that sentential context has an early and important effect on which of a word's multiple meanings becomes most active, perhaps by suppressing meanings that are contextually inappropriate. The authors imply that Chinese is particularly prone to sentential context effects due to two characteristics of the language: rampant homophony and ambiguity in syntactic category. We note, however, that Ahrens (1998) argues against such a typological approach, since Chinese classes with English in being less sensitive to context than is Italian, which is grammatically more like English.

The last chapter in this section, chapter 23, "The comprehension of coreference in Chinese discourse" (pp. 257-267) by Chin Lung Yang, Peter C. Gordon, and Randall Hendrick, deals with the interface between syntax and discourse comprehension. The authors' own research argues that the interpretation of pronominal elements in Chinese discourse is driven to a large extent by syntactic structure, just as has been claimed for languages like English. Surprisingly, the processing of pronominals is essentially the same whether they are overtly pronounced or silent (i.e., zero pronouns). Thus the authors challenge the common assumption that Chinese sentence processing is more discourse-oriented than languages like English. As usual with contributions in this book, however, there is no dialogue with researchers holding opposing viewpoints (e.g., Su 2004)

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2.3 Language and the Brain

The third and final section of the book (chapters 25-32) has a grab bag feel to it, since neurolinguistics is defined as much by methodology as by research focus. Moreover, three of the eight chapters are essentially brain-free, lumped together with the neurolinguistics for reasons that we can only speculate about. Of the remaining chapters, one is about aphasia, two are about reading (yet again), one is about bilingualism, and one is about phonology.

Chapter 25, "The relationship between language and cognition" (pp. 281-286) by Terry Kit-Fong Au, is the first of the chapters in this section with no brains in it. It can be

summarized via the two questions addressed by the author: "Can we think without language?" (p. 281) and "Can language shape thought?" (p. 282). The answers are, respectively, yes and no, thereby rejecting Whorf's hypothesis in favor of the mainstream separate-but-equal view of language and cognition. The author (along with others, like the uncited Wu 1994) played a key role in demolishing speculations about how Chinese language might influence Chinese thought, in particular that the putative lack of counterfactual markers hinders the understanding of counterfactuals (since in fact, Chinese does mark counterfactuals). The author notes that there is now a "Whorfian renaissance" (p. 286), though none of the recent Whorfian research on Chinese is cited (e.g., Zhang & Schmitt 1998, Boroditsky 2001).

Another chapter with virtually no neurolinguistics in it is chapter 27, "Specific language impairment in Chinese" (pp. 296-307) by Paul Fletcher, Stephanie Stokes, and Anita M. - Y. Wong (the second contribution by Stokes). The diagnosis of specific language impairment (SLI) requires that obvious neurological problems have already been ruled out, but it makes sense to group SLI research with brain research, given that it seems to have genetic correlates. However, as the authors note, there are conflicting claims about where these correlates are located in the chromosomes, and even the "specific" part of the name "SLI" is open to question, since sufferers typically also show nonlinguistic (particularly motoric) symptoms. The authors thus suggest that SLI has its roots in low-level limitations on speech processing capacity, as revealed by the greater difficulty English-speaking children with SLI have with inflection (which are unstressed or subsyllabic) than do their Cantonese-speaking {159} counterparts (where function morphemes are stressed syllables).

The final "brainless" chapter in the language and brain section is chapter 29, "Modeling language acquisition and representation: connectionist networks" (pp. 320-329) by Ping Li, which earns its place by dealing with artificial brains. Instead of modeling actual neural architecture, however, connectionism here is used to mimic patterns observed in behavioral experiments and corpus studies. The cited applications of connectionist modeling to Chinese all relate to the mental lexicon, namely character acquisition, lexical category formation, and the bilingual lexicon. Connectionism is particularly well suited to the modeling of lexical processes, since it treats all knowledge as the storage of items and the connections between items, and in the case of lexical knowledge, it seems that this is how things actually work (even the mostly serial models of Levelt et al. 1999 and Pinker & Ullman 2002 pass certain lexical processes over to networks).

The remaining chapters in this section do indeed fall squarely in the domain of neurolinguistics. Only one, chapter 30, "The manifestation of aphasia syndromes in Chinese" (pp. 330-345) by Jerome L. Packard, discusses the brain-damage patients who were once the neurolinguist's sole source of data. The author's own studies tend to show that Chinese aphasia patterns the same as in other languages, with Broca's aphasics (with damage in Broca's area, towards the front of the left hemisphere) being less fluent than Wernicke's aphasics (with damage further back of the left hemisphere). The former also show simplified syntax and dropped grammatical markers (e.g. *de* and *le*) while the latter show the reverse.

Reading returns in two contributions in this section, the first being chapter 31, "Naming of Chinese phonograms: from cognitive science to cognitive neuroscience" (pp. 346-357) by Dan-Ling Peng and Hua Jiang. "Phonogram" is another name for the phonetic components of

characters, and as the title suggests, data other than brain activity are discussed as well. Most of these other findings are covered in other chapters, such as the roles of character regularity and consistency in adult processing and development (cf. Shu and Wu's chapter) and how such effects can be modeled in a connectionist network (cf. Li's chapter). A few pages are also set aside to discuss the authors' recent neuroimaging research, which shows, unsurprisingly, that many areas of the {160} brain light up during the multifaceted task of Chinese reading.

Chapter 32, "How the brain reads the Chinese language: recent neuroimaging findings" (pp. 358-371) by Li Hai Tan and Wai Ting Siok, argues that what makes character reading neurologically distinct from the reading of English (or Pinyin read by native Chinese, a nice experimental control) is the special role played by the left middle frontal gyrus, a spot located a couple centimeters upward and forward relative to Broca's area. This spot, regardless of the language spoken by its owner, is devoted to holding a "limited amount of spatial information in an active state" (p. 361), which is just what's needed to "mediate visuo-orthographic analysis of written Chinese" (p. 362); in Chinese brains it actually grows larger through use, like a well-exercised muscle It's thus an important piece of the reading puzzle, but only one piece. Particularly misleading is the diagram on p. 370 showing that the majority of Chinese reading studies report activation in the left middle frontal gyrus; surely the studies reporting activation in other parts of the brain were equally informative about other aspects of the overall system.

Despite its title, much of chapter 26, "Language processing in bilinguals as revealed by functional imaging: a contemporary synthesis" (pp. 287-295) by Michael W. L. Chee, actually focuses on differences in language processing in monolingual speakers of Chinese vs. English. The major findings regarding bilinguals don't depend on neurological data at all, namely the commonsense observations that "[r]elative language proficiency/familiarity is an important consideration when comparing processing in different languages" (p. 291) and that "the processing of speech-like sounds is dependent on linguistic experience" (p. 294). More interesting is the author's failure to replicate research claiming neurological differences in those who were first exposed to a second language before vs. after puberty, thereby casting further doubt on the critical period hypothesis.

The final chapter to summarize is chapter 28, "Brain mapping of Chinese speech prosody" (pp. 308-319) by Jackson T. Gandour. Brain imaging data from speakers of Mandarin and other tone languages support three rather straightforward conclusions: lexical tone is processed {161} primarily in the left hemisphere (as noted in other chapters as well), emotion-related prosody is processed primarily in the right hemisphere, and intonation is processed bilaterally. All of these results make perfect sense.

2.4 A general observation

Of the many thoughts inspired by these chapters, one demands highlighting immediately. Namely, like most so-called handbooks published in academics, this book is not really a handbook at all. One might expect a handbook to provide objective descriptions of what seems known for certain and what is still controversial, perhaps with advice about how readers can carry out further research themselves. Yet with a few notable exceptions, the typical chapter in this book reads more like a miniature journal article. There are literature

reviews, but they are designed to advocate the authors' own theoretical positions, and the ultimate goal, in most cases, is to summarize the authors' most recent research, including work that is receiving its first major public airing in this very book.

It's easy to understand why this happens: researchers battling in the trenches aren't accustomed to stepping back and taking a bird's-eye view. Yet the result can be quite confusing for the naive reader, not only when chapters contradict each other without responding directly to the other's challenges, but even more seriously, when a solitary chapter stands for an entire research domain without any opposing chapter to stand its bias in relief. Moreover, since the alphabetical order of the chapters within sections obscures meaningful relationships between chapters, it is very hard for the naive reader, picking out just one or two chapters of special interest, to notice these biases and contradictions.

These problems are more than merely a disservice to the reader; the inward-looking focus of most psycholinguists today seriously reduces the value of their own findings, making the establishment of basic facts, let alone grand unifying theories, that much harder. An unshakeable principle of empirical research is that robust findings, supported by numerous studies conducted by researchers with different biases, are usually unsurprising, whereas the dramatic findings of a small study rarely stand the test of time. This principle applies not only to corpus studies of a single child's language development, but also to psycholinguistic experiments involving fifty or so undergraduate subjects and a hundred or so stimuli, and to the even smaller studies conducted by {162} neurolinguists. The only way around the problem is to conduct as much research, of the greatest variety, as possible, and to replicate, replicate, replicate. Meta-analyses (statistical reanalyses of data from multiple published studies, such as the one mentioned on p. 275 of Zhang et al.'s chapter), along with improved coordination across multiple labs and researchers with competing points of view, would also help winnow out artifacts due to the accidental details of individual studies. None of this can happen, however, if individual researchers and their cliques continue as they long have, systematically ignoring or belittling the others.

3. WHY CHINESE?

In addressing our charge that Chinese psycholinguistics is inherently arbitrary (focusing as it does on one language, or language family), the first thing to recognize is that the universalistic philosophy underlying most psycholinguistics is not really Chomsky's fault (the editors implicitly blame him on p. 1). In fact, all scientists tend to be universalists, with the physicists, biologists, social psychologists, and vision researchers as much concerned with universal principles as the psycholinguists and grammarians. Given the limitations of time and resources, it is unfair to blame them for starting their universalist musings from what they know. Moreover, universalism in (psycho)linguistics is intrinsically divorced from nativism; the former is a methodological philosophy, the latter a system of empirical claims. Even if nothing about language is innate, we still must explain the general principles that make it possible for virtually any random brain to become fluent in any human language, or literate in any orthographic system.

Thus when we agree that psycholinguists must overcome their Western bias and include Chinese in their theorizing, this doesn't mean that Chinese should be studied exclusively for itself. Rather, from a universalist perspective, Chinese is merely one natural experiment

among many, a combination of variables that may permit the testing of universal hypotheses in ways unavailable in other languages. The editors and contributors to this book know this, though naturally enough they also happen to love Chinese for itself, resulting in studies that are sometimes only interesting to people who are curious about Chinese in particular (and we count ourselves among them).

From a universalist perspective, however, Chinese turns out to be less {163} than an ideal natural experiment. First, if one of the editors' goals truly is to "dispel the myths and mysteries" about Chinese (p. 3), then they should begin by admitting that the major cause of the fast-growing interest in Chinese psycholinguistics is not so much the intrinsic property of Chinese itself as the existence of a large and well-educated population of Chinese speakers available to serve both as research subjects and as researchers. Among the five thousand or so languages in existence today, many have far more exotic and theoretically important characteristics than Chinese, but unfortunately the accidents of history have made it too impractical to conduct much psycholinguistic research on them.

Second, most of the so-called special features of Chinese are actually not all that unusual cross-linguistically. Consider some of the features highlighted by the editors and contributors in this book. Lexical tone, for example, is found in a very large proportion of the world's languages (only in Europe is it rare). The claimed lack of inflection in Chinese is actually closely mirrored in English. Compared to other Indo-European languages, English is so under-inflected that it shows roughly the same morpheme-per-word ratio as Chinese, and dismissing aspect markers like *guo* as mere clitics presumes that we know precisely where Chinese draws its word boundaries (see Myers, Huang, & Wang 2006). Chinese morphemes do show more homophony than many languages, but given that most Chinese words have at least two morphemes, this fact only matters to language processing if Chinese word access is morpheme-based, an assumption that makes a lot more sense for readers than for listeners (see Packard 1999). Ambiguity in syntactic category is also not an unusual feature; English does it as well (*walk* can be a noun, *milk* a verb), and some researchers argue that syntactic category isn't an inherent lexical feature in any language (see Barner & Bale 2002 for psycholinguistic evidence).

Third, if one's goal is to test universal theories of language processing, studying Chinese faces the problem of synchronic bidialectalism discussed in Honorof and Feldman's chapter. The term "Chinese" is used not only for the Sinitic language family (Mandarin, Putonghua [standard Mandarin of the PRC], Cantonese, and Taiwanese [Southern Min] all have index entries in the book), along with the various orthographic systems associated with this family, but also as a synonym for "Standard Chinese" (Mandarin, or Putonghua). No other major {164} language faces anywhere near this degree of ambiguity about how it should be defined.

One might argue that it's not any one feature that makes Chinese important to psycholinguistics, but its own peculiar combination of features. In terms of experimental design, however, this is a liability, not an advantage. The confounding of multiple variables in cross-linguistic research makes it difficult to know which subset of these variables is relevant to which others, especially if some of the variables interact with each other or with extra-linguistic variables like educational conventions, meta-linguistic beliefs, or culture-specific cognitive processes (if there are any such things). The challenges are compounded still further when bilingualism is addressed as well, as is done in several of this

book's chapters, which adds further variables like age of acquisition, degree of immersion, motivation, and the complex neurological dance of two languages competing for resources within one brain.

A possible response to challenges like these would be to forget about conducting cross-linguistic research for its own sake, and instead attempt to design the appropriate controls within a single language. For example, if one is interested in the differences between reading characters vs. letters, comparing Chinese and English reading is not ideal, given the many known and unknown confounding variables. Therefore, some studies (including those discussed in Tan and Siok's chapter) take advantage of the fact that Chinese can be written in both characters and letters (Pinyin), thereby keeping the language constant while varying the orthography.

Where this sort of trick isn't possible, cross-linguistic comparison can still be productive if the researcher keeps three fundamental principles in mind. First, given the apparent lack of any relevant genetic differences across speech communities, any cross-linguistic difference in grammar or processing must be learnable. Some of the contributors, eager to highlight the intrinsic specialness of Chinese, seem to neglect this point. For example, Leong claims that Chinese-acquiring children know that the syllable is the fundamental unit in Chinese phonology, not the segment as in English. This may well be true, but where does this knowledge come from? Since it is rather straightforward for linguists to analyze Mandarin in terms of segments (as in IPA or Pinyin), what is blocking children from making a similar analysis? Whatever algorithm they are using, it {165} must be the same one that English-acquiring children use to extract segment-sized units for their language. Any proposed universal algorithm could then be tested on both English-acquiring and Chinese-acquiring children, and it may even be possible to manipulate the parameters experimentally to turn English children temporarily into Chinese, and vice versa. The general lesson here would almost fit on a bumper sticker: Think globally (develop universalist hypotheses), but act locally (test them on individual languages).

The second principle for sound productive cross-linguistic research is to develop models that are sufficiently articulated to capture the complex interrelationships among the many confounded variables. A good example is represented by Tardif's chapter, where cross-linguistic differences in noun and verb learnability are explained in terms of a chain of effects leading back to essentially accidental differences between Chinese and English. Because Tardif takes the trouble to include such "nuisance" variables in her explanatory model, she leaves open the possibility that the universal "nouns are easier" cognitive model is actually right after all, once these nuisance variables are factored out.

The third principle is to recognize that cross-linguistic data are inherently corpus data, even if they are collected in experiments, since the inventory of the world's languages is fixed ahead of time. Reliable corpus analysis depends on large and unbiased corpora, so researchers on various languages must coordinate with each other more effectively, as well as expand the corpus by conducting experiments on hitherto untouched languages (including most of the non-Sinitic languages of China, Taiwan, and Singapore). Equally important, experimentalists will have to become more familiar with the highly sophisticated tools that have been developed for testing hypotheses on corpora. Among these are tools that have been developed specifically for typological research (see Cysouw 2005), as well as statistical

techniques designed to deal with the confounding of cross-linguistic variables in experiments (see Bates et al. 2003).

Cross-linguistic psycholinguistics is vitally important, but poses serious challenges. If its potential is to be achieved, Chinese psycholinguists must join others in taking these challenges seriously.

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4. BALANCING PRIORITIES

We start our discussion of gaps in contemporary Chinese psycholinguistics by noting where this particular anthology fails to reflect the full scope of research already being done. The most notable gap, to our mind, is the lack of a focused discussion on morphological processing. This gap cannot be justified by the relatively impoverished morphology of Chinese (cf. Packard 2000), since the processing of Chinese compounds is actually quite a lively area of research, much of it conducted by contributors to this volume (see reviews in Taft, Liu, & Zhu 1999 and Myers 2006). Yet in this book, morphology comes up only indirectly: the reading of nonlexical combinations of characters (Leong), the acquisition of function words (Shi), the putative lack of morphological processing in production (Chen and Dell), the reading of characters in sentential context (Feng), the processing of bound morphemes and characters (Taft), and morphological deficits in aphasia (Packard). The discussion of adult sentence processing in this book is similarly diffuse. While there are two chapters on the topic (Zhang et al. and Yang et al.), both discuss sentence parsing only with respect to other issues (lexical semantics and discourse processing, respectively). Finally, as already noted in passing in several reviews above, the contributors have occasionally missed citing relevant research.

For the most part, however, gaps in the book accurately reflect gaps in the Chinese psycholinguistic literature as a whole. This is true to some extent even for morphology and syntax. Very little research has been done on morphological operations in Chinese other than compounding (cf. Packard 1993, Myers et al. 2006). Furthermore, in sharp contrast to other languages, there hasn't been much interest among Chinese psycholinguists in formal sentence parsing theories; for instance, there are no such studies in the review by Miao (1999) (cf. Hsiao & Gibson 2003). Just as in this book, research on Chinese neurolinguistics has been slanted towards brain imaging methods that give good spatial resolution but poor temporal resolution, which has made it difficult to determine what happens when, the most essential test of any processing model. Language production is also underrepresented in Chinese psycholinguistics, but this is true of psycholinguistics in general, partly because of the methodological challenge of getting people to speak on cue. Finally, as the editors acknowledge, {167} the book also accurately reflects the relative lack of attention paid to the processing of spoken Chinese.

This last gap is, of course, the flip side of Chinese psycholinguists' overly heavy focus on reading. This bias strikes the linguist as precisely backwards. As Bloomfield (1933, p. 21) correctly put it: "Writing is not language, but merely a way of recording language by means of visible marks. [...] In order to study writing, we must know something about language, but the reverse is not true." Certainly Chinese characters are worthy of study, since the relative ease with which people learn and use them is indeed a wonder of the natural world: like St. Elmo's Fire or the platypus: if Chinese characters didn't actually exist, nobody would believe

they could. At the same time, however, if they had never existed, the (scientific) world would probably have never missed them. Even without Chinese characters it's possible to demonstrate that reading doesn't always require phonological activation (see our summary of Taft's chapter), and once that's settled, there doesn't seem to be much else to be learned about the human mind from the fact that it can read Chinese. Even more curious, the vast majority of Chinese reading studies pretend that characters are read in isolation. Only one of this book's eleven reading chapters (Feng) focuses on the reality that characters are actually read in long strings, without marked word boundaries, and only one other mentions research on the reading of words as wholes (Taft).

The fact that Chinese psycholinguists are fixated specifically on characters, not reading in general, is the essential cue to the real problem underlying contemporary psycholinguistics: psychologists don't know enough linguistics. Instead, they tend to build on folk-linguistic notions, beliefs that native speakers naively have about the nature of their language or language in general. Chinese psycholinguists seem to reason as follows: everybody knows that language is words (*huà*), and Chinese words (*zì*) are characters, hence to study Chinese is to study Chinese characters (traditional Chinese linguists were stuck in the same trap for centuries). There is also the folk-linguistic belief that "real" language is what is taught in school. The fact that reading is an unnatural act that requires explicit training and is differentially mastered (serving as a convenient shibboleth for limiting access to higher social levels) thus makes reading appear to be much more "real" than spoken language. Hence the heavy {168} pedagogic emphasis in several of the reading studies in this book.

We're not saying that psychologists don't know any linguistics at all, but the strict discipline needed to produce good research in their field leaves little time to reframe their thoughts about language in the way linguists have demonstrated to be more appropriate. Maintaining a research program to the bitter end takes passion, and ultimately what psycholinguists are passionate about are questions encoded in folk-linguistic terms, not the higher-level issues that linguists recognize as most important. This problem is not limited to Chinese psycholinguists, of course, and some might even argue that it's not really a problem at all. Reading characters is a more basic skill than, say, processing written texts, so of course we should establish a detailed theory of the former before attempting the latter. However, this argument is as fallacious as the argument that we must have a complete theory of physics before we can start studying chemistry.

It's well past time for Chinese psycholinguists to end their character fixation and saccade into the rest of the vast richness of Chinese.

5. PSYCHOLINGUISTICS AND THE FUTURE OF LINGUISTICS

Linguistics and psycholinguistics may have different academic cultures, as we have just suggested, but otherwise linguistics, as a science, is simply a branch of psycholinguistics. Our last major comment in this review is that it is time for linguists to recognize this essential fact and adjust their methodology and theorizing accordingly. This book thus represents not only the present of Chinese psycholinguistics, but also the future of Chinese linguistics in general. And the sooner linguists take an active part in shaping the study of language from a psychological perspective, the sooner psycholinguistic research will move beyond character reading into more fertile ground.

Myers, J., & Tai, J. H.-Y. (2007). A critical review of *The handbook of East Asian psycholinguistics, vol. 1: Chinese*, by Ping Li, Li Hai Tan, Elizabeth Bates, & Ovid J. L. Tzeng (eds.) Cambridge University Press, 2006. *Journal of Chinese Linguistics, 35* (1), 145-175.

The traditional limitation of psycholinguistics to language acquisition, language processing by adults, and neurolinguistics (the three major subdivisions of this book) is just that: traditional. In actual fact, the empirical challenges faced by "ordinary" linguists (e.g., theoretical syntacticians and phonologists) are of precisely the same sort faced by psycholinguists. In particular, since language is in the head, grammarians have no more direct information about language structure than psycholinguists do about processing, {169} and it is an illusion to think otherwise. For example, the acceptability judgments that form the basis of much of grammatical theorizing are behavioral data tainted by numerous factors other than grammar (see Schütze 1996). Psychologists and neuroscientists have long faced the "noisiness" of behavioral data head-on, which is why they adopt sophisticated experimental techniques and statistical analyses like those of the "hard" sciences. They do this even if the raw data are in fact linguist-style acceptability judgments, as in the syntax acquisition chapter by Chien and Lust. The fact that grammarians don't collect and analyze adult judgments with the same degree of methodological sophistication is purely an accident of history that will be resolved in the fullness of time; all sciences trend towards becoming ever more experimental and ever more quantitative. That is why we say this book provides a glimpse into the future of linguistics, like it or not.

The closeness of this future can best be felt by considering the editors' summary of the "current state of the art" of Chinese psycholinguistics with respect to "five general issues or directions" (pp. 3-6). Each issue already plays an important role in contemporary grammatical research, albeit in somewhat different terms. The first is the "role of orthography versus phonology in lexical (semantic) processing." Though linguists generally shun the study of orthography, the underlying issue here is not really orthography per se, but rather phonology, something that linguists take to be an essential part of the architecture of human grammar. Linguists should therefore be very interested to know if phonology can be regularly bypassed in one mode of language processing (i.e., reading).

The second issue listed by the editors is the "time course of lexical access in sentence processing." This receives greater highlighting by the editors than is justified by the book itself (only one chapter, Zhang et al., actually addresses it), though it has formed an important theme in research by some of the editors (Bates in particular). This theme also directly confronts a basic assumption made in grammatical theory, namely the notion of grammar as composed of autonomous modules (here, lexical semantics and syntax). Modularity is especially prominent in generative linguistics, of course, but it is also a working principle of structuralist linguistics more generally. Again, linguists should be very interested to know what processing experiments have to say about the {170} interaction between these putative modules.

The third issue is the "interaction of lexicon, grammar, and context in acquisition." Again, this topic fits better with the editors' own research than with the contents of this book (Tardif's chapter comes closest), but it strikes close to the heart of contemporary linguistic theory. Acquisition has played a central (if usually rather abstract) role in grammatical theorizing at least since Chomsky (1965), to the extent that it's considered almost more important how children deal with language than how adults do. Since the stakes are so high, grammarians have long maintained a branch office in the baby lab, and it is for this reason that the chapters in this book that read most like "ordinary" linguistic research, with

numbered sentences and abstract grammatical theorizing, are in the language acquisition section.

The fourth issue listed by the editors is the "neuroanatomical mechanisms of processing and acquisition," but studying these is less a theme than an inevitable duty: ultimately all of linguistics, like the rest of psychology, must go back to the brain, because ultimately all sciences are branches of physics. So far this imperative hasn't had much influence on psychology, let alone linguistics, since we still know too little about language in the brain. This is partly side-effect of the small-study problem: brain-imaging studies are too expensive (and sometimes too dangerous) to involve more than a handful of subjects carrying out a small number of tasks, and it's commonplace for them to conflict with each other. At the same time, brain scans contain so much data that they can act something like Rorschach inkblots, with conflicting stories seeming to fit them about equally well. This is especially so if the data are collected without very clear hypotheses in mind, or without taking into account the temporal resolution of the measuring. This problem is illustrated by Peng and Jiang's chapter, where one brain-scan result is described (p. 355) as involving a "distributed neural network (including the frontal, temporal, occipital, parietal lobes, and the cerebellum)" – in other words, virtually the entire brain. It seems more likely that different parts were activated at different times for different jobs, but the images were blurred together in the scan.

The final issue highlighted by the editors is "neural network modeling and computational analyses." Their basic point here is unassailable: computer modeling is an essential part of the quantitative worldview inherent in all of {171} modern science, and not even grammatical theory is immune from its lure (cf. the notion of "crashing" in Chomsky's Minimalist Program). However, the editors seriously mislead naive readers by implying that their preference for connectionist modeling is universally shared in the psycholinguistic community. This is far from true; Marcus (2001) and Marslen-Wilson & Tyler (to appear) are just two recent examples of psycholinguists pointing out the serious conceptual and empirical limitations of connectionist modeling. Nevertheless, connectionism does have an important role to play in the future of (psycho)linguistics, since it's the best tool yet developed for linking behavior to the brain.

In all five of these areas, linguists must be prepared to guide the research in a way that does full justice to the nature of real language, and not just the psychologist's overly naive version of it.

6. CONCLUSIONS

In the unlikely event that our main conclusions haven't already been hammered home sufficiently bluntly, we repeat them again briefly here. The first is: read this book. Second, Chinese psycholinguists have to coordinate a bit more efficiently. Third, they have to consider more deeply the implications of viewing Chinese as just one of the multitudes of languages processable by the human brain. Fourth, they have to think more like linguists, if only to distract them from their unhealthy obsession with orthography. Finally, and most importantly, linguists have to think more like psycholinguists; all linguistic data are psychological data, and should be collected and analyzed in accordance with the standards of the rest of cognitive science. Contemporary grammarians have outgrown their traditional place among the philologists and literary critics, and are now, for all goods and purposes,

cognitive psychologists. It's time they started acting like it, and there's no better place to start than to study books like this.

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REFERENCES

AHRENS, K. (1998). Lexical ambiguity resolution: Languages, tasks and timing. In D. Hillert (Ed.), *Sentence processing: A cross-linguistic perspective* (pp. 11-31). Academic Press.

BARNER, D., & BALE, A. 2002. No nouns, no verbs: Psycholinguistic arguments in favor of lexical underspecification. *Lingua, 112*, 771-791.

BATES, E., D'AMICO, S., JACOBSEN, T., SZEKELY, A., ANDONOVA, E., DEVESCOVI, A., HERRON, D., LU, C-C., PECHMANN, T., PLEH, C., WICHA, N. Y. Y., FEDERMEIER, K. D., GERDJIKOVA, I., GUTIERREZ, G., HUNG, D., HSU, J., IYER, G., KOHNERT, K., MEHOTCHEVA, T., OROZCO-FIGUEROA, A., TZENG, A., & TZENG, O. (2003). Timed picture naming in seven languages. *Psychonomic Bulletin & Review, 10* (2), 344-380.

BLOOMFIELD, L. 1933. *Language*. New York: Holt, Rinehart and Winston.

BOND, M. H. (Ed.) 1996. *The handbook of Chinese psychology*. Hong Kong: Oxford University Press.

BORODITSKY, L. 2001. Does language shape thought? English and Mandarin speakers' conceptions of time. *Cognitive Psychology, 43*(1), 1-22.

CHANG, H.-W., J.-T. HUANG, C.-W. HUE & O. J. L. TZENG (Eds.) 1994. *Advances in the study of Chinese language processing*. Taipei: Department of Psychology, National Taiwan University.

CHEN, B., & PENG, D. 2001. The time course of graphic, phonological and semantic information processing in Chinese character recognition (I). *Acta Psychologica Sinica, 33* (1), 1-6.

CHEN, B., WANG L., & PENG, D. 2003. The time course of graphic, phonological and semantic information processing in Chinese character recognition (II). *Acta Psychologica Sinica, 35* (5), 576-581.

CHEN, H.-C. (Ed.) 1997. *Cognitive processing of Chinese and related Asian languages*. Hong Kong: The Chinese University Press.

CHEN, H.-C., & O. J. L. TZENG (Eds.) 1992. Language processing in Chinese. Amsterdam: North-Holland.

CHEN, H.-C., & SHU, H. 2001. Lexical activation during the recognition {173} of Chinese characters: Evidence against early phonological activation. *Psychonomic Bulletin & Review, 8* (3), 511-518.

CHOMSKY, N. 1965. *Aspects of the theory of syntax*. Cambridge, MA: MIT Press.

CYSOUW, M. 2005. Quantitative methods in typology. In R. Köhler, G. Altmann, & R. G. Piotrowski (Eds.) *Quantitative linguistics: An international handbook*. Berlin: Mouton de Gruyter.

DEFRANCIS, J. 1989. *Visible speech: The diverse oneness of writing systems*. Honolulu, HI: University of Hawaii Press.

HAKUTA, K., BIALYSTOK, E., & WILEY, E. 2003. Critical evidence: A test of the

critical-period hypothesis for second-language acquisition. *Psychological Science, 14* (1), 31-38.

HSIAO, F., & GIBSON, E. 2003. Processing relative clauses in Chinese. *Cognition, 90* (1), 3-27.

KAO, H. S. R., & R. HOOSAIN (Eds.) 1986. *Linguistics, psychology, and the Chinese language*. Centre of Asian Studies, University of Hong Kong.

KAO, H., C. K. LEONG, & G. D. GUO (Eds.) 2002. *Cognitive neuroscience studies of the Chinese language*. Hong Kong: Hong Kong University Press.

LEVELT, W. J. M., ROELOFS, A., & MEYER, A. S. 1999. A theory of lexical access in speech production. *Behavioral and Brain Sciences, 22* (1), 1-38. Discussion 38-75.

LIU, I.-M., H.-C. CHEN, & M. J. CHEN (Eds.) 1988. *Cognitive aspects of the Chinese language*. Hong Kong: Asian Research Service.

MARCUS, G. F. 2001. *The algebraic mind: Integrating connectionism and cognitive science*. MIT Press.

MARSLEN-WILSON, W. D., & TYLER, L. K. To appear. The lexicon, grammar, and the past tense: Dissociation revisited. To appear in Tomasello, M. & Slobin, D. (Eds.) *Beyond Nature-Nurture: Essays in Honor of Elizabeth Bates*. Mahwah, NJ: Lawrence Erlbaum.

McBRIDE-CHANG, C., & H.-C. CHEN (Eds.) 2003. *Reading development in Chinese children*. New York: Greenwood Press.

MIAO, X. 1999. Sentence understanding in Chinese. In J. Wang, A. W. Inhoff, and H.-C. Chen (Eds.) *Reading Chinese script: A cognitive analysis* (pp. 279-295). Erlbaum. {174}

MYERS, J. 2006. Processing Chinese compounds: A survey of the literature. In G. Libben and G. Jarema (Eds.). *The representation and processing of compound words* (pp. 169-196). Oxford: Oxford University Press.

MYERS, J., & TSAY, J. 2000. The acquisition of the default classifier in Taiwanese. *Proceedings of the International Symposium on Chinese Languages and Linguistics, 7*, 87-106. Chiayi, Taiwan.

MYERS, J., HUANG, Y.-C., & WANG, W. 2006. Frequency effects in the processing of Chinese inflection. *Journal of Memory and Language, 54*, 300-323.

NAKAYAMA, M. (Eds.) 2002. *Sentence processing in East Asian Languages*. Stanford: Center for the Study of Language and Information Publications.

PACKARD, J. L. 1993. *A linguistic investigation of aphasic Chinese speech*. Dordrecht: Kluwer.

PACKARD, J. L. 1999. Lexical access in Chinese speech comprehension and production. *Brain and Language, 68*, 89-94.

PACKARD, J. L. 2000. *The morphology of Chinese: A linguistic and cognitive approach*. Cambridge, UK: Cambridge University Press.

PERFETTI, C. A., & TAN, L. H. 1998. The time course of graphic, phonological, and semantic activation in Chinese character identification. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 24*, 101-118.

PINKER, S., & M. T. ULLMAN. 2002. The past and future of the past tense. *TRENDS in Cognitive Sciences, 6* (11), 456-463.

SCHÜTZE, C. T. 1996. *The empirical base of linguistics: Grammaticality judgments and*

linguistic methodology. Chicago: University of Chicago Press.

SORACE, A. 2003. Near-nativeness. In C. J. Doughty & M. H. Long (Eds.), *The handbook of second language acquisition* (pp. 130-151). Blackwell.

SU, I.-R. 2004. The effects of discourse processing with regard to syntactic and semantic cues: A competition model study. *Applied Psycholinguistics, 25* (4), 587-601.

TAFT, M., & VAN GRAAN, F. 1998. Lack of phonological mediation in a semantic categorization task. *Journal of Memory and Language, 38*, 203-224. {175}

TAFT, M., LIU, Y. & ZHU, X. 1999. Morphemic processing in reading Chinese. In J. Wang, A. W. Inhoff, & H.-C. Chen (Eds.) *Reading Chinese script: A cognitive analysis* (pp. 91-113). Mahwah, NJ: Lawrence Erlbaum Associates.

TANENHAUS, X. 1988. Psycholinguistics: An overview. In F. J. Newmeyer (Ed.) *Linguistics: The Cambridge survey III: Language: Biological and psychological aspects* (pp. 1-37). Cambridge University Press.

TZENG, O. J. L. (Ed.) 1999. *The biological bases of language. Journal of Chinese Linguistics Monograph Series No. 13*. Project on Linguistic Analysis: University of California at Berkeley.

WAN I-P., & JAEGER, J. J. 1998. Speech errors and the representation of tone in Mandarin Chinese. *Phonology, 15*, 417-461.

WANG, J., A. W. INHOFF & H.-C. CHEN (Eds.) 1999. *Reading Chinese script: A cognitive analysis*. Mahwah, New Jersey: Lawrence Erlbaum Associates.

WU, C. H.-F. 1994. *"If triangles were circles,..." – A study of counterfactuals in Chinese and in English*. Taipei: Crane Publishing Company.

YU, L., & SHU, H. 2003. 汉语言语产生的语音加工机制 [Phonological processing mechanism in Chinese speech production]. 心理科学[*Psychological Science*]*, 26* (5), 818-822.

ZHANG, N. 1990. *Chinese slips of the tongue and models of language production*. Unpublished doctoral dissertation. Shanghai International Studies University.

ZHANG, S., & SCHMITT, B. 1998. Language-dependent classification: the mental representation of classifiers in cognition, memory, and ad evaluations. *Journal of Experimental Psychology: Applied, 4*(4), 375-385.