BRAIN AND LANGUAGE 45, 94–107 (1993)

Where Is the Boundary between Compounds and Phrases in Chinese? A Reply to Zhou et al.

ELIZABETH BATES

University of California at San Diego

SYLVIA CHEN

University of Southern California

PING LI

The Chinese University of Hong Kong

MEITI OPIE

University of California at San Diego

AND

OVID TZENG

University of California at Riverside

In a recent paper on object and action naming in Chinese aphasics (Bates, Chen, Tzeng, Li, & Opie, 1991), we report two major findings. Both of these findings are discussed in some detail in a critique by Zhou et al. (1993).

First, we replicated a double dissociation that Miceli and his colleagues had reported previously for object vs. action naming in Italian-speaking Wernicke's and Broca's aphasics (Miceli, Silveri, Villa, & Caramazza,

This research was supported by a grant from PHS-NIDCD RO1-DC00216-07 to Elizabeth Bates. We are grateful to Shuan-fan Huang for his comments on the compounds/phrases distinction and for information on L1 acquisition. Address correspondence to Elizabeth Bates, Center for Research in Language 0526, University of California at San Diego, La Jolla, CA 92093-0526.

0093-934X/93 $5.00

1984). Specifically, Broca's aphasics have more difficulty naming actions than objects, while Wernicke's aphasics have more difficulty naming objects than actions. Our replication of this effect in Chinese is important because it eliminates one of several competing explanations for this double dissociation. In languages like English and Italian, verbs carry more complex morphological marking than nouns. Hence it could be the case that a verb-naming deficit in Broca's aphasia is secondary to a more general problem with access, selection, and/or production of inflectional morphology. Because Chinese has no inflectional morphology of any kind, on verbs or nouns, the noun/verb dissociation in this language cannot be explained by morphological differences between the two vocabulary types.

Second, we found a surprising variant of the noun/verb dissociation at the sublexical level. Chinese has a large number of compound words, including words that are made up of a verbal element and a nominal element (henceforth V–N compounds). For example, the word for "to read" is KAN-SHU, literally LOOK-BOOK. On items of this kind, we found that Broca's aphasics are significantly less likely to lexicalize the verbal element in V–N compounds (e.g., "KAN"), while Wernicke's aphasics are less able to lexicalize the nominal element in the same compound words (e.g., "SHU"). Based on this finding, we have argued that the noun–verb dissociation in Broca's and Wernicke's aphasia reflects a problem that occurs at both the lexical and the sublexical levels. Hence it cannot be explained by postulating a straightforward disconnection between a "verb lexicon" and a "noun lexicon" (cf. Miceli et al., 1984; Miceli, Silveri, Romani, & Caramazza, 1989).

In their critique, Zhou et al. do not dispute our first conclusion. In fact, even though they have reanalyzed our data from a different point of view, they replicate our noun–verb dissociation at the whole-word level. They do question our choice of materials to make this point, complaining that the Miceli et al. stimuli were not developed for Chinese language or Chinese culture. Our response to their methodological complaint comes in two parts.[1] First of all, we would like to point out that our coding

[1] Zhou et al. complain that we did not use and indeed seemed unaware of existing word frequency norms in Chinese. In this regard, it is important to keep in mind that our aphasia study was designed in 1986 and took a number of years to complete. The frequency norms that were available at that time could not be used to separate lexical and sublexical processes in the version of Chinese spoken in Taiwan. For example, Liu, Cheung, and Wang (1975) only provide frequencies for whole words, and the frequency norms published by the Institute of Language Teaching and Research (in Beijing) were not appropriate to our study because those data are based on vocabulary used in Mainland China. Fortunately, progress in Chinese psycholinguistics has been very fast, and better frequency norms are now available (although most are still unpublished). The study of Tseng cited at the end of this paper has been conducted making use of norms collected by Wu Rwei-tun in Taiwan (Wu, personal communication).

system is not a simple translation of Miceli et al., nor did we arbitrarily assign one lexical item for each picture to serve as the "best response" (as Zhou et al. suggest). To develop our scoring criteria, we carried out a pilot study with eight normal Chinese-speaking subjects. For each item, the majority response (which was also consistent with our own intuitions) was designated as the "target," but other responses which were different from the targets but acceptable to Chinese normals were coded as "other correct." Based on this pretest, we did (as noted in the paper) eliminate one culture-specific item that was difficult for normal Chinese speakers to recognize or name. The remaining pictures posed no significant problems for the pilot sample or for normal Chinese subjects matched in age, sex, and education to our Chinese aphasics.[2] Second, we chose the Miceli et al. materials for our first study of action and object naming because the primary goal of that study was replication. We regard this as a necessary starting point for richer and more precise investigations of lexical access in Chinese aphasia, with materials that are carefully tailored to the special properties of Chinese nouns and verbs (e.g., Chen, in preparation; Chen, Andersen, Kempler, & Bates, 1992). Consider, however, what might have happened if we had failed to replicate the original finding by Miceli et al., using a radically different set of picture stimuli. How would we ever know if this failure to replicate derived from a true difference between Italian and Chinese or from a difference in stimulus materials? It may be that our Chinese adaptation worked as well as it did because the study was conducted in Taiwan, a society that is heavily influenced by Western culture. Whether or not this is the case, we did replicate the Miceli et al. effects for native speakers of Chinese. This Chinese replication attests to the robust nature of the dissociation between object naming and action naming in Broca's and Wernicke's aphasia, and it opens the way for future research on the nature of this dissociation with materials designed expressly for use in Chinese.

Aside from this methodological quibble, the main criticism raised by Zhou et al. revolves around our second conclusion, i.e., that the double dissociation in Chinese affects production at the sublexical level.[3] They

[2] It is true that some of the Miceli et al. items are not as familiar in Chinese culture as they are in the West and elicited a somewhat greater variety of noun or verb targets than Miceli et al. report for their language (e.g., on Item No. 7 which Italian normals would invariably describe with the verb "pray," Chinese normals might say either "kneel" or "pray"). It does not seem to us that this invalidates the procedure.

[3] There was an important difference between our lexical and sublexical analyses, one which Zhou et al. seemed to have missed. At the lexical level, we scored each description as correct or incorrect (where "correct" includes production of the target word, or another word which was perfectly acceptable, based on our pilot findings with normals). This analysis proved all but impossible to apply at the sublexical level because incorrect selection of one element within a compound changes the meaning and hence the correctness of the other morpheme. As we noted in our original paper, on the sublexical analysis we asked

raise a number of concerns about the nature of Chinese V–N compounds, arguing on structural grounds that many of our stimuli are actually full V–N phrases. According to Zhou et al., "*Over half of the V–N forms classified as verbal compounds in their study are in fact V–N phrases.*" When Zhou et al. remove these "questionable" items from the data set, they find that our sublexical dissociation disappears. In this reply, we will focus on the criteria that Zhou et al. invoke to distinguish between "questionable" V–N phrases and "true" V–N compounds. Our main point is simply this: Chinese V–N compounds are genuine hybrids, displaying a combination of phrasal and lexical properties that are the stuff of nightmares for linguists who believe in universal categories with neat borders. We agree that many different definitions could be offered to distinguish between compounds and phrases, but there is no "right" place to draw the line. If we accept one set of criteria (in particular, the structural criteria that Zhou et al. rely upon to argue that our compounds have a phrasal status), then we necessarily violate or abandon another equally important set (for example, the criteria that are required to define the minimal "citation form" for transitive and intransitive verbs in the Chinese language). It is interesting that apparent dissociations in aphasia can disappear or reappear depending on one's criteria. But none of these criteria are "right."

THE HEART OF THE MATTER: COMPOUNDS AND PHRASES IN CHINESE

In English (and in many other Western languages), compounds and phrases can be distinguished on structural grounds like the following:

(i) Compounds can be inflected like verbs (e.g., "horsewhip" → "horsewhipped").

(ii) Compounds involve a reversal of the word order used in a corresponding phrase (e.g., "horsewhip" comes in the order N–V, while the original phrase from which it was derived comes in the order V–N, as in "whip a horse").

(iii) Compounds are inseparable, that is, one cannot insert additional lexical or morphological materials between the elements that make up a "true" compound word (e.g., one cannot say "horse-badly-whipped").

(iv) Because compounds can function as a main verb, they can take

instead whether the patient was able to *lexicalize* the noun element and/or the verb element within a V–N compound, whether or not that lexicalization was correct. Thus, if a patient produced the wrong V or N morpheme within a compound but nevertheless did manage to encode something about the target, then s/he received credit for "+lexicalization" (e.g., LOOK-THING or LOOK-NEWSPAPER rather than LOOK-BOOK). Zhou et al. do not make it clear what criteria they applied in their sublexical reanalysis, but their reference in paragraph 2 to two "errors on the verbal element of a Verb–Noun compound" suggests that they may have attempted a very different kind of analysis from ours.

object complements even if such complements are redundant with the nominal element in the compound word (e.g., one can say "He horsewhipped the beast" even though one cannot say "He whipped the horse the beast").

As Zhou et al. point out, criteria (i–iii) cannot be used to distinguish compounds from phrases in Chinese, because (i) there are no bound inflections on Chinese verbs at all, (ii) word order reversal is not used in compound formation, and (iii) many true compounds can undergo a limited amount of insertion in Chinese. Among the remaining structural criteria, this leaves (iv), which Zhou et al. (following T-C. J. Huang, 1984) refer to as the Phrase Structure Condition or PSC.

In fact, the PSC is problematic even when it is applied to English. Presumably, the second object complement is permitted in a compound (but not in a true verb phrase) because one of the nouns has been absorbed into the main verb and no longer qualifies as an argument of that verb. Notice, however, that the PSC is subject to a number of poorly understood pragmatic constraints in English. For example, a sentence like "he horsewhipped the horse" sounds very strange indeed; most English listeners would agree that the sentence "He whipped the horse" sounds much better. This is not an isolated example: consider the infelicity of phrases like "Housecleaned the house" or even "Housecleaned the cottage," "Bottle-washed the bottles" or even "Bottle-washed the wine decanter." The line between pragmatic and syntactic constraints is not an easy one to draw. As we shall see, the line is even harder to draw in Chinese.

The PSC has particularly strong implications for Chinese because many terms that would otherwise qualify as compounds fail to meet this test. For example, the expression KAN-SHU (LOOK-BOOK) is the usual way to talk about reading in Chinese. However, if one wants to say "I read the newspaper," one must replace the nominal element BOOK with the intended object complement, saying the equivalent of LOOK-NEWSPAPER rather than LOOK-BOOK-NEWSPAPER. On these grounds, KAN-SHU is a phrase rather than a compound. If this strong criterion is applied to the items in our data set, then (as Zhou et al. note), none of the 27 Verb–Noun targets in our action-naming stimuli qualify as compounds.

Zhou et al. are aware that C-T. J. Huang's criterion may be too strong, so they discuss a softer version derived (in part) from earlier suggestions by Li and Thompson (1981). These authors discussed three criteria for distinguishing between compounds and phrases in Chinese:

(v) Limited separability, a variant of (iii) that takes into account the fact that most Chinese compounds can be separated by a limited class of morphemes, but cannot undergo the full range of syntactic transformations that are applied productively to real phrases.

(vi) Boundedness, i.e., if one or both of the constituents in a V–N structure is a bound morpheme, then that structure is more likely to be a compound.

(vii) Idiomaticity, i.e., the meaning of a compound is "special" and cannot be reduced to a combination of its parts, whereas the meaning of a phrase is clearly composed of the meaning of it constituents.

Zhou et al. do not discuss (v–vii) in any detail. However, following suggestions by Y. Y. Huang (1991), they propose that criteria (vi) and (vii) are actually reflexes of (v), which is a weak version of the PSC. According to this criterion, "*Those V–N forms which only allow limited syntactic movements are compounds and those V–N forms which allow various kinds of transformations are phrases.*" The variant of the PSC is the one that Zhou et al. settle on in their critque. Applying this definition to our stimuli, they conclude that at least 15 of our V–N compounds should be classified as phrases. When the remaining V–N compounds are analyzed on their own, Zhou et al. conclude that there is no double dissociation at the sublexical level.

We agree that either version of the PSC (weak or strong) complicates the definition of compounds in Chinese (see footnote 1 in our original paper). However, these criteria must be applied with considerable caution, for several reasons.

First, there is an intimate interaction between compounds and phrases at the level of argument structure, which makes the distinction much harder than one might infer from the Zhou et al. critique. Consider their examples (1a–b) and (2).

1a. *ta you de hen hao.*
she swim DE very well
"She swims very well."

1b. **ta you-yong de hen hao.*
she swim-swim DE very well
"She swims very well."

2. *ta hen guan-xin ni.*
she very close-heart you
"She cares about you very much."

Notice first that the morpheme-by-morpheme translation for (2) is misleading. The morpheme "guan" cannot literally be translated as "close." In fact, it comes from the compound "guan-huai" which means "care-embrace." The compound "guan-xin" therefore has to be interpreted as "to care for someone with the heart." The "heart," functioning as either an agent or an instrument, is to care for an OBJECT which does not appear within the compound. Thus, the distinct syntactic behavior of "you-yong" and "guan-xin" is due to differences of argument structure rather than differences in compound versus phrasal status. Specifically, the noun "yong" is the direct object (or internal argument) of the verb

"you" while "xin," not an object, serves as an instrument or agent (or noninternal argument). Because the true object of "guan-xin" is not satisfied within the compound, the object outside of the compound (i.e., ni "you") is allowed to follow the V–N and becomes the object of the verb (e.g., guan, "to care for"). In other words, there is an intimate relationship between verb argument structure inside of compounds and the argument structure of the corresponding verb at a sentential level (Di Sciullo & Williams, 1987). This point does not emerge in Zhou et al.'s discussion of the PSC.

Second, Zhou et al. also provide an incomplete and misleading account of boundedness in relation to the PSC. A bound morpheme is (by definition) a morpheme that can never appear as an independent word within a sentence (Chao, 1968; Li & Thompson, 1981; Ren, 1980; Zhu, 1981). This approach, however, is not empirically sufficient because "bound" morphemes are not consistently bound in Chinese. For example, QI "instrument", a true bound morpheme, does appear as a free word in the sentence. "Cheng bu liao QI, jiu qu zhong-tian!", meaning "If (you) cannot be trained then go work on the field," but literally translated as "finish not complete instrument, then go plant field." Moreover, free morphemes are not always free. For example, REN (literally man) functions as a free word in the sentence "nei ge REN bu hui shuo-hua" ("That person is not good at talking"), but it functions as a bound form in the compound "REN-zao-rou" (meaning "vegetarian meat" but literally "Man-make-meat").

Of the criteria discussed in Zhou et al., idiomaticity is the only one that concerns the semantic properties of compounds. However, they did not explain to the English reader how the meanings of individual morphemes change when compounds are formed. We are particularly interested in this semantic aspect of compounds because we believe it may provide a better solution to the problem of distinguishing compounds from phrases. In particular, idiomaticity appears to be related to another semantic distinction, *referential specificity*. Although idiomaticity is a matter of degree (as quoted by Zhou et al. from Li and Thompson, 1981), we find that referentiality (or semantic accessibility) of nominal elements is consistently absent in compounds and must be present in phrases (S-F. Huang, in press). The examples below are all nominal constructions, to sidestep the controversy raised by Zhou et al. in order to make our point. These examples show that the *same* nominal constructions contain *both* a compound reading (illustrated in 3a, 3c, 4a, 4c, 5a, and 5c) and a phrasal reading (illustrated in 3b, 3d, 4b, 4d, 5b, and 5d).

3. N–N

a. *jin-yu*
   gold-fish
   "goldfish"

b. *jin yu.*
gold fish
"Fish made from gold."
c. **jin-de-ya*
gold NOM fish
"goldfish"
d. *jin de yu.*
gold NOM fish
"Gold made fish."
4. N–V–V
a. *ren-zao-rou*
man-make-meat
"vegetarian meat"
b. *ren zao rou.*
man make meat
"The meat which is made by men."
c. **ren-zao-de-rou*
man make NOM meat
"vegetarian meat"
d. *ren zao de rou.*
man make NOM meat
"The meat which is made by men."
5. V–N–N
a. *xi-yi-fen*
wash-clothes-powder
"detergent"
b. *xi yi fen.*
wash clothes powder
"The powder which is used in washing clothes."[4]
c. **xi-yi-de-fen*
wash clothes powder
"detergent"
d. *xi yi de fen.*
wash clothes NOM powder
"The powder which is used to wash clothes."

In each of the compound readings, the nominal element has no referential content without its modifier. In the phrasal reading, the nominal element has referential content with or without its modifier. For example, the referent "goldfish" of (3a) is derived from the whole compound "jin-yu," referring to a special kind of fish. In contrast, the morpheme "yu" in (3b) refers to an independent entity, namely "fish"; the adjective

[4] The powder could be cornstarch, which usually is used in washing coverlets.

"jin" (gold) is used to describe that fish. Syntactic transformations such as modifier insertions cannot apply to constructions interpreted as compounds because the semantic integrity of compounds cannot be preserved after the insertion of modifiers, which is why (3c), (4c), and (5c) are unacceptable. The same syntactic transformations, however, can apply to constructions which are interpreted as phrases (see (3d), (4d), and (5d)).

Like nominal cases listed above, the V–N constructions that we used in our paper can take both a compound and a phrasal reading. Here too, the distinction turns on contrasts at the semantic/pragmatic level. These verbal V–Ns are compounds when they denote names; the same items serve as phrases when they are used to describe events. For example, "xie-zi" (write-character) in (6a) is a component when it refers to the name of the action (i.e., to write or writing). However, the same string of words in (6b) is a phrase when it is used to describe the event, i.e., (someone) is writing words. Like nominal compounds, syntactic transformations such as topicalization cannot apply to verbal V–Ns with compound readings because these verbal V–Ns are no longer semantically integrated items (or serving as names) after the nominal elements are moved to the topic position (see example (6c)). Like the counterparts of nominal compounds, which behave like phrases, the topicalization can apply to verbal V–Ns with a phrasal reading without violating their phrasal nature (see example (6d)).

6a. *xie-zi bu nan xue.*
write-character not difficult learn
"Character-writing is not difficult to learn."

6b. *ta xie le nei xie zi.*
he write-character that some character
"He wrote those characters."

6c. **zi, bu nan xue xie*
characters, not difficult learn write
"Character-writing is not difficult to learn."

6d. *nei xie zi, ta xie le.*
that some characters, he write
"These characters, he wrote."

It is our contention that the V–N constructions elicited in our study were functioning as compounds. That is, the subjects produced these forms out of context, in answer to the very clear question: "Qing gaosu wo tupian li dongzuo de mingcheng" ("Please tell me the name of the action in the picture."). However, as we have just pointed out, the same V–N constructions can also be used with a phrasal reading. Zhou et al. provide a series of examples to show that our V–N items are really phrases. Notice, however, that the nominal element is referentially specific in all of their examples (items 7a–7c below are taken from 4a–4c in

Zhou et al.; 8a–8c are taken from their 3a–3c):

7a. *zhei jian yi-fu wo bu hui feng*
these CL clothes I not able sew
"These clothes, I don't know how to sew."

7b. *ni, yi-fu feng mei feng?*
you clothes sew not sew
"Did you sew the clothes?"

7c. *yi-fu, wo bu feng le.*
clothes, I not sew ASP
"I'm not going to sew clothes (any more)."

8a. *zhei ge huang women bu neng shuo.*
this CL lie we not can say
"This lie, we cannot tell."

8b. **ni, hung shuo mei shuo?*
you lie say not say
"Did you tell the lie?"

8c. **huang, wo bu shuo le.*
lie we not say ASP
"I'm not going to tell lies (any more)."

We agree with Zhou et al. that the V–N constructions in question have a phrasal reading in all the above examples. But that is entirely unrelated to the way that those items were used in our test of action naming. Chinese linguists face a dilemma: compounds have a phrase-like form but a word-like function. In our view, this conflict is best resolved by assuming that Chinese compounds must be analyzed at two levels: structure (form) and meaning (function). At the level of structure, compound words and phrases are similar to each other, while at the level of meaning, compounds are significantly different from phrases (Chen & Shi, 1992; Zhu, 1981). It is this semantic contrast (i.e., referential specificity) that triggers the range of syntactic variations described by S-F. Huang and by Y. Y. Huang.

The fact that verbal V–Ns carry both compound and phrase readings was not captured by Zhou et al. because they ignored a very important aspect of word formation in Chinese: V–N constructions of this sort are the major device for action naming in Chinese, and they are often the only legal device for action naming.[5] In contrast with the citation forms that characterize action naming in English, most actions *cannot* be named with single verbs in Chinese. Noun morphemes or additional verbs have to be attached to the main verb morpheme. Consider our original example of KAN-SHU. This verb means "to read" but it is literally translated as LOOK-BOOK, a V–N form. It is impossible to talk about reading in

[5] V–V compounds (also called resultative compounds) constitute another crucial pattern for action naming, for example DA-KAI, literally HIT-OPEN for "to open."

Chinese without providing some kind of nominal element in the object slot. This is true even for fully intransitive sentences like

(a) *wo wu sui jiu xue-hui kan-shu.*
I five age immediately-then study capable look-book
"I learned to read when I was five years old."

(b) *kan-shu you rong-yi you you qu.*
look-book both contain easy and have interest
"Reading is easy and enjoyable."

(c) *wo zheng-wan dou zai kan-shu.*
I whole-night all -ing look-book
"I was up reading all night."

Likewise, a single verb such as "feng"' (literally sew) is not a complete name for the action "to sew." A noun, usually "yi-fu" (clothes), has to follow right after the verb "feng" (to sew), resulting in the compound structure "feng-yi-fu." This is very clear from our results for the sewing item in the Miceli et al. stimuli. In the target picture, the object being sewed is not a piece of clothing, but a rather generic piece of cloth. Most Western subjects who describe this item do not mention the object at all, but Chinese normals reliably place the morpheme "clothes" right after the morpheme "sew." If we accept the interpretation offered by Zhou et al., then we must conclude that English subjects respond to action naming by providing bare intransitive verbs, while Chinese subjects (for mysterious reasons all their own) choose to describe the same pictures with a full sentential description. We would argue instead that the presence of the noun "clothes" in the action naming of "to sew" is not for descriptive purposes. Instead, it is provided to fulfill a structural requirement, i.e., the presence of a noun right after a verb is obligatory for native speakers of Chinese.[6]

We do agree with Zhou et al. on one point: the sublexical dissociation that we report in our study deserves further investigation. It would be useful to determine whether this effect replicates with a larger set of V–N compounds, designed to ask the same question in a more systematic way. It would also be useful to determine whether the same dissociation occurs with nominal V–N compounds that are not subject to the same phrasal reading. Three of our recent studies have focussed on aphasics' ability to use nominal V–N compounds (Chen, 1990, and in preparation; Chen

[6] In this regard, we have some interesting anecdotal information from a small group of English-speaking subjects who are starting to learn Chinese. The Miceli et al. stimuli were administered to these subjects in Chinese as part of a pilot study of second-language learning in adults. Unlike native speakers of Chinese (who provided the obligatory nominal element for items like "feng-yi-fu"), these novice speakers of Chinese did try to name the same pictures with a bare verb morpheme (e.g., "feng"). This proves that it is possible to name pictures with a bare verb in Chinese—but it is the kind of error that is only produced by novices who speak a very different kind of language.

et al., 1992). So far, we have observed the same noun/verb double dissociation between Broca's and Wernicke's aphasics. Specifically, when aphasics are asked to name objects, e.g., "fei-ji" (literally fly-machine), Broca's aphasics omit the verbal element (i.e., fei, to fly) more frequently than the nominal one (i.e., ji, machine). By contrast, Wernicke's aphasics omit the nominal element (i.e., ji, machine) more frequently than the verbal one (i.e., fei, fly). Thus, the proposed double dissociation between Broca's aphasia and Wernicke's aphasia is evident even in nominal V–N compounds, which do not involve the confounding of compounds with phrases discussed by Zhou et al. This adds further evidence to our contention that the noun/verb dissociation has analogues at the sublexical level.

Another source of evidence comes from research on the early stages of language learning in Chinese children (S-F. Huang, personal communication, 1993). Specifically, children make frequent use of V–N compounds of the sort described here during what corresponds to the one-word stage (i.e., before 20 months of age). There are only two explanations for this finding: (1) the V–N items in question can be produced by children in the one-word stage because they are true compounds (like the English item "apple juice," which is common in the one-word stage) or (2) the one-word stage does not exist in Chinese. Although current evidence does not distinguish between these two possibilities, we respectfully suggest that the first explanation is much more parsimonious than the second.

Finally, although we stand by our contention that the same item can have both a compound and a phrasal reading, we agree that individual items may vary in their *degree of idiomaticity*, and hence in the probability of a compound vs. a phrasal interpretation when they are encountered out of context. In a recent experiment carried out in Taiwan (Tzeng, in preparation), fluent Chinese readers were asked to perform a lexical decision task on two-character compounds that varied along this dimension, including highly idiomatic compounds (in which the meaning of the whole is often quite different from the meaning of the individual parts) and items that are lower in idiomaticity (in which there is still a rather transparent relation between the meaning of the whole and the meaning of the individual parts). If our interpretation of Zhou et al. is correct, they would categorize the first set of items as compounds and the second set as phrases. This classification should lead, in turn, to the following predictions: (1) whole-word frequency effects for compounds, but no frequency effect for the individual characters in the compounds and (2) frequency effects for the individual characters in a phrasal construction, but no frequency effect for the whole word (since, of course, it would not qualify as a whole word). We did indeed find that highly idiomatic compounds only show a whole-word effect, suggesting that these forms do not evoke

a phrasal reading when they are encountered out of context (indeed, these highly idiomatic forms may never have a phrasal reading at all). However, items at the end of the continuum showed both kinds of frequency effects, i.e., for the whole word and for the individual elements in the word. In other words, these items simultaneously evoke *both* a compound and a phrasal reading.

CONCLUSION

In this reply, we have answered Zhou et al.'s comments point by point. We believe that some of their criticisms are due to misunderstandings, but most are due to the particular structural linguistic perspective that they have adopted. The distinction between compounds and phrases is (and has been) a matter of debate among Chinese linguists (Li & Thompson, 1981; C-T. J. Huang, 1984; S-F. Huang, 1986; Y. Y. Huang, 1991), and there is no simple answer to the problem. Above all, there is no "right" place to draw the line. Although these disagreements among experts on Chinese are frustrating, they do not preclude us from carrying out interesting crosslinguistic research on language breakdown. Indeed, we are convinced that Chinese offers a unique perspective on the relation between lexical and sublexical processes and may yield insights into brain organization for language that are not available in English or any of the other languages that have been studied to date.

REFERENCES

Bates, E., Chen, S., Tzeng, O., Li, P., & Opie, M. 1991. The noun–verb problem in Chinese aphasia. *Brain & Language,* **41,** 203–233.

Chao, Y. R. 1968. *A grammar of spoken Chinese.* Berkeley: Univ. of California Press.

Chen, S. (in preparation). *Morphological breakdown in Chinese aphasia.* Doctoral dissertation, University of Southern California, Los Angeles.

Chen, S. 1990. *Non-inflectional morphological breakdown in Chinese aphasia.* Abstract presented at the 2nd North-East Chinese Linguistics Conference, University of Pennsylvania, Philadelphia.

Chen, S. 1992. *On word-type transferring in English-speaking subjects learning Chinese as the second language.* Manuscript in preparation, University of Southern California.

Chen, S., Andersen, E., Kempler, D., & Bates, E. 1992. *On the structure preservation in Chinese aphasia.* Abstract presented at the Academy of Aphasia, Toronto, Canada.

Chen, S., & Shi, D-X. 1992. On the feeding relation betwen syntax and morphology: Evidence from Chinese V–N compounds. In *Proceedings of Third International Symposium on Chinese Languages and Linguistics.* Taiwan: Chinghwa University.

Di Sciullo, A. M., & Williams, E. 1987. *On the definition of word.* Cambridge, MA: MIT Press.

Huang, C-T. J. 1984. Phrase structure, lexical integrity and Chinese compounds. *Journal of Chinese Language Teachers' Association,* **19,** 53–78.

Huang, S-F. (in press). *Studies in Chinese morphology.* Taipei, Taiwan: Wen-crane Publisher.

Huang, S-F. 1986. Chinese as a headless language. In *Proceedings of the International Conference of Sinology,* Taipei, Taiwan.

Huang, Y. Y. 1991. *Verbal compound and Chinese phrase structure*. Ph.D. dissertation, State University of New York at Stony Brook.

Li, C., & Thompson, S. 1981. *Mandarin Chinese: A functional reference to Chinese grammar*. Los Angeles: Univ. California Press.

Liu, Y. M., Cheung, C. J., & Wang, S. C. 1975. *Frequency count of 40,000 Chinese words*. Taipei, Taiwan: Lucky Publisher.

Miceli, G., Silveri, M., Villa, G., & Caramazza, A. 1984. On the basis for the agrammatic's difficult in producing main verbs. *Cortex*, **20**, 207–220.

Miceli, G., Silveri, M. C., Romani, C., & Caramazza, A. 1989. Variation in the pattern of omissions and substitutions of grammatical morphemes in the spontaneous speech of so-called agrammatic patients. *Brain and Language*, **36**, 447–492.

Ren, X. L. 1980. *Hanyu Gouci Xue (Chinese Morphology)*. Shanghai: The Commercial Publisher.

Tzeng, O. (in preparation). *On-line processing of Chinese compounds: Evidence from lexical decision*. Manuscript in preparation, University of California, Riverside.

Zhou, X., Ostrin, R. K., & Tyler, L. (1993). The noun–verb problem and Chinese aphasia: Comments on Bates et al. (1991). *Brain and Language*, **45**, 86–93.

Zhu, D. X. 1981. *Yufa Jiangyi (Chinese Syntax)*. Shanghai: The Commercial Publisher.