

Does real grammatical class effect in word production exist in isolating languages?

Zaizhu Han^{a,*}, Yanchao Bi^a, Yun Zhou^b, Hua Shu^a

^a State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University, Beijing 100875, PR China

^b Beijing Tiantan Hospital, Beijing 100050, PR China

Selective noun or verb deficits in word production observed in some aphasic patients have helped us understand how grammatical knowledge is represented in the brain (e.g., Bi, Han, Shu, & Caramazza, 2007; Caramazza & Hillis, 1991; see reviews in Laiacona & Caramazza, 2004; Shapiro & Caramazza, 2003a). It has been shown that such patients are not a coherent group but are produced by various causes, including conceptual ones and grammatical ones. The majority of the research has been conducted with patients speaking Indo-European languages where one important grammatical aspect of nouns and verbs is that they have different inflectional morphological rules. A series of patients who show disproportionate noun or verb deficits in picture naming tasks have also been found to be more severely impaired in inflectional morphological tasks for that corresponding grammatical class (Laiacona & Caramazza, 2004; Shapiro & Caramazza, 2003b; Shapiro, Shelton, & Caramazza, 2000). These observations have led some researchers to propose that morphological operations for nouns and verbs can be selectively impaired, and such grammatical-class specific morphological impairments would cause differences in noun/verb naming. It has been further assumed that for isolating languages such as Vietnamese and Chinese where nouns and verbs do not undergo morphological changes in any grammatical context, the noun/verb differences would then either root in the conceptual system or in the word form representations (Shapiro & Caramazza, 2003a).

Does noun/verb dissociation with real grammatical basis exist in isolating languages such as Chinese? We here present a Chinese patient showing disproportionate impairments in writing verbs over nouns. The grammatical class effect in his writing is not likely to originate in the conceptual system or the orthographic word form representations, indicating that there might exist a grammatical basis for selective verb deficit that is more general than inflectional morphology.

Case report

ZY is a 36 year-old, right-handed man, with a high school education. He suffered serious brain injury ten years ago and a MRI showed mass lesions involving most of the left hemisphere. ZY was severely impaired in oral production, being unable to perform any oral naming or oral repetition tasks. His comprehension of single words was within normal range:

auditory word–picture matching (25/25), visual word–picture matching (25/25), auditory lexical decision (34/35) and visual lexical decision (33/35). He also performed well in a nonverbal association match task (27/30), where he needed to judge which of two pictures (e.g., railway and road) was more closely related to the target picture (e.g., car).

His writing of nouns and verbs was first tested in a picture naming task where the names of object pictures and action pictures were matched on frequency, length, familiarity and naming agreement ($ts < 1$). He correctly wrote more nouns than verbs (noun, 12/34; verb, 0/34; $\chi^2(1) = 14.57$, $p < .0001$). The same pattern presented in writing-to-dictation using the same items (noun, 11/34; verb, 2/34; $\chi^2(1) = 7.70$, $p < .01$).

He was then tested on a writing-to-dictation task using three sets of monosyllabic (one character) words: concrete nouns (“tea”), abstract nouns (“season”), and verbs (a mixture of action verbs e.g., “to stare” and abstract verbs e.g., “to forget”). The words in the three sets were matched on frequency, visual complexity, and orthography–phonology–regularity ($ts < 1$). His writing performance was comparable for the two kinds of nouns (concrete: 8/33; abstract: 9/33), and was more accurate than the performance on verbs (3/33; nouns vs. verbs: $\chi^2(1) = 3.79$, $p = .05$). In another writing-to-dictation task noun–verb homographs (花, /hua1/, flower/n., to spend/v.) were used, being presented in a nominal context (/hua1/ as in “rose-flower”) and in a verbal context (/hua1/ as in “to spend money”) in two separate blocks. He again wrote correctly more items in the noun context than in the verb context (11/35 vs. 4/35; $\chi^2(1) = 4.16$, $p < .05$).

Discussion

Our patient, ZY, was more impaired in writing verbs than nouns in written picture naming and writing-to-dictation tasks using various types of nouns and verbs. Such noun/verb difference is not likely to originate from the conceptual system because ZY was intact in comprehending both nouns and verbs and because the noun/verb difference were present even when non-prototypical nouns and verbs were used. The grammatical effect cannot be attributed to a selective loss of orthographic knowledge for verbs either, because a noun/verb difference was observed even with homographs.

Importantly, given that Chinese is an isolating language and nouns and verbs are not morphologically inflected, it is hard to argue that the grammatical effect in our patient is due to a selective impairment of some

* Corresponding author. Fax: +86 10 5880 2911.
E-mail address: zzhhan@bnu.edu.cn (Z. Han).

explicit morphological operations for verbs. To account for the grammatical effect in ZY's writing, one may assume that there is a grammatical class dimension in the organization of the orthographic output lexicon, such that the orthographic lexical representation of verbs can be disproportionately impaired (Caramazza & Hillis, 1991; Hillis, Wityk, Barker, & Caramazza, 2002). Alternatively, despite the lack of inflection, there might be some kind of abstract morpho-syntactical mechanisms for nouns and verbs to function in their grammatical roles that are universal in languages and such abstract morpho-syntactical mechanism for verbs can be selectively impaired.

References

- Bi, Y., Han, Z., Shu, H., & Caramazza, A. (2007). Nouns, verbs, objects, actions, and the animate/inanimate effect. *Cognitive Neuropsychology*, 24(5), 485–504.
- Caramazza, A., & Hillis, A. E. (1991). Lexical organization of nouns and verbs in the brain. *Nature*, 349, 788–790.
- Hillis, A. E., Wityk, R., Barker, P., & Caramazza, A. (2002). Neural regions essential for writing verbs. *Nature Neuroscience*, 6, 19–20.
- Laiacona, M., & Caramazza, A. (2004). The noun/verb dissociation in language production: Varieties of causes. *Cognitive Neuropsychology*, 21, 103–123.
- Shapiro, K., & Caramazza, A. (2003a). The representation of grammatical categories in the brain. *Trends in Cognitive Sciences*, 7, 201–206.
- Shapiro, K., & Caramazza, A. (2003b). Grammatical processing of nouns and verbs in left frontal cortex? *Neuropsychologia*, 41, 1189–1198.
- Shapiro, K., Shelton, J., & Caramazza, A. (2000). Grammatical class in lexical production and morphological processing: Evidence from a case of fluent aphasia. *Cognitive Neuropsychology*, 17, 665–682.